Are open eco-innovation projects just like any other open innovation project?

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Résumé :

L'éco-innovation constitue un processus complexe, nécessitant des compétences variées, qu'on ne trouve pas souvent au sein d'une seule organisation. Dans ce contexte, le concept d'Open Eco-Innovation (OEI), qui articule innovation ouverte et éco-innovation, suscite un intérêt croissant. Toutefois, les facteurs conditionnant le succès des projets d'OEI demeurent encore peu explorés. Cette recherche propose d'examiner ces derniers à travers l'analyse de quatre projets d'OEI dans l'industrie des sports outdoor. Les études de cas réalisées mettent en évidence l'importance de l'alignement stratégique et relationnel des partenaires, comme bien souvent dans les projets d'open innovation. Cependant, cet alignement suppose l'activation préalable d'autres leviers, révélant ainsi une certaine séquentialité dans leur mise en œuvre. Les pressions réglementaires et les menaces sectorielles apparaissent ainsi comme des déclencheurs initiaux, incitant les entreprises à initier des démarches d'éco-innovation en interne. L'atteinte d'un certain degré de maturité en matière d'éco-innovation favorise ensuite l'alignement stratégique et relationnel des partenaires dans les projets d'OEI.

Mots-clés : Open innovation, Eco innovation, Open eco innovation, Etudes de cas, Industrie des sports outdoor

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INTRODUCTION

Over the years, literature on environmental, green or 'eco-innovation' as Rennings (2000) names it, has expanded significantly. Researchers have extensively examined it through the lenses of business strategies and policy implications across various contexts. This growing interest stems from eco-innovation's focus on fostering development while recognizing the constraints of the natural environment, aligning closely with the principles of 'sustainable development' (Hazarika & Zhang, 2019). On one hand, growing consumer awareness of the environmental impact of their consumption choices, coupled with their willingness to reduce their ecological footprint, creates new opportunities for value creation by companies (De Marchi & Grandinetti, 2013). On the other hand, increasingly stringent regulations, along with pressure from NGOs and environmental groups highlighting corporate polluting behaviors, push firms to mitigate the environmental effects of their activities to minimize reputational risks and avoid additional costs. The growing focus on sustainable production and consumption systems has gained momentum, particularly during periods of economic crisis, as firms increasingly recognize sustainability as a pathway to future growth and innovation (De Marchi, 2012; Laperche & Uzunidis, 2012). Transitioning to less environmentally impactful production models not only reduces ecological footprints but also generates economic benefits through innovations that align with environmental goals (De Marchi & Grandinetti, 2013).

However, because of its complex and systematic nature, eco-innovation requires diverse kinds of knowledge from heterogenous external partners (De Marchi & Grandinetti, 2013; Kanda et

al., 2018; Rhaiem & Doloreux, 2022). Ghisetti et al. (2015) emphasize the value of openness to external knowledge sources, which can help companies overcome internal constraints—such as a lack of capabilities and intangible inputs for generating or adopting environmental knowledge. These constraints often hinder their ability to gain a competitive advantage through eco-innovation (EI). Pereira et al. (2020) also underline that companies might benefit significantly from collaborating to achieve sustainable innovation. Openness could also help companies enhance their sustainability by strengthening their connections with (and responsiveness to) environmentally conscious partners within innovation systems oriented towards sustainable development and the circular economy. Therefore, networking and strong partnerships, particularly with suppliers and other stakeholders, have been identified as key drivers in fostering and applying innovative environmental technologies (De Marchi, 2012; Horbach, 2008; Pereira et al., 2020).

For these reasons, the potential application of Open Innovation (OI) in the eco-innovation (EI) process, a phenomenon we name Open Eco-innovation (OEI) (Chistov et al., 2023; Ghisetti et al., 2015; González-Moreno et al., 2019), is increasingly gaining attention in both academic and professional literature (Chistov et al., 2023; Pereira et al., 2020). Rhaiem and Doloreux (2022) as well as Chistov et al. (2023) note that identifying the factors that influence OEI projects could provide a better understanding of this emerging practice and help mitigate the risks of failure. As a matter of fact, if the levers of open innovation and those of eco-innovation have now been extensively investigated, there is still a lack of knowledge concerning the determinants of OEI. Therefore, our research question is the following: *What are the success factors for open eco-innovation projects?* The research sub-questions are: *What are the most salient success factors? Are there any levers specific to OEI? If so, which ones?*

To address these questions, we first compile the success factors identified in the literature on EI and OI to formulate a list of levers for OEI projects. Subsequently, we examine four successful collaborative projects of OEI in the outdoor sports industry, drawing on 28 interviews with key members of these projects. These case studies emphasize the predominance of OI-related levers, most notably the strategic and relational alignment of partners. However, for this alignment to be achieved, other levers must already be in place, introducing a sequence in the activation of these levers. Thus, while regulatory pressures and industry threats play a significant driving role at the outset of the process, encouraging companies to develop EI projects internally, it is the attainment of a certain maturity in terms of EI that subsequently fosters the strategic and relational alignment of partners in OEI projects.

The paper is organized as follow. In the theoretical part, we will first provide a brief analysis of the eco-innovation and open innovation concepts, exploring the various definitions of OEI before detailing the main levers of OEI: firms' internal and external levers, and then the levers related to the collaborative project itself. After describing the qualitative methodology used for this research, we detail and discuss the main findings.

1. THEORETICAL BACKGROUND

1.1. WHAT IS OPEN ECO-INNOVATION?

The concept of Open Eco-Innovation (OEI) refers to the application of open innovation (OI) strategies in the development of eco-innovations (EI).

1.1.1. What is eco-innovation ?

Innovation aimed at sustainable development emphasizes progress in a specific direction, addressing environmental and sustainability concerns. Such innovations are characterized by their ability to reduce environmental burdens in at least one area, contributing to improvements in the identified problem areas. Eco-innovation (EI) has become a key focus of European Union

policy, particularly through initiatives like the "European Green Deal," which targets carbon neutrality by 2050 and a 55% reduction in greenhouse gas emissions by 2030 (compared to 1990 levels). Programs such as Horizon 2020 and the Next Generation Fund (2021–2026) emphasize eco-innovation, while tools like the EU's Eco-Innovation Index track progress and convergence among member states (Costantini et al., 2023).

According to Rennings (2000, p.322) EIs are "*all measures of relevant actors (firms, politicians, unions, associations, churches, private households) which develop new ideas, behavior, products and processes, apply or introduce them that contribute to a reduction of environmental burdens or to ecologically specified sustainability targets*". They can originate from firms or non-profit organizations, may or may not be traded on markets, and can take technological, organizational, social, or institutional forms. Over time, the definition of eco-innovation has evolved to include related aspects, such as considering the entire life cycle of a product (Kemp & Pearson, 2007) and addressing human needs to improve quality of life (Reid & Miedzinski, 2008). As Hojnik and Ruzzier (2016) point out, despite the differences in wording, all the definitions reflect the two main consequences of EI: fewer negative effects on the environment and more efficient use of resources.

However, the systemic nature of EI, along with the uncertainty surrounding its development and implementation, poses significant challenges for organizations (De Marchi, 2012; Pichlak & Szromek, 2021; Rauter et al., 2017; Rennings, 2000). Many organizations have been developing innovations for years while neglecting critical environmental issues (Maier et al., 2020) or viewing innovation and sustainable development as opposing forces (Bigliardi & Filippelli, 2022). Consequently, eco-innovation is regarded as a more complex instrument compared to other types of innovation (Chistov et al., 2021; Rauter et al., 2017). Its adoption remains slow and fraught with challenges due to its complexity compared to other innovations. EI faces unique barriers, including external pressures (e.g., limited stakeholder demand), internal constraints (e.g., lack of financial resources and technological expertise), and techno-economic challenges (e.g., high costs and incompatibility with existing processes) (Chistov et al., 2023).

Cooperation in eco-innovation is essential as most companies lack the core competencies, resources, and knowledge needed to independently develop sustainable innovations (De Marchi & Grandinetti, 2013; Horbach, 2008; Rhaiem & Doloreux, 2022). Collaborating with external partners provides access to valuable knowledge, technologies, and contextual insights, enabling

faster market introduction and the integration of sustainability into product design (Pereira et al., 2020). It also facilitates cost and risk sharing, economies of scale, and knowledge spillovers, while improving technological predictability (Chadha, 2011; Fabrizi et al., 2018). By cooperating in research and development, companies can internalize environmental spillovers and achieve greater returns compared to working in isolation.

1.1.2. What is open eco-innovation?

Recent research views inter-organizational collaboration in eco-innovation (EI) as an integral component of an open innovation (OI) strategy. This approach involves organizations adopting a broader strategy to leverage external resources, both tangible and intangible, for the development and/or the commercialization of EI (Chistov et al., 2021; González-Moreno et al., 2019; Laperche & Picard, 2013).

OI was initially developed by Chesbrough (2003) to describe strategies to better organize innovation and enhance its effectiveness. Open innovation posits that companies should leverage both external and internal ideas, as well as internal and external pathways to market, to drive the advancement of their innovations. Chesbrough and Bogers (2014, p. 17) define OI as "*a distributed innovation process based on purposively managed knowledge flows across organizational boundaries*". Open innovation involves three main processes: *outside-in*, which integrates external resources to enhance innovation; *inside-out*, which allows unused ideas to be used or shared externally in their businesses and business models; and the *coupled process*, which combines both approaches through collaborative projects with complementary partners (Bogers et al., 2018; Enkel et al., 2009).

Open eco-innovation (OEI) is a rapidly growing field of research (Bigliardi & Filippelli, 2022; Bogers et al., 2020; Chistov et al., 2021; Sanni & Verdolini, 2022), situated at the intersection of innovation, cooperation and environmental studies (Ghisetti et al., 2015). According to Chistov et al. (2021), who did a systematic literature review on the concept of OEI, the first publication on OEI dates back to 1992, focusing on the Danish Clean Technology Program, which fostered collaboration among polluters, suppliers, and consultants for environmental innovation (Georg et al., 1992).While related research began in 1992, significant interest in collaboration within eco-innovation only emerged in 2010, with over half of OEI articles

published between 2017 and 2020. Although the explicit term "Open Eco-innovation" appears in relatively few publications, its use is growing rapidly, and more researchers are adopting it (Chistov et al., 2021; Fabrizi et al., 2018; Ghisetti et al., 2015; González-Moreno et al., 2019; Kobarg et al., 2020; Rhaiem & Doloreux, 2022). OEI can be defined as "*the use of purposive inflows and outflows of knowledge, resources and commercialization paths to develop and/or adopt innovations improving the environmental performance of firms*" (Chistov et al., 2021: 3). In a nutshell, OEI focuses on reducing organizations' environmental impact by leveraging information and knowledge flows (both outside-in and inside-out), as well as external resources. It addresses internal constraints, accelerates innovation, and relies on cooperation with external partners and integration into green innovation ecosystems. Additionally, the intellectual capital generated can be patented, licensed, or shared, creating new revenue streams while benefiting society and the environment. In the following part, we will attempt to identify the levers that push firms to engage in collaborative projects of OEI.

1.2. MAIN DETERMINANTS OF OPEN ECO-INNOVATION

If much has been written on the determinants of EI and OI (Aquilani et al., 2017; Dubouloz et al., 2021; Durst & Stähle, 2013), the literature remains relatively scarce regarding the levers and barriers of OEI. In this paper, and following a cross-analysis of the literature on EI and OI, we aimed to identify the main drivers of OEI, which we present. Because the EI literature distinguishes between internal and external factors (Horbach, 2008; Horbach et al., 2013; Rennings, 2000; del Río et al., 2016; Hojnik & Ruzzier, 2016), we will first present those levers. In a third part, we will explore OI-specific factors to identify key determinants of OEI, focusing on how these factors impact inter-organizational adoption and success (Chistov et al., 2021).

1.2.1. EI External Levers

Research on EI determinants highlights three key drivers: 1) *supply-side* factors (e.g., technology-push from suppliers), 2) *demand-side* factors (e.g., market and consumer pull), and *regulatory* factors (e.g., regulatory push-pull effects) (Horbach, 2008; Horbach et al., 2013; Rennings, 2000). These can be categorized into four distinct drivers. First, **sector opportunities** play a crucial role, as technological advancements within the industry and its level of maturity significantly determine the potential for eco-innovation (del Río et al., 2016). Second, **supplier engagement** emerges as another critical factor, as the geographic proximity and technological development of suppliers can facilitate eco-innovation (Díaz-García et al., 2015). Organizations

are increasingly aligning with responsible suppliers to enhance their brand reputation (Pacheco et al., 2018). Third, **consumer demand** has a significant impact on eco-innovation. Growing environmental awareness among consumers fosters a preference for eco-friendly products, which drives market demand (Cai & Zhou, 2014). Nevertheless, uncertainties persist, as higher prices for such products may deter widespread adoption (de Jesus & Mendonça, 2018). Certifications and standards adopted by companies further demonstrate their commitment to reducing environmental impact and help build consumer trust (He et al., 2018). Finally, **regulations** act as one of the most influential drivers of eco-innovation. Environmental policies, often cited as a key factor, can incentivize sustainable practices and create competitive advantages for regulated firms, as highlighted by Porter's hypothesis (Kesidou & Demirel, 2012; Porter & van der Linde, 1995). Regulatory pressures include existing and upcoming environmental regulations, taxes or levies, and public procurement requirements, all of which compel organizations to innovate in environmentally sustainable ways (Spena & Paola, 2020).

1.2.2. EI Internal Levers

The literature identifies three major categories of internal EI levers: strategic, organizational and operational factors.

Strategic Levers

EI aligns with long-term business goals. First, **visionary leadership** is critical, as it drives the integration of environmental and economic development objectives (Carrillo-Hermosilla et al., 2010; Díaz-García et al., 2015). Long-term strategic orientation and environmental management systems (EMS) reflect a company's commitment to sustainability (Kesidou & Demirel, 2010). **Top management support** is a consistent success factor in driving eco-innovation strategies (Del Rio et al., 2016; Hojnik & Ruzzier, 2016). Additionally, EI may be perceived as a competitive advantage as it enables differentiation in the market, enhances brand reputation and fosters consumer trust (Cai & Zhou, 2014).

Organizational Levers

Organizational agility also facilitates EI, allowing companies to respond proactively to evolving sustainability demands (Kiefer et al., 2019; Pacheco et al., 2018). A supportive **organizational culture** encouraging collaboration, overcoming resistance to external partnerships and fostering sustainability initiatives (Aquilani et al., 2017; Kiefer et al., 2019). A culture of sustainability can mitigate challenges such as the "not-invented-here" syndrome and encourage risk-taking for innovative solutions (Kiefer et al., 2019).

Operational levers: Available Resources

This perspective aims to understand the factors linked to the resources and capabilities needed to eco-innovate. Three resources - financial, human, and technical – can be highlighted. Financial resources are a first important enabler as EI requires significant upfront investment (Kesidou & Demirel, 2012). However, companies under financial pressure may also eco-innovate for cost efficiency, adopting certifications or energy-efficient practices (Horbach et al., 2013; de Jesus & Mendonça, 2018). **Human resources**, including dedicated R&D teams and employee training programs, are critical for fostering awareness and developing eco-solutions (Pacheco et al., 2018). Employee training seems determinant both to raise awareness of the importance of EI and to increase the skills of teams in developing EI (del Río et al., 2016; He et al., 2018). Finally, **technical resources** play a pivotal role. Existing infrastructure and production systems may create lock-in effects, making it difficult to integrate new eco-innovative processes (Del Rio Gonzalez, 2009). Overcoming these technical challenges

requires investments in new technologies and a reevaluation of production systems (Hojnik & Ruzzier, 2016; Horbach et al., 2013).

1.2.3. Levers related to OI projects

As previously discussed, collaboration is considered one of the most important competencies in the eco-innovation process (Chistov et al., 2021; del Río et al., 2016; Mazzanti & Zoboli, 2006; Sumter et al., 2021). Therefore, the success of OEI projects does not depend solely on factors inherent to EI. We must include OI-specific factors in our analysis, that is to say determinants at the collaborative project's level. Six main categories were identified in the OI literature: A/ Partners' selection; B/ Strategic Alignment; C/ Management of knowledge; D/ Communication mode; E/ Coordination mode; F/ Conflict resolution methods.

A. Partner Selection. The choice of partners is often cited in the literature as one of the most important factors in the success of any form of inter-company collaboration (Emden et al, 2006). The inclusion of **competitors** introduces complexity, generates more relational risks such as opportunism or knowledge leakage and can erode trust and collaboration effectiveness. But it also can foster innovation through "mimetic pressures," where less environmentally advanced firms emulate leaders in sustainability (Hojnik & Ruzzier, 2016). Additionally, the **size and age** of partnering organizations influence their contributions; larger firms provide more resources, while smaller firms offer agility. The age of a firm can also impact alignment, as older firms may have established routines and expertise, while younger firms tend to be more flexible and innovative. Various types of **proximities**—geographical, social, cognitive, and institutional—can act as facilitators to alignment (Boschma, 2005). Geographical proximity enhances face-to-face communication and strengthens trust, while cognitive proximity ensures shared knowledge bases and a common understanding of objectives. Social proximity, derived from pre-existing relationships, and institutional proximity, often linked to shared industry standards or networks, both contribute to smoother collaboration.

B. Partners Strategic Alignment is a critical determinant of success in OI projects. Effective collaboration depends on a **shared vision** and **aligned objectives** (Emden et al, 2006; Kale et al, 2000; Mora-Valentin et al, 2004; Zacharias et al, 2020). Successful OEI projects depend on alignment across three dimensions: clear objectives, fair benefit-sharing, and effective time management. Effective collaboration requires a *clear understanding of the project's goals*, which reduces misunderstandings and fosters a unified sense of purpose among partners. *Transparency and fairness in benefit-sharing*, whether financial or intangible, are also

critical to maintaining trust and commitment, avoiding conflicts that can undermine the partnership (Gardet & Fraiha, 2012). Finally, *proper time management* ensures the coordination of efforts and adherence to deadlines, which is particularly important for long-term projects where delays can result in frustration and increased costs (Dubouloz et al., 2021). Together, these dimensions ensure that partners remain aligned and focused on achieving shared objectives.

Intermediaries play a vital role in facilitating alignment by acting as neutral third parties to mediate conflicts, foster trust, and provide coordination. For instance, Rouyre and Fernandez (2019) highlight the importance of intermediaries in conflict resolution and ensuring fairness among partners. They can stimulate firms to adopt sustainable practices by providing external motivation and support (Pacheco et al., 2018). Mitigation strategies, including robust governance mechanisms and non-disclosure agreements, are essential to maintaining alignment and protecting intellectual property (Dubouloz et al., 2021; Rouyre & Fernandez, 2019).

C. Knowledge Management is a critical factor in OI projects, balancing the need for collaboration with the protection of intellectual property. Transparent knowledge sharing accelerates collaboration and innovation but must be carefully managed to avoid risks such as information leakage or misuse (Rouyre & Fernandez, 2019). Effective knowledge protection through non-disclosure agreements and confidentiality protocols safeguards sensitive data while fostering trust among partners. Additionally, the formalization of common knowledge through clear frameworks and intellectual property agreements ensures shared understanding, reduces misunderstandings, and strengthens collaboration. Together, these dimensions enable OI projects to maximize innovation potential while protecting organizational interests.

D. Communication mode plays a significant role in OI projects, with formal, semi-formal, and informal modes each contributing uniquely to collaboration. Formal communication, such as scheduled meetings and official reports, ensures accountability, documents decisions, and facilitates traceability. Semi-formal communication, including workshops and brainstorming sessions, promotes creativity and the exchange of innovative ideas while maintaining a level of structure and focus. Informal communication, characterized by casual and spontaneous interactions, fosters trust, strengthens interpersonal relationships, and allows for the quick resolution of minor issues (Grandori and Soda, 1995 ; Nooteboom *et al.*, 1997). Together, these

modes create a robust communication framework that supports coordination, knowledge sharing, and conflict resolution in OEI projects.

E. Coordination mode is essential in OI projects to ensure smooth operations and the achievement of shared goals. Coordination can be categorized into two modes: relational governance and contractual governance. Relational governance relies on trust, open communication, and cooperation to align goals and facilitate adaptability, particularly in long-term partnerships (Gardet & Fraiha, 2012). In contrast, contractual governance employs formal agreements to define roles, responsibilities, and intellectual property protections, reducing potential conflicts in competitive environments (Das and Teng, 1998; Gulati, 1998; Rouyre & Fernandez, 2019). Governance structure may be capitalistic or non-capitalistic. Capitalistic structure, characterized by financial stakes between partners, foster long-term commitment and shared accountability, making them suitable for large-scale projects. Non-capitalistic structures, such as technology-sharing agreements, provide flexibility but require robust governance to prevent conflicts and ensure alignment. Together, these coordination modes enable the effective management of partnerships in OI projects.

F. Conflict resolution is a critical component of OI projects, ensuring that disputes do not hinder collaboration. Joint problem-solving, where partners collaborate to identify mutually acceptable solutions, fosters trust and strengthens partnerships. Persuasion, based on rational arguments and evidence, enables logical and constructive resolutions to disagreements (Gardet & Fraiha, 2012). In contrast, applying pressure by leveraging influence may achieve short-term results but risks eroding trust among stakeholders. Penalties, including financial sanctions or exclusion from project benefits, act as deterrents to non-compliance and maintain accountability (Gardet & Mothe, 2011). When internal mechanisms fail, third-party interventions, such as mediation or arbitration, provide neutral and effective resolutions for complex conflicts. Together, these mechanisms help maintain alignment and cooperation in OI projects.

To sum-up, Open eco-innovation (OEI) may be influenced by three key categories of levers: EI external levers, EI internal levers, and OI project-specific levers. The question is which of those potential levers identified play the most important roles in OEI projects. Furthermore, are there

any levers specific to OEI projects that have not been identified in either the EI or OI literature? The study of OEI project cases may provide some answers to these questions.

2. METHODOLOGY

Given (1) the limited research on the success factors of OEI projects and (2) the objective of this study, which is to identify the most impactful factors and understand how they influence the success of these projects, we opted for a qualitative approach based on case studies (Eisenhardt, 1989; Langley, 1999; Langley, Smallman, Tsoukas, & Van de Ven, 2013; Yin, 2009). We first present the selected sample and explain the process of its selection. Then, we detail the methods used for data collection and analysis.

2.1 SAMPLE: THE STUDY OF FOUR SUCCESSFUL CASES OF OEI

The empirical study is based on a sample of four Open Eco-Innovation (OEI) projects (see Table 1), selected using a theoretical sampling method. To ensure a relatively homogeneous sample, the selected cases share the following characteristics: 1) they take place in the same industry—the outdoor sports industry, 2) they involve both competing and non-competing companies, 3) they all concern process innovation both upstream and downstream of new product development, and 4) they are considered successful. Success was defined as achieving initial tangible and usable results for the stakeholders, although some projects are not yet fully completed. The sample's diversity criteria include the type of innovation developed (two upstream process innovation and two downstream), the number of partners involved in the project (from 4 to 15), and the geographic scope of the project (two projects are national, and two are international). Table 1 hereunder summarizes, for each project, the main partners, the emerging context and critical dates.

Table 1- Comparative description of the 4 case studies

OEI Project	PEFCR Hard Goods	Greenwolf Repair Workshop	Carbon Reduction Project	ASF 4.0 Advanced Shoe Factory
Main Partners & Roles	- **FESI**: Coordination. - **Peak63**: Consultant for methodology and network. - **2bpolicy & Think think Design**: Technical expertise. - **Salomon, Rossignol, Decathlon, Technica, Evvo, Bolle, Atomic, Elan, Fischer Marker Dalbello Völkl, Tyrolia, Head & K2** : Participants Data sharing, testing.	- **Greenwolf**: Repair operations - **Patagonia**: Needs definition and criteria sharing. - **Salomon and Picture:** Spare parts and event support. - **J&F:** consultant - **OSV**: Coordination, funding. - **Mont Blanc Insertion**: Pilot facilities.	- **EOG**: Coordination, data management, audits. - Initiative launched with 10 European outdoor brands - French brands participating: **Salomon, Millet, Picture, Deuter:** Supplier data, audit funding. - **Asian Suppliers**: Participation in audits, improvement implementation.	- **Chamatex**: Project initiator, leadership and innovation, together with **Groupe Zebra**: R&D and design. - **Salomon, Millet, Babolat**: Investment, testing. - **Siemens, Bosch**: Automation technology.
Main Objective	Develop a standardized method to measure the environmental footprint of skis and snowboards.	Establish a shared textile repair workshop to reduce environmental impact and promote product longevity.	Reduce carbon emissions and increase renewable energy use in shared supply chains.	Automate and localize sports shoe production in France, reducing reliance on Asian manufacturing while promoting sustainability.
Keystone Dates	- **2021**: Launch of the platform "Winter Sports Sustainability Network" - **2023**: Agreement on PEFTrust tool. - **2025**: Method validation.	- **2013**: Patagonia initiates project. - **2017**: Greenwolf becomes independent. - **2023**: Expansion to Annecy.	- **2021**: Pilot group launched - **2022-2023**: Supplier audits and actions. - **2023**: Expansion with renewable energy projects. - **Each year**, launch of working groups with new brands	- **2013-2016**: development of Matryx fabric, an innovative textile designed by Chamatex in collaboration with the Zebra Group for Babolat. - **2019**: ASF founded. - **2021**: Factory operational. - **2022**: Expansion announced.

2.2 DATA COLLECTION AND ANALYSIS

To ensure data triangulation, several data collection tools were used. First, an analysis of publicly available documents (websites, brochures) was conducted to gather initial information on the nature of the projects and the partners involved. Then, 28 semi-structured interviews, each lasting an average of 1 hour and 10 minutes, were conducted between May and October 2023, with key organizations participating in these projects. For each case, at least four different member organizations were interviewed. Within these organizations, interviewees included CEOs, CSR managers, innovation managers, or product development managers. The details of these interviews are provided in Table 2.

Table 2 - List of interviewees

PROJECT	Function of the interviewees and code
Case 1 **PEFCR Hard Goods** 10 interviews with 9 organizations	General Secretary (P1)[1]; Eco-design & CSR engineer (P2); Head of Innovation – Snowsports (P3); Sustainable Development Coordinator (P4); Head of Sustainability (P5); Product Manager (P6); CSR Manager (P7); Designer External Product (eco-design) P8; Co-founder (P9); Head of environmental impact (P10)
Case 2 **GREENWOLF** 6 interviews interviews with 4 organizations	Former Director (G1); VP– Head of Snowsports (G2); Managing director (G3); Sustainable Development Consultant (G4); Regional Manager (G6)
Case 3 **CARBON REDUCTION PROJECT** 6 interviews with 4 organizations	Head of Quality Management (C1); Global Sustainability Director (C2); Head of Quality Management & CSR (C3); Sustainability Manager (C4); Co-founder (C5); CSR & Sustainability project manager (C6)
Case 4 **ASF 4.0**	Former CEO (A1); President (A2); Former R&D and Innovation Director (A3); Founder (A4); Director (A5); Footwear Purchasing Manager (A6)

[1] To preserve the anonymity of respondents, we give only their function and we do not link them to a specific company.

6 interviews with 5 organizations	
TOTAL	22h25 total interviews / 811 transcript pages

The interviews were conducted using a guide structured around three main themes: 1) the presentation of the company and its eco-innovation policy (the role of eco-innovation in the company's overall innovation strategy and actions implemented to eco-innovate), 2) the role of Open Innovation (OI) projects in the eco-innovation policy, and 3) the chronological narration of the studied OEI project, covering the following aspects: 3.1) the company's motivation to join the project, 3.2) the project objectives, 3.3) partner selection criteria, 3.4) the project's progress (its main stages and current status), 3.5) challenges encountered, and 3.6) success factors from the interviewee's perspective.

The chosen method for processing the qualitative data gathered from the interviews is thematic content analysis. A coding framework was developed based on the literature review and the analytical framework presented earlier, focusing on the potential success factors of OEI projects. This framework includes three main categories of success factors: external, internal, and project-specific. Each category is further divided into subcategories. The initial framework was refined throughout the coding process. The first interview was coded collectively by the research team, while the subsequent ones were coded by a single researcher. The software Atlas.ti was used to conduct this coding.

For the analysis of the corpus, we adopted the cyclical and iterative model proposed by Miles and Huberman (1994) and used the software Atlas.ti to perform the content analyses. To assess the degree of contribution of each factor, we opted for a counting methods and established frequency counts. With this counting procedure, we gain a clearer sense of the data and the studied phenomena. We then summarized the qualitative data in explicit and structured tables. However, we have constantly taken care not to limit our analysis to these counts; rather, the research team continually revisited the cases to verify the interpretations of constructs and relationships (Wolfe et al., 1993).

3. MAIN FINDINGS

The results obtained from the analysis of the four successful OEI project cases reveal a hierarchy of OEI drivers (see Table 3). At first glance, external factors appear to be relatively

less influential, while internal company factors seem essential, and factors related to the open eco-innovation project itself are decisive. However, the qualitative methodology adopted also highlights a sequence in the activation of these drivers. First, the presence of external drivers prompts companies to redirect their strategies toward eco-innovation (EI). Next, the culture of EI and the necessary resources are developed internally. Once companies reach a sufficient level of maturity in EI and recognize the limitations of a standalone strategy, they decide to engage in OEI projects. These projects are then facilitated by drivers specific to OEI. These findings are detailed in the following paragraphs.

Table 3 - Hierarchy of OEI Success Factors

Type of drivers	Impact on the OEI Project success
External drivers	+
Members' internal drivers	++
OEI Project's Drivers	+++

3.1 External Drivers: Identifying Threats and Anticipating Stricter Regulations

Chronologically, the companies interviewed within the OEI projects first identified two major threats likely to significantly impact their industry, which motivated them to commit to IE, either individually or collectively (see Table 4).

Table 4 - Main External OEI drivers

Type of external driver	Nb of codes
Threats related to the industry	29
Constraining regulation	27
Customer demand of eco-driven products or processes	16
Financial aid and subsidies	16
Responsible supplier engagement	13

The most cited of the external factors studied corresponds to **threats related to the industry** sector. Indeed, the particularity of our four cases is that they are all from the outdoor sports sector, an industry directly impacted by climate change (decreasing snowfall, increasing

weather instabilities such as storms, typhoons, cyclones, etc.), which constrain outdoor sports practices (primarily mountain sports such as skiing, mountaineering, climbing, etc.). Companies in the outdoor sector are victims of these disruptions (as their playground is affected), but they are also becoming aware that they are partly responsible. Sportswear belongs to the textile industry, which is considered one of the most polluting in the world (textile production is highly water-intensive and responsible for about 20% of global drinking water pollution due to dyes and other finishing products; polyester clothing releases microplastic fibers into the environment; transportation costs from Asia, where the products are manufactured, are significant; European Environment Agency, 2023). The ski industry is also under scrutiny (artificial snow production in winter sports resorts requires the construction of hill reservoirs to collect water). The COVID-19 pandemic has also penalized many companies in the sector (textiles, footwear, but also bicycles and cycling components, for example) as production was halted or slowed for weeks, and thousands of containers were subsequently blocked in Asia, causing delivery delays long after the end of lockdowns.In this context, thinking about more sustainable practices to reduce environmental impact is a necessity. Numerous reflections are emerging within the sector, encouraging even the most reluctant companies to follow.

> *"We did not spontaneously create this project; we are participating in broader discussions about (...) the role of the textile industry"*; *"The ski industry, at the moment, is under a lot of scrutiny and is thinking, 'We need to communicate and regain control of what is being said about the environmental impact of our sector'"* (P9, PEFCR hard goods).
>
> *" COVID-19 just happened. So, this project to produce locally became much more strategic"* (A5, ASF4.0).
>
> *"I think in the future there will be much more large-scale cooperation happening, especially in this field. Because this is also a transformative process for an entire industry or sector, like textiles"* (P5, PEFCR hard goods).

Legal constraints follow closely. In two cases (PEFCR hard goods and Carbon Reduction Project), regulations were a strong driver encouraging companies to move toward greater eco-innovation.

> *"Unless there's any sort of government legislation or real pressure on them to do this, it's just not a priority for them" (*C6, Carbon Reduction Project*).*

While legal constraints were not yet too stringent at the start of the studied projects, and there is still a lack of harmonized international or even European frameworks (*"We are walking on eggshells with regulations. In France, one thing is said; in Europe, it's different, and globally, it's different again"* P2, PEFCR hard goods), these constraints are expected to tighten in the coming years, and many companies have acted in *anticipation*. For example, in France, by 2025, brands will be required to provide environmental labeling. Extended Producer Responsibility also means that each actor will be responsible for the entire lifecycle of the products they put on the market. Actors are therefore acting in anticipation:

> *"Of course, there are also legally binding changes happening"* (C3, Carbon Reduction Project).
>
> *"Let's just say there are legislative processes underway (...). Organizational inertia is eliminated by these legislative accelerations. It is difficult to remain inert when you are obligated to act. There is truly a desire to align with future regulatory requirements"* (P9, PEFCR hard goods).
>
> *"We tell ourselves that the situation might not be sustainable, and tomorrow, everything shipped by boat for weeks might be taxed (...). We are at the beginning of the story"* (A6, ASF4.0).

Some legal developments have even forced companies to cooperate, either to establish a common standard or because the scope and complexity of the project, as well as the lack of expertise within a single company, inevitably led to cooperation.

> *"In the specific context of calculating the environmental footprint, there is a legal obligation to allow everyone to use your tool, so this calls for developing it jointly"* (P9, PEFCR hard goods).
>
> *"It's regulatory. We can't do it alone; we are too small. So, in fact, you don't really have a choice"* (P3, PEFCR hard goods*).*
>
> *"We knew we had to follow the PEF methodology, or we would have to do the work twice later"* (P2, PEFCR hard goods*).*

Collaboration between actors within the same sector can also enable lobbying actions toward public authorities, as explained by C5: *"If you want to be a driver of regulation as such, to ensure it benefits you in the end or serves the common good—for a sober and fair textile industry—you have to engage in lobbying."*

Customer demand, on the other hand, appears to be somewhat less influential among the drivers mentioned: *"To be very clear, today, people don't look at 'made in' for footwear; they're not ready to pay more for made in France, especially with inflation over the past year or two (...)."*. But again, everything comes down to anticipation on the part of the companies studied:

> *"We tell ourselves we are investing for the future, that in a few years, this will certainly be the case, and we will have to be ready." (*A6, ASF4.0).
>
> *"If we want it to be understandable to our consumers, we need all to agree on how we communicate" (*P9, PEFCR hard goods*).*

Finally, **financial aid and subsidies** can initiate projects, as in the cases of the Greenwolf repair workshop or ASF.

> *" X raised forty million from the Region; he involved policymakers who followed the project closely, such as the Minister of Labor, Minister of Industry, BPI representatives, and the Prefect..."* (A3, ASF).
>
> *"It was a fund at the time from the Region that provided investment subsidies. We applied, we got it, and it really helped us with the purchase of startup equipment. Forty thousand euros in subsidies—it was great"* (G3, Greenwolf).

Ultimately, external factors act as triggers but are not considered true success factors for the projects.

3.2 Key Organizational Factors Driven by Eco-Innovation Leadership

While external factors trigger companies' awareness of the need to pursue eco-innovation, whether independently or collaboratively, the success of OEI projects relies more heavily on achieving a certain level of maturity in EI. This maturity is intrinsically tied to strong managerial commitment to engage in EI projects, the presence of an EI-oriented culture and organization, and the allocation of necessary resources for these projects.

Table 5 - Main internal OEI Drivers

Type of internal drivers	Nb codes
Organizational levers	114
Strategic levers (leadership support, vision…)	107
Operational levers: sufficient resources	86

Among the internal factors within companies, organizational factors appear to be very important (see Table 5), particularly the existence of a culture of eco-innovation. It seems that most companies in the sample now possess a strong interest in and culture of eco-innovation:

> *"I was very surprised by the depth of technical knowledge related to Life Cycle Analysis methods and standards that everyone in the group possesses. This is one of the factors that allows for rapid implementation."* (P9, PEFCR hard goods).
>
> *"I find that the people I've worked with in this propject have actually been really proactive, really motivated, really keen to do things."* (C6, Reduction carbon project).
>
> *"Our Sustainability Department consists of around sixty people who radiate throughout the company."* (P10, PEFCR hard goods).

A collaborative culture is also important. The presence of large players within the projects, with experience in external collaboration and expertise in the necessary tools and procedures, facilitates project success.

> *"We know how to manage collaboration, whether it's confidentiality agreements, development partnership contracts, exclusivity or not—we know how to handle this level of involvement. Today, we no longer innovate solely internally." (A1_ASF4.0).*

The recognition that eco-innovation requires collaboration is crucial:

> *"To manage this type of innovation—EI—you definitely need partners. (...) We've fully understood internally that we're not going to save the world on our own."*(A1_ASF4.0).
>
> *"There are certain topics, particularly around sustainability, that require significant investments and resources, whether technical or financial, that are far greater. So for us, it's not an issue to collaborate, even with competitors."* (Salomon_ASF4.0).

Having an agile structure also came up frequently in the interviews:

> *"We have the ability to turn the table upside down every day."* (A2_ASF): *"We have a certain agility; we're reactive (...) We're very available, we visit them often; in short, we talk a lot."* (A5, ASF).

However, according to the participants, no OEI project can succeed without management support and a strategic vision that promotes eco-innovation within the company.

> *"Starting in 2016, environmental issues grew in importance in our company: we gradually introduced environmental performance indicators at the highest levels"*(P10, PEFCR hard goods).
>
> *"To create all these conditions, I place great importance on leadership. We're in a moment of transition, and vision is really what matters. A whole series of initiatives have raised awareness—not so much about sustainability issues, because if you're in the outdoor industry, you're already sensitive to those topics—but more about complexity. Raising awareness of the complexity of the issue and the tools we need to address it has really accelerated in the past year at the executive committee level, which now has a deeper understanding of these challenges."* (P3, PEFCR hard goods). *"We're fortunate that the Vice President is the owner of this topic. It comes from the very top. There's a willingness from management to tackle these issues, and they're aware that more technical steps are needed to achieve this."* (P2, PEFCR hard goods). *"Less transformative topics should be managed at the departmental level, but those that involve deep decarbonization or challenge business models and commercial practices need to be addressed at the executive level. That's why the project leader requires each company to involve a CEO or at least a high-ranking deputy. You can't have people without strong decision-making power involved."* (C4, Reduction carbon project).

Without management support, there's no allocation of the necessary resources for the project:

> *"Top managers will give the budgets we need for these kinds of projects. And of course, resources in terms of manpower. It's a pilot project, and we are all learning. It's still a learning process, but the support so far from our management has been very good."* (C3, Reduction carbon project).

A number of resources are indeed necessary for the smooth execution of OEI projects. Among the cited resources is the presence of specific eco-innovation expertise within the company. Having a CSR manager is a minimum but not sufficient; sharp skills in various domains are required. These skills can be acquired through recruitment or strengthened through training programs.

> *"In my team, I have someone specialized in impact measurement."* (C2, Reduction Carbon project).

"We launched training programs created by employees for employees. A whole range of initiatives was launched." (P3, PEFCR hard goods).
"We realized that if we didn't fully master this carbon footprint assessment, it would be much harder for us to understand the underlying issues and how we could improve... We're currently considering adding CSR responsibilities to job descriptions." (C1, Reduction carbon project).
"*We've been developing this expertise internally for six years now, evaluating data quality and developing specific datasets with suppliers; we've invested several million euros."* (...) *"I lead five people on this topic to ensure we go in-depth into all the elements that allow us to do this properly."* (P10, PEFCR hard goods).

When EI is among the company's strategic priorities, OEI projects are also supported by the financial resources essential for their implementation:

"We have a sustainable innovation budget. That means we can allocate it to projects like this." (Salomon).

"For the project to create an LCA methodology, it was easier to secure funding because we know it's a project that will benefit everyone." (P4, PEFCR hard goods).

"One central question is: could the brands pay for the experts and consultants to visit the facilities?" (C6, Reduction Carbon project).

"At the moment, all systems are go: we're ready, motivated, and have the budget—everything's fine." (C1, Reduction Carbon project).

"We invested collectively, so it was certainly easier to generate the entry ticket than if the three brands had done it individually." (C2, Reduction Carbon project).
"I remember saying, 'OK, I have the budget; I'll pay for three thread trials.' Each trial cost about 8,000 euros, so I set aside 30,000 euros for it. He funded the development; my engineers had time allocated for prototyping, so it was all budgeted within our strategy." (A3, ASF4.0).

"If we have shareholder clients who are willing to invest, that's even better. When you're a shareholder, your mindset is different from when you're just a customer." (A2, ASF4.0).

3.3 Partner Alignment: A Key to OEI Project Success

If the previous results highlight external and internal factors that can play a role in the success of OEI projects, our findings show that collaboration-related factors ultimately appear to be the

most decisive. Table 6 provides a descending list of the main project-related factors most frequently cited by the interviewed participants. The alignment of partners emerges as central, whether in terms of strategic fit and compatibilty. Following this are coordination mechanisms adapted to the project, ranging from contracts to trust, depending on the project, and finally, the presence of an innovation intermediary that facilitates and regulates exchanges and knowledge management mechanisms.

Table 6 - Main drivers of OEI Projects

Main Drivers linked to the OEI project	Nb codes
Strategic fit	194
Compatibility of partner profiles (proximities, complementarities)	164
Adapted coordination mode	59

3.3.1 Strategic Fit between partners: A Sine qua Non condition for successful OEI projects

For an OEI project to function properly, our results show that partners must be strategically aligned, meaning they should share an equivalent level of motivation and a common vision regarding the project's objectives and modalities (duration, resource commitment, etc.).

An OEI project is a long-term endeavor. Therefore, it is crucial that the partners are genuinely motivated for the project. This was evident in the large-scale ASF project, as illustrated by the following quotes:

> *"We have common goals, and we realize that we are less competitors and more allies; we benefit more from joining forces than competing on this kind of future project."* (...) *"We don't necessarily have the means to launch certain projects on our own, and we realize that it's not a bad idea to do it together."* (A5, ASF4.0).
>
> *"There must be a very strong economic interest in the middle. Otherwise, it doesn't work."* (A4, ASF4.0).
>
> *"When the idea was brought to us, we immediately saw the potential. It was impossible to set up a factory ourselves; it's not in our DNA—we don't want to manage a footwear factory."* (A6, ASF4.0).

> *"We were all motivated; we all really wanted it, and that's what made it work."* (A3, ASF4.0).

The same strategic intention was evident in the PEFCR HG project, as a partner explains: *"We all know we must do it, and we know we can't do it alone. (...) Ultimately, you feel that for the good of your business and, in a way, the common good, there is a very strong connection between the partners to achieve a joint project at FESI."*

Partners must also align with the pursued strategy (strategic fit). This alignment doesn't necessarily have to exist before the initial commitment to the project but must occur very quickly. Open discussions between the stakeholders are essential for this:

> *"With partner A., before attending the meeting, we discussed these topics to agree on what we wanted (...). Then with the others, we managed, after two meetings, to understand each other's issues, where everyone stood on the subject, and integrate our project into theirs so that everyone was OK with the approach. Finally, we finalized our way of working together. (...) We clearly defined the project's objectives, a one-year duration, the members, with letters of commitment. We established conditions for joining the group. Costs were defined..."* (P2, PEFCR HG).

> *"It is necessary to clarify things and put everything on the table at the beginning of the collaboration: What are we doing, and how are we doing it, rather than at the end. Because at the end, there are always unspoken issues, and it always creates problems. If everything is clear from the start—if we agree that 'we will develop a solution together, and what we ask in return is exclusivity for the outdoor sector, and then you can develop this solution for other sectors'—everything is clear from the beginning. There won't be any surprises. If we discuss from the start what will happen in case of an innovative solution— 'who will hold the patent and how?'—it becomes much clearer, and when there's an innovative solution, there won't be any conflicts." (A1, ASF4.0).*

Partners must also align with the project's duration because, in some cases, results will only appear after several years. This is particularly true for the ASF project, which spans 10 years:

> *"Partners must agree to give two or three years to the project—not just three months saying, 'Let's have three brainstorming sessions, and that's it.'"* (A3, ASF4.0).

This alignment sometimes requires reaching compromises and the organization in charge of coordinating the project plays a key role in this process:

> *"You have to find the common denominator. It's always a very, very difficult discussion because it's not about the smallest common denominator. Some companies are very ambitious and want to move forward, while others are less so. So, you don't want to come up with something unambitious that gives the industry a bad image. But at the same time, you have to consider the resources and means of the different companies. Some are SMEs, highly specialized in CSR and environmental issues; others aren't, and they operate with much older, family-run business models that take longer to adapt or change. Then there are large companies with teams of ten people working on these issues, so they can be much more active and ambitious than smaller companies with one or two people doing their best to move forward."* (P1, PEFCR HG).

However, this compromise must lead to a win-win situation: *"We're not here just to be nice and share. We also want to grow with this project."* (P3, PEFCR HG).

3.3.2 Partner Profiles: Balancing Complementarity and Proximity

The complementarity of partners also emerged frequently in interviews as a success factor for OEI projects. For an OEI project to succeed, partners must have a solid foundation of CSR knowledge and complementary skills in areas relevant to the project.

> *"We found ourselves with brands whose business models were compatible."* (A1, ASF4.0).
> *"You need an ecosystem with complementary skills: a chain of subcontractors, a factory, brands to market the products, and an innovation company like Zebra. It's the combination of these elements. Everyone shares their expertise, and that's what creates value. We couldn't do it alone because everyone lacks some skills, whether industrial, material-related, or retail."* (A5, ASF4.0).

> *"It's the result of an association with strong players on the brand side, on the machine integration side... High-level manufacturers and high-level brands."* (A2, ASF4.0).
> *"You need to have the best at each level. Industrially, we have top-notch people between Siemens, Bosch, and Desmin. Then we had international brands like Salomon, which has*

strong industrialization knowledge—even though they don't manufacture today, they know a lot about footwear." (A2, ASF4.0).

Finally, the proximity between partners facilitates this alignment. This proximity can take different forms. In the studied cases, it is first and foremost social. Indeed, belonging to the same industry, all the companies know each other, some for a very long time.

"They know us. It's a microcosm, it's pretty much always the same people we see (...). It strengthens the connection, the network." (P10, PEFCR HG).
"Everyone knows what the others are doing; it's really a small industry." (P4, PEFCR HG).
"I think there's already a human fit, so there was no need for an intermediary." (A3, ASF4.0).

Their members have multiple opportunities to meet, for example, at events organized by institutions such as Outdoor Sport Valley (OSV) in France or EOG at the European level, as well as professional trade shows like ISPO in Munich or Sport Achat in France.

"Of course, we know each other. I had met her at the working group. We saw each other again at the OSV day the other day. We discussed these topics again. Immediately, it's easier. You say, 'Well, we already know each other.' Obviously, it helps." (P4, PEFCR HG).
"The interpersonal connection I had with all the members was decisive. The different brands followed me because they knew me, because they had seen over the past three years what I had done for the Sustainability Development pole within OSV. This relationship of trust—it's human." (G4, Greenwolf).

This social proximity is supported by institutional proximity: membership in the OSV cluster:

"In Rhône-Alpes, being an OSV member certainly facilitates exchanges. When you can discuss with other partners during an OSV meeting, it often opens doors, even on other topics. So it certainly accelerates collaboration." (P2, PEFCR HG).

These brands have also often collaborated together before:

> *"We collaborated in different combinations before. We have very close contact with X for many years. We have some information exchange with Y, also with W, Z.., I know them for many years. I think it definitely makes it easier when you know each other; then you're able to talk much more openly." (C3, Carbon Reduction Project).*

Proximity is also cultural. Collaborating with actors of the same national culture seems easier than with companies from foreign countries.

> *"In the ski industry, there are few links between the French and the Austrians/Germans; they are two blocs that don't get along too well. So, we spoke quite a bit with B and C, and on their side, they spoke with all the Austrians. There were really two blocs. It's easier to connect with the French. We speak French; it's easy."* (P4, PEFCR HG).
> *"I think ten companies from the same country are simpler than ten companies spread across four countries. When you come from four different countries with four different regulations and four different needs, it's more complicated to align. Fortunately, we're still on the same continent. But it's true that we don't have the same expectations and needs initially."* (P2, PEFCR HG).

It has been observed that it is much easier for French actors to agree on a common solution than with their foreign partners. They notably formed a kind of coalition to stand together. However cognitive proximity is also important to progress faster. This is first linked to the fact that all actors belong to the same industry and often perform similar jobs.

> *"We are actors with the same constraints, the same industrial knowledge; we all work in the ski industry."* (P10, PEFCR HG).

> *"We all use the same materials, so we know we will cross paths again."* (C1, Carbon Reduction Project).

> *"We have almost the same functions, so it's easier."* (P4, PEFCR HG).

But it also depends on the companies' maturity in eco-innovation.

> *"What also strongly surprised me is the level of technical expertise in LCA methodologies and standards, approaches, and estimates... that each member of the group has. It's a great discovery that allows us to move very quickly on this project. Because what can*

> *often block progress is this maturity gap, where some ask questions that are obvious to others, leading to impatience, etc. Here, I think there's a good harmony."* (P9, PEFCR HG).

This cognitive proximity is sometimes even a prerequisite for joining the OEI project, as in the PEFCR HG project. P2 explains: *"We set conditions for joining the group: having knowledge in LCAs, ensuring there are no companies or company representatives who are completely unfamiliar with LCAs and come to debate the topic. It would have really complicated discussions to have to explain. It was one of the conditions for participation."*

Finally, geographical proximity reinforces social proximity and facilitates the smooth running of the project because the actors can meet more frequently. While all the projects used digital solutions for communication, these do not replace face-to-face exchanges, which are considered much more effective.

> *"Digital tools, we've seen, don't facilitate collaboration. Because often, problems are resolved outside of meetings. They are raised during meetings, but behind the scenes, the exchange is not facilitated at all. Problems are resolved outside of meetings. And at the next meeting, we say: 'We resolved the issue.' I think in-person interactions allow for more time, whereas doing three hours of Teams isn't very effective. Remote work, I think, is a barrier to collaboration."* (P2, PEFCR HG)

> *"In Slovenia the other time, if we hadn't been in person, we would have missed everything. All the discussions you have during breaks, here or there, are very impactful. That's almost where you work. You can discuss things much more concretely than in the work session. So, we should aim to meet in person as much as possible. Especially because when it's hybrid, those who are remote don't fully understand, try to participate but aren't heard: it's always more complicated!"* (P4, PEFCR HG).

> *"Seeing someone in person really helps to know them more as a person than just as a project participant. Again, it builds trust. If you can meet someone in person, even if it's just for a coffee for 20 minutes, it really helps."* (C6, Carbon Reduction Project).

4. DISCUSSION & CONCLUSION

The literature on Open Innovation (OI), Eco-Innovation (EI), and more recently Open Eco-Innovation (OEI) has identified numerous potential levers and success factors for OEI projects (Pereira et al., 2020; Christov et al., 2021). However, to the best of our knowledge, no research has yet succeeded in prioritizing these factors or empirically identifying the specific determinants of success for innovation projects. This research constitutes a first attempt to empirically identify and rank these levers. Our results first highlight that factors related to OI (particularly partner alignment) seem to be the most important, followed by internal factors, and then external factors. However, qualitative analysis refines this conclusion, revealing a sequence in the activation of these levers, with seemingly less important factors actually playing a key role earlier in the process. Therefore, we propose to discuss our findings in two stages.

4.1. Strategic and Relational Partner Alignment as Key Determinants

Three categories of levers potentially contributing to the success of OEI projects were identified in the literature: EI *external* levers (sectoral opportunities, supplier engagement, consumer demand, regulations, etc.), EI *internal* levers within member companies (strategic, organizational, operational), and levers related to *OI projects* (partner alignment, knowledge management, communication, coordination, etc.). Analysis of interviewee responses and the frequency of codes assigned to these lever categories reveals that OI project-related factors, particularly the selection of partners and their alignment in terms of objectives, are most important, followed by EI internal factors, with EI external factors ranking last.

Partner alignment appears to be the most critical success factor across the four cases studied. This alignment includes both **strategic and relational dimensions** (Emden et al., 2006). Strategically, partners must share a similar level of motivation and a common vision of the project's objectives and modalities (e.g., duration, resource commitment). This factor is particularly crucial here as the four projects involve competitors. Alignment is thus essential to mitigate risks of opportunism. The literature on open innovation and broader inter-organizational cooperation strategies (alliances, networks, etc.) has consistently emphasized the importance of partner selection for the success of inter-organizational projects (Hurmelinna-Laukkanen et al., 2022; Shah & Swaminathan, 2008). In our cases, except for ASF, partner selection did not involve one entity choosing other organizations for the project but rather

voluntary engagement of firms solicited in a very open manner by a third-party organization. Nonetheless, consistent with previous studies, we observe that partner alignment in terms of strategic objectives significantly benefits cooperation and, in our context, open eco-innovation (Kale et al., 2000; Mora-Valentin et al., 2004; Zacharias et al., 2020).

Two main factors facilitated this strategic alignment. The first is regulation, which pushes actors to recognize the urgency of adopting more environmental practices and encourages collaboration to jointly define new environmental standards (Shen et al., 2020). The second is the central role played by a coordinating organization in all four cases studied. These OEI projects are centralized and coordinated by a formal organization (a supplier and innovation agency for the ASF project, the French cluster OSV for the Greenwolf project, and European organizations for the Carbon Reduction and PEFCR Hard Goods projects). These hub organizations regulate exchanges within the projects to define strategic orientations, ensure coordination, optimize partner relationships, and discourage opportunistic behaviors that could hinder project efficiency (Dhanaraj & Parkhe, 2006; Favre-Bonté et al., 2016; Lorenzoni & Baden-Fuller, 1995). They act as innovation intermediaries (Rouyre & Fernandez, 2019).

Relational alignment among partners is also crucial and reinforces strategic alignment. This relational alignment stems from the proximity between partners. Various types of proximity are at play, as defined by Boschma (2005): geographical, social, institutional, cultural, and especially cognitive proximity. The four cases involve actors from the same industry, most of whom are located in the same geographical region (Rhône-Alpes or the Alpine Arc in Europe) and, on the French side, are part of the Outdoor Sport Valley (OSV) cluster. *Geographical* proximity facilitates exchanges, including informal interactions outside project-related meetings. Innovation management researchers agree that repeated direct contact enhances knowledge transfer and fosters trust (Torre & Rallet, 2005). This geographical proximity also promotes embeddedness (Granovetter, 1985) and social proximity, resulting from a shared history of exchanges and relationships within the cluster and more broadly the industry (Gilsing et al., 2008; Granovetter, 1985). *Social* proximity enables the development of trust-based relationships that facilitate tacit knowledge exchange (Inkpen & Tsang, 2005) and reduce risks of opportunism. *Institutional* proximity relies on shared cultural habits and values as well as coherent institutional rules. It encompasses both a clear institutional framework—based on consistent and applicable laws and governance—and a clear cultural structure, with common language and habits (Boschma, 2005). In our cases, this proximity is both cultural (the outdoor

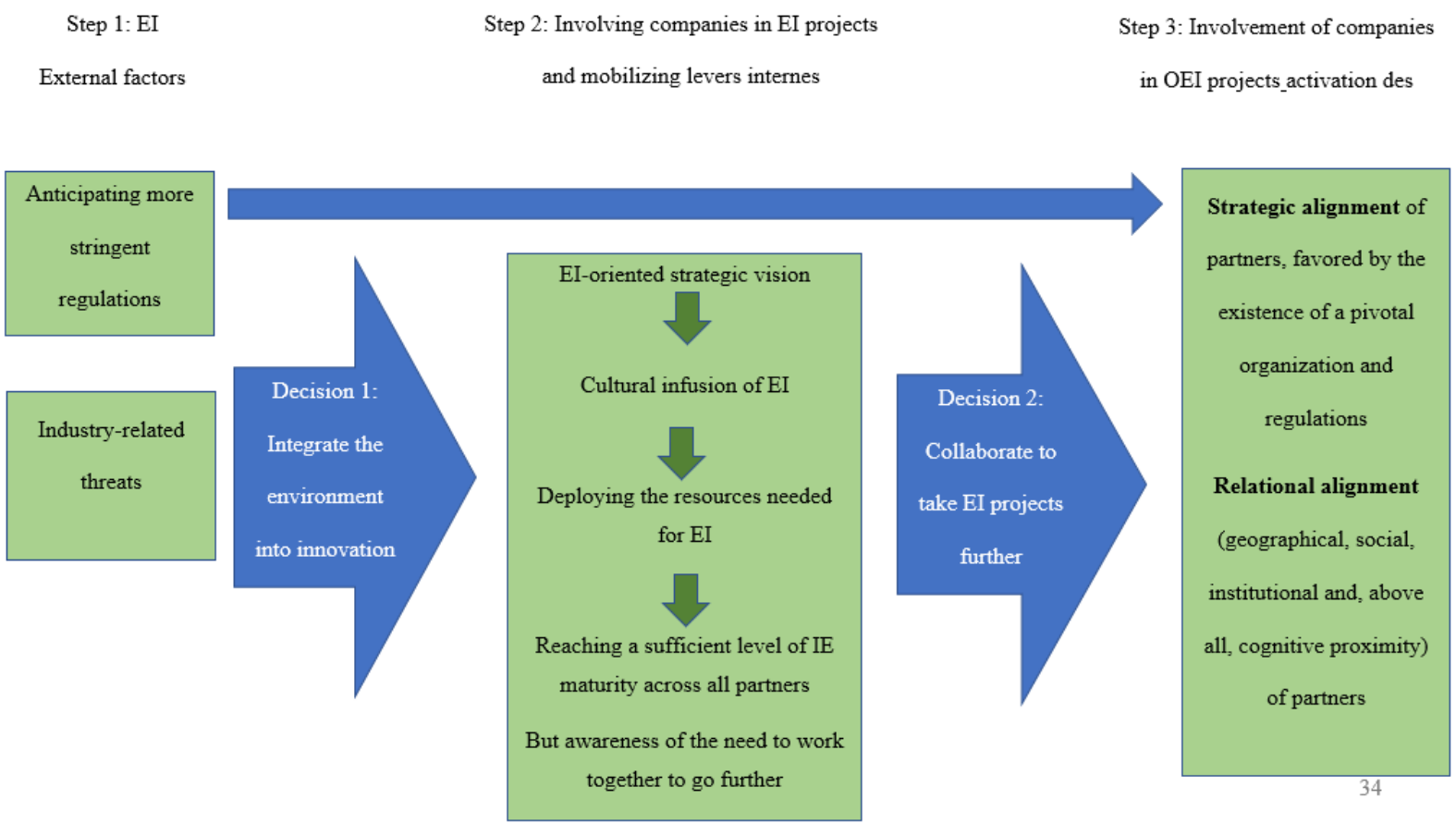
sports culture) and related to the compatibility of actors' histories and values (Doz et al., 2000) and their affiliation with sports industry institutions (FESI, EOG, OSV cluster). Previous literature has often emphasized that effective communication and knowledge exchange between partners require a minimum level of congruence in norms and procedures (Parkhe, 1991). Finally, *cognitive* proximity—the ability of actors to communicate, understand, absorb, and generate new knowledge together—is essential. Project partners share a common knowledge base in both the sector and eco-innovation, enabling them to speak the same language. This cognitive proximity facilitates knowledge sharing and effective interactions (O'Connor et al., 2021). In our cases, cognitive proximity appears as a prerequisite for success, hinting at a sequential activation of levers favoring OEI. Asymmetry doesn't seem to be relevant to project success, symmetry not being linked to the size of the partners but rather to their maturity in terms of IE.

4.2. The Sequencing of Drivers Activation

Beyond identifying and prioritizing the drivers that promote OEI project success, our qualitative research highlights a trajectory in lever activation (see Figure 1).

Chronologically, external factors—primarily regulations and sectoral threats—initially raised awareness of the need for change. Environmental orientation, defined as managers' recognition of environmental issues surrounding the company, initially comes from external sources in most project partners (Banerjee, 2002). These sectoral and regulatory changes are perceived as potentially affecting market access in the near future, prompting companies to address environmental issues and even collaborate to define new product design standards (Shen et al., 2020). These therefore confirms that regulations act is an influential drivers of OEI, but at the beginning of the process (Spena & Paola, 2020). Facing these threats, companies initially respond reactively and autonomously by introducing and formalizing environmental objectives within their innovation strategies (Kesidou & Demirel, 2010; Del Rio et al., 2016; Hojnik & Ruzzier, 2016 ; Khan et al., 2021). These objectives are subsequently operationalized. The gradual infusion of an environmental culture is facilitated by training and hiring employees with EI expertise and allocating resources to EI projects. Companies thus achieve an initial level of EI maturity.

Figure 1: Sequencing the activation of OEI levers in the outdoor industry



However, given the scale of EI projects, companies eventually realize the urgency of collaboration, even if this was not previously common in the studied industry. This awareness and environmental maturity, combined with sectoral and regulatory pressures and the presence of a coordinating organization, further promote partners' strategic and relational alignment, ultimately ensuring OEI project success.

4.3. Managerial Implications, Limitations, and Future Research Directions

In terms of managerial implications, the results emphasize the importance of strategic and relational alignment among OEI project partners. Two levers are particularly critical: the necessity of achieving sufficient EI maturity before engaging in collaboration, to be considered a valuable partner and avoid slowing the OEI project. Companies wishing to participate in OEI projects should incorporate eco-innovation modules into their training plans or hire employees with relevant expertise. Secondly, the presence of a coordinating organization facilitating exchanges appears to be another key success factor for OEI projects.

This exploratory research has limitations and suggests avenues for future research. First, the empirical study focuses on only four OEI projects in a single sector, the outdoor sports industry. Further research could analyze projects from other industries. Second, while our study identifies a sequence in lever activation, it was conducted retrospectively. A longitudinal approach could provide an interesting perspective for refining the proposed model. Third, the study focuses solely on successful cases. Including failed cases could offer better comparisons and help identify barriers to OEI projects. Finally, the role of coordinating organizations in aligning partners strategically deserves more detailed analysis.

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