



Threading fashion's paradox knot: IP strategy in open and sustainable innovation

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Threading fashion's paradox knot: IP strategy in open and sustainable innovation

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Abstract

Purpose – This study examines how entrepreneurial ventures in the fashion industry use intellectual property (IP) to manage paradoxical tensions arising from sustainable open innovation. We focus on two paradoxes – knowledge sharing vs. knowledge control and economic vs. sustainability outcomes – and show how they knot together, generating emergent tensions that shape ventures' IP strategy toward seeking complementarity where possible and compromise where necessary.

Design/methodology/approach – A qualitative, interview-based study of 24 sustainable ventures in the fashion industry (32 interviews plus secondary data). Using three-stage open coding, we analyzed decisions around sustainability pathways, sustainability challenges and the role of IP. We identify emergent tensions arising at the intersection of the two paradoxes and trace how ventures mobilize IP to navigate them.

Findings – Three emergent tensions are identified: incumbent-led vs. venture-led change (sustainability pathways), sustainability ideals vs. economic incentives (sustainability challenges) and innovation diffusion vs. venture survival (role of IP). Ventures use IP not to privilege sharing or protection, but to orchestrate both through boundary-spanning, threshold protection with selective openness and processual adjustments over time.

Originality/value – The study advances paradox theory by empirically detailing how paradox knots materialize in entrepreneurial practice, and extends IP strategy research by reframing IP as a dynamic, processual orchestration and boundary object under enduring paradox. It clarifies when and how IP both enables and constrains sustainable innovation, highlighting its integral (though often under-recognized) role in achieving integrated economic and sustainability outcomes.

Keywords Intellectual property, Open innovation, Sustainability, Entrepreneurship, Paradox theory, Fashion industry

Paper type Research article

1. Introduction

One of the primary functions of intellectual property rights (IPRs) in innovation is to provide legal protection against imitation, thereby allowing innovators to capture returns on their investments. Unsurprisingly, much of the early research on intellectual property (IP), particularly patents, emphasized knowledge protection as a means of value capture (Appio *et al.*, 2014; Di Minin and Faems, 2013; Holgersson, 2013; Levin *et al.*, 1987; Teece, 1986). Yet IPRs come in many forms, each serving different purposes and the simplified focus on patents has gradually given way to a broader understanding of the role of IP in innovation. For instance, copyrights protect against unauthorized use while safeguarding creators' moral rights; trademarks protect producers but also assure consumers of brand quality and patents not only shield against imitation but enable controlled and selective sharing of technology (Arrow, 1962; Baldwin and Henkel, 2015; Chesbrough, 2003; Henkel, 2006; Holgersson *et al.*, 2018). Today, both research and practice recognize that IP strategy involves much more than formal IPRs used defensively; it encompasses a wide range of formal and informal means for

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enabling, coordinating and controlling innovation within and across organizational boundaries (Aloini *et al.*, 2017; Henkel *et al.*, 2013; Holgersson and Granstrand, 2022; Hurlmelinna-Laukkanen and Yang, 2022; Miric *et al.*, 2019; Teece, 2018; Tietze *et al.*, 2025).

IP has consequently become increasingly important in managing paradoxical tensions that arise in the course of certain types of innovation in particular (Lauritzen and Karafyllia, 2019; Laursen and Salter, 2014; Lewis, 2000). In this study, we highlight two critical paradoxes central to sustainable open innovation (Bogers *et al.*, 2020; Jesus and Jugend, 2023): the paradox between knowledge sharing and knowledge control, and the paradox between economic and sustainability objectives. Specifically, open innovation research has shown that firms must embrace both knowledge sharing and control to tackle wicked problems (Ooms and Piepenbrink, 2021) and address societal grand challenges (McGahan *et al.*, 2021), with IP playing a central role (Chesbrough, 2003; Holgersson and Granstrand, 2022). The COVID-19 pandemic provided an illustration: calls were made for firms to share their IP through pledges, pools and waivers (Chesbrough, 2020; Contreras *et al.*, 2020; Dahlander and Wallin, 2020), and many responded. But such practices aren't new, as evidenced by The Sewing Machine Combination patent pool, the first patent pool in US history. Formed in 1856, its aim was to increase access to and reduce litigation related to sewing machine patents. IP strategy research has now devoted considerable attention to the sharing-control paradox in connection to various forms of open innovation (Di Minin and Faems, 2013; Henkel *et al.*, 2013; Holgersson *et al.*, 2018).

However, existing research suggests that IP is often a double-edged sword when it comes to sustainable innovation, serving as a necessary incentive for its development (Eppinger *et al.*, 2021; Vimalnath *et al.*, 2022) but a barrier to its diffusion (Athreye *et al.*, 2023; Bustamante *et al.*, 2023; De Rassenfosse and Palangkaraya, 2023). Thus, there is a pressing need to understand how IP enables and constrains sustainable innovation by shaping the dynamics between knowledge sharing and control in pursuit of joint economic and sustainability outcomes. Our aim is therefore to identify emerging tensions in the interaction between these two paradoxes and to explore how IP strategy contributes to orchestrating the “knot” that arises at their intersection.

That is, scholars increasingly emphasize that paradoxes rarely exist in isolation but are interwoven in complex “knots,” where managing one paradox inevitably affects others (Henriksen *et al.*, 2021; Waldner *et al.*, 2022). When multiple paradoxes become knotted, new emergent tensions arise from their interactions (Henriksen *et al.*, 2021; Waldner *et al.*, 2022). While IP strategy research has greatly advanced our understanding of how IP can help firms cope with the sharing-control paradox, we know far less about its role in orchestrating complex paradox knots.

We examine this role through an empirical study of 24 entrepreneurial ventures in the fashion industry, based on 32 interviews and secondary data. The fashion industry is, by some measures, the world's second most polluting sector (McKinsey and GFA, 2020; Niinimäki *et al.*, 2020), where sustainable innovation is increasingly driven by entrepreneurial newcomers (Anand *et al.*, 2021; Krasnokutskaya *et al.*, 2024). IP strategy in this setting deals with conflicting tensions related to the intertwined sharing-control and sustainability-profitability paradoxes (Athreye *et al.*, 2023; Bustamante *et al.*, 2023; De Rassenfosse and Palangkaraya, 2023). These tensions are exacerbated for entrepreneurial ventures, which lack the size, resources, legitimacy and complementary assets needed to protect their competitive advantage without IP (c.f. Teece, 1986; Vimalnath *et al.*, 2022), though they are crucial for the industry's sustainable innovation (Anand *et al.*, 2021; Krasnokutskaya *et al.*, 2024).

In the following, we start by introducing the key theoretical building blocks of this work. After that, we describe the empirical method and analysis, before presenting the empirical findings, the emerging tensions and the role of IP in orchestrating the knotted paradox. These findings are then discussed based on theory and previous literature.

2. Theoretical background

2.1 *Open innovation in sustainable fashion*

Open innovation is defined as the purposeful management of inbound and outbound flows of knowledge across organizational boundaries (Chesbrough, 2003). Reasons can be both financial and nonfinancial (Chesbrough and Bogers, 2014), with research increasingly stressing the latter (Bogers *et al.*, 2018). As such, the importance of open innovation has been highlighted for tackling wicked problems (Ooms and Piepenbrink, 2021) and societal challenges (McGahan *et al.*, 2021), including COVID-19 (Chesbrough, 2020; Dahlander and Wallin, 2020) and the ongoing sustainability crisis (Bogers *et al.*, 2020; Jesus and Jugend, 2023; Krasnokutska *et al.*, 2024).

Fashion is one of the industries with the most urgent need to address sustainability (McKinsey and GFA, 2020). Solutions are required that leverage shared knowledge in order to mobilize collective action, which is where open innovation takes on particular relevance (Krasnokutska *et al.*, 2024; McGahan *et al.*, 2021) but also where tensions arise. This is especially true for an industry like fashion, with its lack of transparency and geographically dispersed and fragmented supply chains (Niinimäki *et al.*, 2020). Knowledge control, in the form of, for instance, secrecy around suppliers, may, for instance, inhibit knowledge sharing. Meanwhile, the pursuit of profitability may prevent certain sustainability solutions from gaining traction, as is the case when production is split between suppliers in order to cut costs, making it harder for brands to keep track of their production practices and comply with legislation. Finally, these tensions may be related in various ways, as when knowledge control through secrecy is what initially makes brands lose track of their suppliers, therefore harming sustainability.

Even so, the need to become more sustainable has inspired many initiatives, as evidenced, for instance, by the introduction of “green lines” into brands’ fashion collections. Other initiatives are being driven by governments through legislation, for example, by banning, fining or taxing the use of certain materials. A great many initiatives are likewise carried out by sustainable fashion ventures, industry newcomers championing new technologies and business models in attempts to challenge, support or enable change (Krasnokutska *et al.*, 2024; Schaltegger and Wagner, 2011; Westman *et al.*, 2023).

Figure 1 provides a simplified overview of some common types of innovation currently being advanced along the fashion value chain. It should become apparent that many innovations are not confined to a single function but rather span relationships *between* functions. For instance, while material innovation is relevant at the sourcing and production stages, it likewise impacts a garment’s end of life. Bio-based materials are sustainable in their production, while biodegradable materials can be sustainably discarded as well. Importantly, a garment’s end of life is crucial to consider at the production stage, inherent to a circular value chain. Hence, life cycle considerations and integration along the value chain are often more important than efficiency and optimization within any one function (Brydges, 2021; Saha *et al.*, 2022).

2.2 *Tensions and paradoxes in sustainable open innovation*

Notable in this regard is that research on open innovation has shown how, sometimes, the best way to share an innovation is to make it proprietary. Strong IP positions can enable knowledge sharing and innovation diffusion, facilitating technology trade, co-development and integration into existing infrastructures while protecting a firm’s competitive advantage. Specifically, obtaining legal rights enables ventures to license their IP in order to scale and promote technology adoption (Chesbrough, 2003; Hagedoorn and Zobel, 2015; Grimaldi *et al.*, 2021; De Rassenfosse, 2012).

For entrepreneurial ventures, however, tensions between knowledge sharing and knowledge protection are particularly salient. Liabilities of newness and smallness hamper their resources and legitimacy (Gimenez-Fernandez *et al.*, 2020), meaning there is a strong

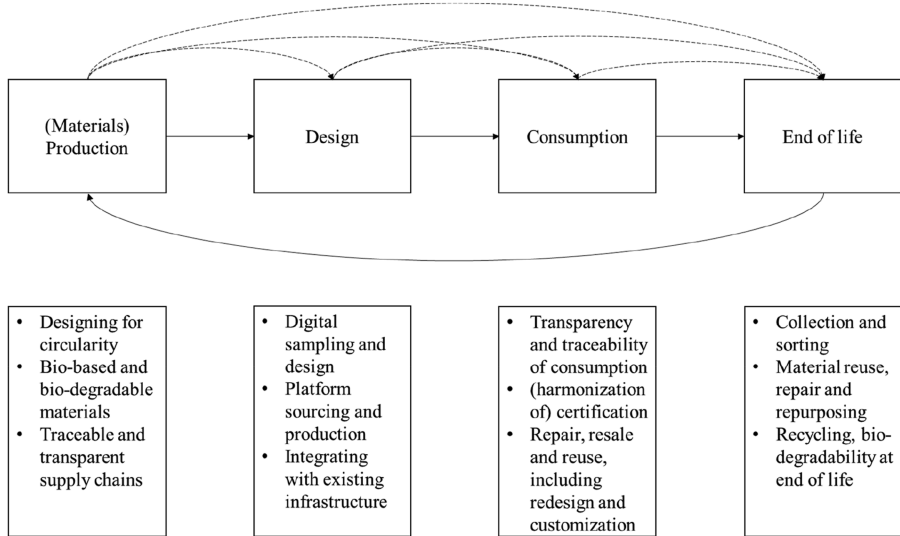


Figure 1. Simplified sustainable fashion value chain. Source: Authors' own work

need for ventures to obtain external investment and engage in collaboration with incumbents. Often IP makes up the venture's main leverage within these relationships, so that knowledge protection is especially important, and may compromise knowledge sharing (Hurmelinna-Laukkanen, 2011; Olander *et al.*, 2009; Vimalnath *et al.*, 2022).

Protecting knowledge in a context of sustainable open innovation may moreover result in a slower rate of diffusion, hindering imitation, follow-on innovation and adoption of technologies by incumbents capable of scaling them (e.g. Shapiro and Varian, 1999). Hypothetically, the best way to promote societal outcomes may be for ventures to forego value capture as much as possible for the sake of value creation, sharing IP as openly as is feasible so that others can imitate, helping create a market for new technologies while incumbents take innovations to market and diffuse them at scale. This implies a paradox where sharing IP threatens a venture's economic survival while protecting it hinders the diffusion of sustainable innovation (Athreye *et al.*, 2023; Bustamante *et al.*, 2023).

The literature on sustainable entrepreneurship refers to a situation where ventures achieve both economic and sustainability outcomes using the same value proposition as one of "integrated" or "hybrid" outcomes. If ventures instead modularize in order to achieve economic and sustainability outcomes using different parts of their business model, this is referred to as "parallel" outcomes (Davies and Chambers, 2018). However, the role of IP in this has not received much attention, while its role in sustainable innovation in general is contested (Eppinger *et al.*, 2021; Vimalnath *et al.*, 2022). On the one hand, IP forms a necessary incentive for innovation, enabling ventures to survive so that sustainable solutions can be developed and diffused through collaboration and licensing (Steiber and Alänge, 2021). On the other hand, IP may hinder the diffusion of sustainable innovation by erecting barriers to imitation and adoption (Athreye *et al.*, 2023; De Rassenfosse and Palangkaraya, 2023).

Moreover, it is currently unclear whether the tensions that ventures experience manifest as one-off tradeoffs or dilemmas between the prioritization of one outcome over the other, or reveal themselves to be ongoing, enduring paradoxes between knowledge sharing and knowledge protection on the one hand (Bogers, 2011; Jarvenpaa and Wernick, 2011) and between sustainability and economic outcomes on the other hand (Smith and Lewis, 2011; Lewis and Smith, 2022). Specifically, while a tradeoff implies a single decision point where

different opposing demands are weighed against one another, a paradox implies enduring tensions and repeated decisions to consistently balance, manage or resolve said demands. Hence, a tradeoff may be resolved by selecting priorities between competing demands and perhaps achieving outcomes in parallel. Meanwhile, paradox resolution requires integrated outcomes where complementarity is sought between knowledge control and knowledge sharing, and between economic and sustainability outcomes.

As was suggested, paradoxes may additionally be related, creating what is known as a knotted paradox at their intersection (Jarzabkowski *et al.*, 2022; Sheep *et al.*, 2017). This means that IP decisions with regard to the knowledge sharing-control paradox have an impact on whether, how and to what extent ventures manage the sustainability-profitability paradox, and vice versa. According to organization paradox theory, the original paradoxes may both amplify or attenuate each other (Sheep *et al.*, 2017), and new tensions may emerge over time. This study consequently elucidates how IP is used to manage the sharing-control and sustainability-profitability paradoxes, and the emerging tensions in the paradox knot at their intersection.

2.3 Intellectual property rights, intellectual property and intellectual property strategy

IPRs, IP, and IP strategy are all central concepts to this study. IPRs are a “family of temporary, restricted, and transferable or licensable rights to exclude others from commercializing someone’s intellectual or intangible creations or inventions under certain conditions” (Granstrand and Holgersson, 2015, p. 1). They include rights such as patents, copyrights, design rights and trademarks. Due to the formal laws and regulations surrounding IPRs, the meaning of the concept is well-established.

The broader concept of IP is more ambiguous; nevertheless, it is frequently used and defined in various settings (Candelin-Palmqvist *et al.*, 2012). For example, the World Intellectual Property Organization (WIPO) defines IP as “creations of the mind, such as inventions; literary and artistic works; designs; and symbols, names and images used in commerce” (WIPO, 2025). In other words, the concept of IP is much broader than only IPRs (Granstrand, 1999; Granstrand and Holgersson, 2015; Holgersson *et al.*, 2018).

IP strategy, in turn, relates to the strategic decision-making concerning IP and IPRs (Di Minin and Faems, 2013; Holgersson *et al.*, 2018). It extends beyond the use of formal rights to encompass a wide range of interrelated choices – for example, whether to pursue or forego formal protection for an invention, to license technologies in or out, to open source a solution, to enforce IPRs against competitors or to build protection indirectly through unique access to complementary assets or other informal appropriation mechanisms (Zobel *et al.*, 2017) – reflecting the multifaceted ways in which firms can capture, share and protect value from knowledge and innovation (Arundel, 2001; Brouwer and Kleinknecht, 1999; Chesbrough, 2003; Holgersson, 2024).

IP strategy thus concerns how firms acquire and create IP, how they govern it, and how they exploit and commercialize it. Following Mintzberg (1978), strategy can be understood as a “pattern in a stream of decisions,” with outcomes lying on a continuum between deliberate and emergent strategies. This perspective underscores the dynamic nature of IP strategy: some decisions are carefully planned and executed, while others emerge in response to evolving technological, competitive, or institutional conditions. Relatedly, Porter (1980) defined competitive strategy as offensive or defensive actions designed to create and sustain a defensible position in an industry. Translated into the IP domain, such orientations are clearly visible, where offensive aims include blocking competitors to secure “market freedom,” while defensive aims include preventing competitors from blocking one’s own activities to ensure “design freedom” – all of which are part of IP strategy (cf. Granstrand, 1999; Somaya, 2012).

In the context of sustainable open innovation, a key priority for IP strategy is managing the tensions arising from the knowledge-sharing-control and sustainability-profitability paradoxes. As described in the previous section, IP plays a central role in both these

paradoxes and in the tensions that emerge at their intersection. Hence, there is a strong imperative for ventures to manage their IP in such a way as to contribute to resolving rather than exacerbating tensions, achieving integrated outcomes. Little is known about the role of IP in navigating the sustainability-profitability paradox, however, and even less is known about its role in managing paradox knots. As such, there is a significant gap in our knowledge regarding the role of IP in resolving emergent tensions and achieving integrated outcomes. In this study, we contribute to this gap by examining the way entrepreneurial ventures in the fashion industry managed their IP in the context of sustainable open innovation.

3. Methods

This study uses an inductive, qualitative research design. The primary data consists of interviews with venture founders and email follow-ups, complemented with secondary data in the form of (website) publications. Because no clear definition or standardized database of fashion startups exists, the study relies on a nonrandom, purposive sampling approach (Bryman and Bell, 2007; Patton, 2014). The ventures were identified by the researchers, and include startups that were identified as sustainable fashion startups by their own definition and that of credible stakeholders such as governments, investors, incubators, accelerators and sustainability platforms, and with an age of maximum ten years. Specifically, we conducted a web search for “sustainable fashion,” “sustainable fashion startups,” “sustainable fashion ventures” and “sustainable entrepreneurship” and selected sources based on relevance and authority, e.g. well-known sustainability platforms like “Fashion for Good” or publicly and/or privately funded sustainability contests. From this, we selected ventures that fit within our sampling frame.

While this type of nonrandom sampling has inherent limitations in terms of statistical representativeness and generalizability, it is a well-established method in exploratory research, particularly when the research aim is to generate in-depth insights rather than to test hypotheses across large populations (Eisenhardt, 1989; Patton, 2014). In line with this, our study does not claim statistical validity in a broader population. Instead, the purpose is analytical and theoretical generalization (Yin, 2018), offering valuable insights into the dynamics of intellectual property strategy and knotted paradoxes in sustainable entrepreneurial ventures.

Within the sampling frame, a variety of ventures was selected, differing in terms of their business model, type of innovation and geographical location. Rather than seeking a homogenous sample, we aimed to cover a broad range of sustainable innovations taking place in the global fashion industry. Hence, ventures operating in different parts of the value chain, with different types of (hardware and software) technologies, were sought. As such, sampling continued until additional sampling no longer added diversity in terms of sustainable innovations and business models. Ventures were contacted via email and asked for an interview, at the end of which they were asked about their availability for either a follow-up call or a follow-up interview via email. In total, 24 ventures agreed to take part for a total of 32 interviews and 4 email follow-ups. (One of the ventures consented to answering questions through email only.) Appendix A includes an anonymized overview of the different ventures and respondents included in the sample.

Interviews were semi-structured, following a set line of topics but not a set line of conversation. Semi-structured interviews were employed because they combine structure with flexibility, allowing us to probe predefined themes while also following up on unexpected insights (Adeoye-Olatunde and Olenik, 2021; Bryman and Bell, 2007). This was particularly valuable in the context of entrepreneurial fashion ventures, where there is limited prior research and heterogeneous practices. The format enabled respondents to articulate their experiences with IP and sustainability in their own terms, while ensuring comparability across cases. The topic guide used for the first round of interviews can be found in Appendix B. This topic guide was updated throughout the course of data collection, depending on answers

received from respondents, meaning that themes that emerged from the first round of interviews were incorporated in the second round to test their relevance across respondents. Hence, the first round of interviews focused on the kinds of sustainable open innovation ventures practiced and the IP decisions they had taken. After describing the venture's innovation, IP decisions and approach to openness, interviewees were asked whether and how they experienced tensions between knowledge sharing and knowledge protection and between economic and sustainability outcomes and how this impacted the way they decided to manage their IP.

Following data collection, interviews were transcribed and analyzed using three-stage open coding focusing on the decisions involved in ventures' innovation and IP management (c.f. Gioia *et al.*, 2013). In line with the study's inductive design, coding was targeted insofar as the topic list had been, with a focus on decisions, their aims, deliberations within the process of decision-making and the wider concerns that these decisions sought to address. As such, initial coding resulted in a large number of informant-centric, *in vivo* codes referring to the various *a priori* considerations and *a posteriori* outcomes of ventures' decision-making. These were subsequently compared and refined across interviews to result in 29 first-order codes, which were inductively grouped through an iterative process of data analysis, literature study and discussions between the researchers (Bryman and Bell, 2007; Gioia *et al.*, 2013). In consequence, first-order codes were subsumed under nine second-order themes, which themselves were organized under three third-order dimensions: sustainability pathways, sustainability challenges and the role of IP. These dimensions reflected the key components of the sustainable open innovation decisions as taken by ventures in this study. Hence, ventures discussed how their decisions helped promote sustainability along different pathways, which sustainability challenges they aimed to address and how IP featured in this. Spare codes referring to ventures' business models and noninnovation related decisions were not included in the final analysis as they were judged to be of less relevance to the study's research question.

Appendix C includes a coding table with an overview of the first, second and third-order codes, including coding examples. A visual representation of this data structure with abbreviated coding examples can be found in Figure 2 below. As can be seen from the figure, each third-order dimension incorporates an emerging tension resulting from the interplay in the knot between the sharing-control and sustainability-profitability paradoxes. These emerging tensions, including how they manifested and how ventures managed them, are discussed in the next section.

4. Findings

While any firm involved in open innovation will find itself confronting the tensions of knowledge sharing and knowledge protection, this is exacerbated for entrepreneurial ventures, especially those working to address societal challenges like the sustainability crisis. On the one hand, sustainable innovation may benefit from open knowledge sharing due to the complexity of sustainability issues and the need to lower barriers to imitation and adoption. On the other hand, knowledge protection may be a necessary condition for innovation to occur in the first place, as it enables ventures to achieve economic viability. Moreover, knowledge protection may be a requirement for knowledge sharing, while economic success may enable sustainability by legitimizing innovation, freeing funds for development and accelerating rates of adoption. Hence, there is the potential for both tensions and complementarities to arise in ventures' pursuit of sustainable innovation, between knowledge sharing and knowledge protection, between economic and sustainability outcomes, and between both at the same time.

A first finding from this study is that these tensions may be conceptualized as paradoxes rather than dilemmas or tradeoffs due to the persistent, interrelated nature of their respective demands on ventures' innovation and IP management. Ventures hence consistently sought and often found complementarities between opposing demands rather than prioritizing one outcome over another. Moreover, where these paradoxes intersected, they were found to

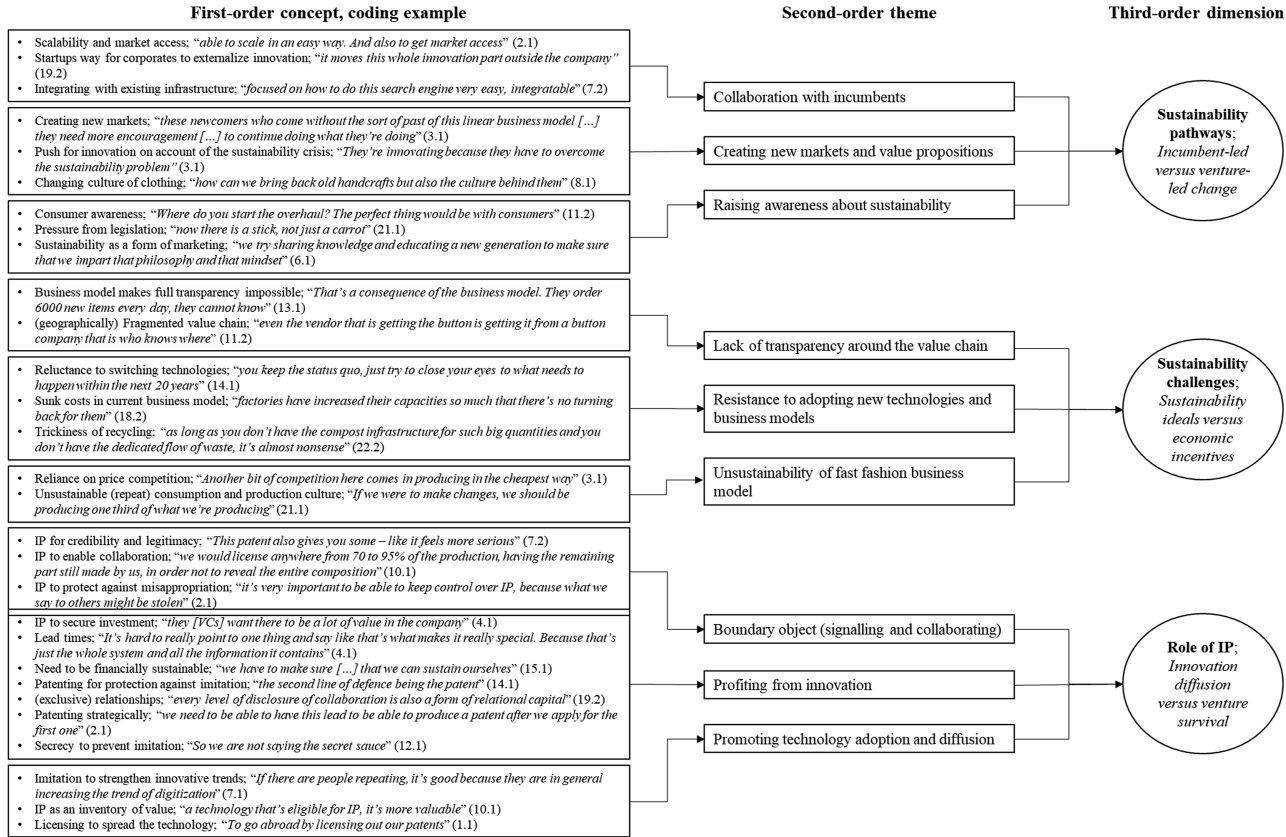


Figure 2. Data structure. Source: Authors’ own work

culminate in a paradox knot, with new emerging tensions, meaning these were the product of the relationship between paradoxes of knowledge sharing-control and sustainability-profitability.

4.1 Sustainability pathways, sustainability challenges and the role of IP

As can be seen from Figure 2, paradoxes were manifested in three decision-making dimensions that were identified in a three-stage open coding of ventures' innovation decisions. In their sustainable open innovation, ventures pursued sustainability pathways to address sustainability challenges, using IP to facilitate this. Sustainability pathways included collaboration with incumbents, creating new markets and value propositions, and raising awareness about sustainability. Sustainability challenges included a lack of transparency around the value chain, resistance to adopting new technologies and business models, and the unsustainability of the fast fashion business model. The former describes the pathways through which ventures sought to make a sustainability impact while pursuing a profitable business case, the latter describes the sustainability problems ventures aimed to solve. What became apparent was that both involved the intention to find complementarities between economic and sustainability outcomes, and that IP was used with the aim of managing the knowledge-sharing-control paradox.

It warrants mentioning that, as this study sought to understand the role of IP in sustainable open innovation, special attention was paid to the reasons, motivations and uses that ventures ascribed to their IP. This meant that the role of IP was especially highlighted, where it is otherwise often overlooked or subsumed under other considerations. Initially, it was expected that, depending on its use, IP would promote or hinder different priorities and outcomes, i.e. knowledge protection, knowledge sharing, economic viability and sustainability. Findings indicated, however, that ventures used IP with the aim of achieving dual outcomes and satisfying opposing demands.

Specifically, the role of IP included acting as a boundary object, enabling ventures to profit from their innovation, and promoting technology adoption and diffusion, each of which was mentioned by every venture in this study. Hence as a boundary object, IP was used by ventures to signal their value to external stakeholders, but also to set boundaries, protect against misappropriation and enable collaboration. As such, this allowed them to both share their knowledge while also protecting it as they pursued sustainability pathways to address sustainability challenges. The same applied to profiting from innovation, which included ventures obtaining investment, gaining lead times and achieving financial sustainability. Each of these allowed ventures to obtain positive cash flows so they could survive to develop and spread their sustainable innovation. Lastly, promoting technology adoption and diffusion included ventures enabling imitation to strengthen new innovations, using IP as an inventory of value and licensing to spread a technology.

In summary, in each role, IP facilitated ventures' pursuit of sustainability pathways to address sustainability challenges by enabling joint knowledge protection and sharing with the aim of achieving integrated economic and sustainability outcomes. As such, IP was used to manage paradoxical tensions rather than trade-offs.

4.2 Paradox knots and emerging tensions

Focusing specifically on the paradox knot in the intersection of the sharing-control and sustainability-profitability paradoxes, the analysis identified emerging tensions. For example, many ventures used IP to legitimize their innovation, enabling collaboration with incumbents by overcoming their resistance to new, potentially unreliable technologies. In this case, ventures needed to share enough of their knowledge to allow collaborators to judge the legitimacy of their innovation while protecting their knowledge from misappropriation in collaboration. Hence, they protected their own economic viability while pursuing sustainability outcomes by improving the sustainability of incumbents.

Examples like this demonstrate complementarities between the knowledge-sharing-control paradox and the sustainability-profitability paradox, while also pointing to enduring sources of tension. The continued analysis, therefore, focused specifically on the tensions occurring in each decision-making dimension as evidenced by the coding, for instance, the opposing demands resulting from collaboration with incumbents in existing markets versus creating new markets in entirely venture-led innovation. This resulted in the identification of three emerging tensions in the paradox knot: between incumbent-led versus venture-led change, between sustainability ideals and economic incentives and between innovation diffusion versus venture survival. Each of these emerging tensions incorporated a different relationship in the focal paradox knot. In the following, each emerging tension is briefly illustrated using examples from the interview data.

4.2.1 Incumbent-led versus venture-led change. Resulting from tensions between different pathways to sustainability, the emerging tension between incumbent-led versus venture-led change highlights ventures' position as newcomers and disruptors. Hence, ventures sought to improve the industry's sustainability performance by collaborating with incumbents and by creating new markets, advancing new value propositions adjacent or in opposition to existing lines of business. The way ventures prioritized the former versus the latter shaped the way they managed their IP.

Specifically, where it was believed that the onus of change lay with incumbents, ventures took their IP decisions with an aim toward collaboration and toward replacing existing materials, practices and technologies by integrating with existing infrastructure. Hence, they used IP to protect their knowledge in order to enable sharing. In contrast, where ventures believed that change needed to come from newcomers, they managed their IP with the aim of protecting it against misappropriation by incumbents while enabling collaboration with other ventures. A combination of secrecy and publishing, the latter often enacted by patenting, made up a large part of both of these approaches.

Maybe you want your competitors to be successful because maybe one day we're not competitors but we are combining forces [...] I want them to be successful because maybe then we would see how this is commercialized, how this works on the market and then there is an impact. (interview 19.1)

Indeed it has happened with many other startups where they say, you know, "a big company just copied our format completely." [...] So, I don't know, is it better that we forbid them from doing it? [...] If they're doing something – then good, apply it, it's good, because they can do it at scale, right? (interview 3.1)

Notably, this tension comes from ventures considering and pursuing potentially conflicting paths to market. On the one hand, ventures argued that they are better positioned to champion certain innovations as they are quicker and leaner as innovators and have a stronger incentive for change as compared to incumbents. In contrast, collaboration may be needed to allow ventures to scale and to enable adoption and diffusion of their innovation. IP is therefore managed with an eye toward both collaboration and independent growth, where one has the potential of threatening the other through spillover, imitation or a lack of means and paths to market.

4.2.2 Sustainability ideals versus economic incentives. The emerging tension between sustainability ideals and economic incentives results from tensions between opposing motivations as related to the sustainability challenges that ventures aimed to address. Specifically, ventures were driven by a personal desire to make a contribution to the sustainability crisis, as well as a need for the venture to become economically viable as a business. In this context, ventures described how the lack of an economic incentive could negatively impact the quality of an innovation as easily as the necessity of economic outcomes could impact sustainability outcomes.

There are organizations who are trying to map the supplier base in a public way and create open source databases. I found them to be a bit technically inferior. [...] There does seem to be a difference in

quality either in like, speed of execution, issues around breaking, maintenance of the data, usability, all of these things play a part. (interview 9.1)

I also wonder if raising money comes at a cost that small companies like mine don't want to endure. Because then you cannot play your own game, you have to produce according to market dynamics. (interview 8.1)

Where possible, ventures used their IP to address sustainability challenges with equal emphasis on their sustainability impact and economic viability. Hence, they aimed at improving sustainability by developing a profitable business case around their sustainable innovation, allowing their innovation to survive and grow, and themselves as its champions to thrive and scale by collaborating with incumbents or developing new markets. Financial success, therefore, bolstered rather than hindered sustainability outcomes by improving adoption, diffusion and scaling. IP, for its part, allowed ventures to profit from their innovation, signal to collaborators and financiers and disclose information about the innovation to potential followers.

That being said, ventures in this study *did* sometimes choose to manage their IP in ways that resulted in fewer options for capturing value in order to make a bigger sustainability impact, for instance, by open sourcing, waiving, or foregoing certain IP rights. A little less than half of the ventures in this study had either opted for open source or were actively considering some form of it. Additionally, some sought ways of managing their IP through a commons-type structure.

What we would want is to make it into some kind of collective property, so with some kind of collective or community, more like a commons. [...] So co-owning intellectual property with parties that work according to principles that we decide on, so you can arm yourself against people that would misuse it. Because we're afraid that if we don't do that, parties that can access the intellectual property under regular market conditions would aim for the lowest possible price point and poor labour conditions. (interview 5.1)

4.2.3 Innovation diffusion versus venture survival. As an emerging tension resulting from IP management itself, innovation diffusion versus venture survival most clearly adheres to the dynamics previously described. Specifically, ventures recognize that their IP may hinder the diffusion of sustainable innovation by erecting barriers to its development and adoption. However, foregoing IP to openly share the venture's knowledge means that the venture can be imitated and outcompeted. Hence, there is tension between knowledge sharing to promote innovation diffusion and knowledge protection to ensure venture survival resulting from ventures' IP.

I mean if you don't care about investors or money or anything then it's okay if you're putting out the product [...] so that everybody can copy it, but if you have to build a company then yes, I would say it's important. It will slow down for sure [...] the sustainability thing, it will slow [it] down. (interview 18.1)

This tension was often managed by pursuing knowledge protection and financial viability to a minimum threshold and prioritizing knowledge sharing and sustainability beyond this point. Defining this threshold, hence, was key to achieving complementarity between opposing demands. Specifically, ventures emphasized the need to protect the niche but not the concept of their innovation, publishing methods without revealing specific technologies and capitalizing on first-mover advantages rather than preventing imitation by followers. Depending in some part on the type of innovation, e.g. materials versus software, these intentions were most commonly translated into patents and trade secrets, typically accompanied by some form of publishing to delineate the boundary between knowledge protection and knowledge sharing.

Without founders the startup cannot survive or get over the first hurdles to get to a cashflow positive situation where you don't need outside money anymore. So I think it's more or less a given – if there is a possibility to make a patent, I think any investor would like that to be done. (interview 17.1)

Even if people are repeating [us], it's good because they are increasing the trend of digitization in the industry. I mean if there are other companies based on what we're doing, doing the same thing [I say]: welcome. (interview 7.1)

5. Discussion

Open innovation is critical to addressing complex sustainability issues because it mobilizes knowledge sharing, collaboration, and collective action (Bogers *et al.*, 2020). In fashion, entrepreneurial newcomers play a significant role, yet their size and resource constraints intensify the tensions they face when managing IP across the knotted paradox between knowledge sharing-control and sustainability-profitability.

5.1 Paradox knots and emerging tensions: the role of IP strategy

A core contribution of this study is to show that the knowledge sharing-control paradox and the sustainability-profitability paradox are not experienced independently but intertwine as a paradox knot that generates emergent tensions – persistent, interrelated contradictory demands on ventures' IP strategy (Jarzabkowski *et al.*, 2022; Lewis and Smith, 2022; Sheep *et al.*, 2017; Smith and Lewis, 2011). Rather than one-off tradeoffs, the studied ventures confronted ongoing tensions that required balancing and an active search for complementarities.

Grounded in our coding, we identify three emergent tensions from the paradox knot, each linked to a decision-making dimension:

- (1) Incumbent-led vs. venture-led change (sustainability pathways)
- (2) Sustainability ideals vs. economic incentives (sustainability challenges)
- (3) Innovation diffusion vs. venture survival (role of IP)

Across cases, ventures managed IP not to privilege sharing or protection, but to combine them – sequencing and calibrating decisions to orchestrate tension in the knot over time and search for complementarity. This extends prior work that treats IP strategy primarily as balancing knowledge sharing and control (Lauritzen and Karafyllia, 2019; Ritala and Stefan, 2021) by evidencing more complex, knotted configurations in which actions to address one paradox reconfigure the other (cf., Henriksen *et al.*, 2021; Waldner *et al.*, 2022). Moreover, it adds to the literature on sustainable innovation by nuancing the role of IP as neither promoting nor hindering sustainable innovation (Eppinger *et al.*, 2021; Vimalnath *et al.*, 2022), but rather orchestrating tensions that emerge from its pursuit.

Figure 3 illustrates how IP strategy relates to the emerging tensions resulting from the knotted paradox. While not all ventures addressed each sustainability challenge using every sustainability pathway, they experienced similar tensions and used IP to manage them.

To further discuss the implications of our findings, Table 1 recapitalizes the way ventures managed their IP in response to each emergent tension.

Figure 3 and Table 1 together illustrate an important finding: that each second-order theme regarding the role of IP was relevant to managing each emerging tension. Hence, boundary spanning, profiting from innovation and promoting technology adoption and diffusion formed the key functions by which IP influenced the addressing of sustainability challenges via sustainability pathways.

Hence, our findings do not introduce entirely new IP mechanisms. Rather, they advance a reframing of IP strategy as a dynamic, processual orchestration that treats IP as a boundary object under enduring paradoxes, where existing IP functions, long since known in the existing

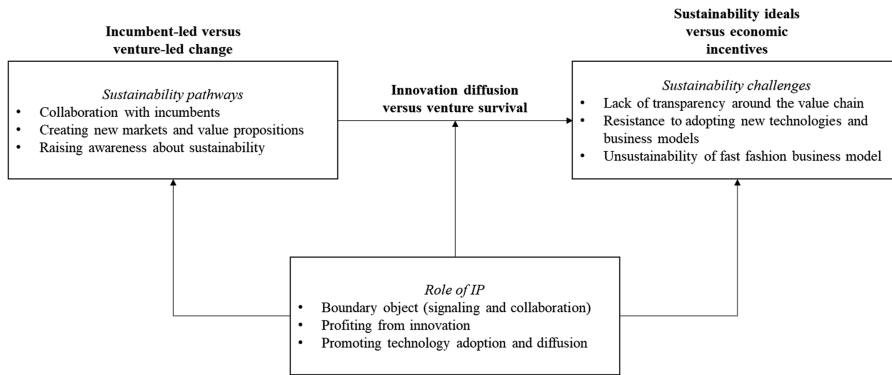


Figure 3. Knotted paradoxes and the role of IP. Source: Authors' own work

Table 1. Knotted paradoxes and IP management

Emerging tension	IP management
<i>Sustainability pathways</i> Incumbent-led versus venture-led change	Ventures protect their IP in order to simultaneously share and protect their knowledge, enabling collaboration with incumbents, integrating with existing infrastructure and hence replacing existing technologies. IP is likewise used to legitimize ventures, creating a market for their innovation and promoting imitation of concepts to create momentum and grow the market. Meanwhile, IP prevents stealing or one-on-one imitation of the venture's knowledge and technology
<i>Sustainability challenges</i> Sustainability ideals versus economic incentives	Ventures use IP to protect new initiatives from existing priorities, gain legitimacy and raise awareness about sustainability, as well as negotiate funding with lower or different growth expectations. Moreover, ventures seek new (collective) ownership structures such as patent pools, pledges and open source with a greater potential for sharing and collaboration, and a weaker incentive toward price competition
<i>Role of IP</i> Innovation diffusion versus venture survival	Ventures use IP to protect the specific method of their innovation while publishing openly about their concepts to promote diffusion and adoption in the industry at large. They hence seek a niche to profit from while encouraging knowledge sharing and collaboration, prompting imitation as well as follow-on and derivative innovation

Source(s): Authors' own work

literature (Eppinger and Vladova, 2013; Holgersson, 2013; Kitching and Blackburn, 1998; Levin *et al.*, 1987; Thomä and Bizer, 2013), aid in managing knotted paradoxes arising in the course of ventures' sustainable open innovation. Three implications follow, with contributions to paradox theory, sustainable open innovation and IP strategy, respectively.

- (1) *IP as a boundary object*: Ventures used patents, selective publishing, and licensing to signal legitimacy, define collaboration boundaries and govern access – thereby enabling collaboration, communication and coordination. Both IPRs and IP strategies served as shared adaptable references for the ventures and their surroundings. This supported both value capture and diffusion (Chesbrough, 2003; Holgersson *et al.*, 2018). We therefore add to the conversation on boundary objects in paradox theory as structures that enable us to cope with paradox, by highlighting the utility of boundary spanning specifically (Lewis and Smith, 2022). Notably, we argue that where paradoxes intersect in a knot, engaging their tensions requires adaptive management.

In this study, we demonstrate IP as one tool for spanning the complex boundaries between the venture and its environment in a context of sustainable open innovation, and for engaging with the tensions that emerge from competing and complementary demands.

- (2) *Threshold logic and selective openness*: Ventures commonly sought a minimum threshold of protection (to secure survival, investment and bargaining power) and then increased openness to foster adoption and market formation. This clarifies why IP can appear to hinder diffusion when sustainability alone is the evaluation criterion, yet enable diffusion when survival and scaling are necessary preconditions (Athreye *et al.*, 2023; Bustamante *et al.*, 2023; De Rassenfosse and Palangkaraya, 2023; Eppinger *et al.*, 2021; Henry and Stiglitz, 2010; Vimalnath *et al.*, 2022). As such, we contribute to the literature on sustainable innovation in general and sustainable open innovation in specific by elucidating the contradictory components that make up the contested role of IP. While contradictions may persist, we hence argue that complementarity can be found where IP is managed to find mutual, balanced support between competing demands, e.g. diffusion of sustainable innovation and venture survival.
- (3) *IP strategy as process*: In line with Mintzberg's view of strategy as a pattern in a stream of decisions (Mintzberg, 1978), IP strategy emerged through deliberate and emergent moves over time – revisiting patenting vs. secrecy or disclosure, adjusting license terms and timing protection and sharing to partner readiness and market and innovation evolution. IP functions such as appropriation, freedom to operate and diffusion operated across all three emerging tensions, not in isolation (cf. Eppinger *et al.*, 2021; Holgersson, 2013; Kitching and Blackburn, 1998; Levin *et al.*, 1987; Thomä and Bizer, 2013). This adds to research that increasingly seeks to position IP as a multifaceted toolkit, and IP strategy as a planned and emergent process (Holgersson and Granstrand, 2022; Hurmelinna-Laukkanen and Yang, 2022; Miric *et al.*, 2019; Teece, 2018; Tietze *et al.*, 2025). Notably, we find that IP as a boundary object and governance mechanism is not only subject to complex and dynamic adjustments, but is also its facilitator.

Taken together, this reframing positions IP strategy less as a fixed choice of tools and more as an ongoing orchestration of knotted paradoxes, where conventional instruments are combined, sequenced and recalibrated to pursue integrated economic and sustainability outcomes combining both knowledge sharing and control (Davies and Chambers, 2018; Bogers, 2011; Hurmelinna-Laukkanen, 2011; Vimalnath *et al.*, 2022). Hence, we argue that a view of IP strategy as an orchestration rather than a selection of instruments, albeit suitable and complementary, will benefit all firms, but especially those innovating in complex settings such as open and sustainable innovation and entrepreneurship.

5.2 Implications for practice: from IP mechanisms to a way of thinking

Building on the previous, we argue that firms benefit from a view of IP strategy as a process, and IP as a boundary object which is managed with a threshold logic with selective openness. Doing so enables adjustments to emerging tensions and unexpected events, which is especially important for firms operating under conditions of paradox, like those practicing sustainable open innovation.

However, any kind of tension or uncertainty should benefit from IP management that allows for emergence (cf., Holgersson *et al.*, 2018). As such, our findings show that openness beyond the necessary threshold of protection to ensure survival creates options for firms to collaborate and grow. Diffusion of sustainable innovation and facilitation of imitation help increase societal value from innovation, yet setting clear terms of engagement for the firm's IP can actually improve sustainability outcomes by preventing misappropriation or a lowering of sustainability targets.

For practitioners, this means complementarity between competing demands is possible by practicing IP as a process, adjusting over time to emergent tensions. Being mindful of the enduring nature of these tensions should, moreover, help firms stay prepared and build the capability needed to respond to these tensions.

5.3 *Moving forward: supporting a change in industry logic*

Even so, several respondents described constraints in their IP options for sharing and protecting innovation. When lacking viable mechanisms that allow both openness and control, ventures often defaulted to more protective strategies, limiting diffusion. Existing structures, such as open source, patent pools and pledges, were perceived as offering too little control, even though many ventures expressed interest in such arrangements if they could still capture some value. Crafting bespoke contractual solutions, however, requires legal capabilities that most startups lack, forcing reliance on standard instruments. This suggests a need for policies that not only encourage sharing and diffusion of knowledge, but also provide educational and institutional support to build such capabilities among ventures (Eppinger *et al.*, 2021; Henry and Stiglitz, 2010; Vimalnath *et al.*, 2022).

Yet as important as these challenges are, technological innovation alone cannot fully address the sustainability problem in fashion. Several interviewees emphasized that the “unsustainability of the fast fashion business model” requires not only new materials, processes and technologies, but also a fundamental shift in the industry’s underlying business logic. This includes questioning fashion’s reliance on price competition and repeat sales as engines of profit and growth. As McGahan *et al.* (2021) note, efficiency gains can paradoxically reduce sustainability by increasing overall production and consumption. When the sheer production volume is the core driver of unsustainability, simply improving efficiency is insufficient. Unless the logic of the system changes, incentives toward socially and environmentally harmful practices will persist, often externalized to the global south (c.f. Giuliani, 2018). While legislation has made important strides, strong pressures remain throughout the supply chain to cut costs and sidestep compliance.

This raises the question of how IP can support such a change in industry logic. IP policy and strategy must find ways to back business model innovation alongside technological innovation. This is particularly important for firms experimenting with logics aimed at reducing consumption – for example, by shifting consumer behavior or by prioritizing repairs over replacements. Patagonia provides a well-known illustration: the American apparel company has focused on fair trade, long-lasting apparel and free repair services, encouraging customers to extend the life of garments rather than replace them. Such practices directly counter short-term, profit-driven tactics such as planned obsolescence, yet Patagonia has shown that a strong sustainability orientation can coexist with profitability and brand value.

Nevertheless, the industry remains dominated by a fast fashion logic, and shifting away from it is not an easy task for individual firms. More research is therefore needed on how IP strategy can contribute to business model innovation, but also broader shifts in industry logic. For such a complex purpose involving multiple paradoxes, this study offers an initial step by highlighting how IP strategy operates within paradox knots, providing a deeper understanding of its integral – though often underrecognized – role in sustainable entrepreneurship and the pursuit of integrated outcomes (Davies and Chambers, 2018; Muñoz and Cohen, 2018; Schaltegger and Wagner, 2011). Ultimately, advancing toward sustainability will require not only technological innovation, but also reimagining the institutional and strategic role of IP in transforming industry logics.

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Supplementary material

The supplementary material for this article can be found online.

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