


# Why use or forgo formal and informal appropriation mechanisms? A qualitative study of sustainable innovations from small- and medium-sized enterprises

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## Abstract

The role that appropriation mechanisms such as patents and secrecy play in sustainable innovation is currently being debated. In particular, we lack an understanding of the different motives behind using or forgoing specific appropriation mechanisms. Current knowledge is mainly derived from the general innovation literature, which emphasizes profiting from innovation. However, sustainable innovators also seek to positively impact the environment and society, which raises the question of whether existing appropriation literature also applies to sustainable innovation. We interviewed 42 business leaders from small-to-medium-sized enterprises concerning a recently commercialized sustainable innovation. The results indicate that known motives from the general innovation literature apply to sustainable innovation but also reveal motives specific to sustainable innovation. We also discovered motives suitable to all innovations, such as non-disclosure agreement motives extending beyond achieving secrecy. Theoretically, our findings suggest the profiting from innovation framework may also apply to sustainable innovation, even though the pursuit of profits is not the only motive of sustainable innovators. In practical terms, the results help sustainable innovators to craft an appropriation strategy, and policy-related opportunities arise for improving patent and trademark filing experiences.

## KEYWORDS

appropriation, patents, sustainable innovation, trademarks

**Abbreviations:** B2B, business to business; B2C, business to consumer; B2G, business to government; CEO, chief executive officer; EPO, European Patent Office; EUIPO, European Union Intellectual Property Office; IP, intellectual property; IPR, intellectual property right; ISIC, International Standard Industrial Classification; MNE, multinational enterprise; NDA, non-disclosure agreement; PSS, product-service solution; R, respondent number; SDG, sustainable development goal; SI, sustainable innovation; SME, small- and medium-sized enterprises; TRIPS, Trade-Related Aspects of Intellectual Property Rights treaty; UN, United Nations; WIPO, World Intellectual Property Organization.

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## 1 | INTRODUCTION

Sustainable innovation (SI) is becoming increasingly prevalent in practice and research (Díaz-García et al., 2015; Cillo et al., 2019). Byproducts from human industrial and technological advancement, such as environmental damage, energy crises, poverty, lack of access to education, and poor access to clean water, have created an impetus for corrective initiatives such as the United Nations Sustainable Development Goals (SDGs). SI tackles these “Grand Societal Challenges,” which impact society and the environment (D’Angelo et al., 2022;

George et al., 2016), and are exemplified by SDG 9, which call for sustainable industrialization and fostering innovation. Thus, innovators develop SIs to address environmental, economic, and social concerns, while also seeking to profit from their innovation. For the purposes of the present article, we have used Bos-Brouwers' (2010, p. 419) definition of SI as "innovations in which the renewal or improvement of products, services, technological or organizational processes not only delivers an improved economic performance, but also an enhanced environmental and social performance, both in the short and long term." SI is broader than green (or "eco-") innovation and also includes social innovation. Green innovation primarily targets a reduction in risks to the environment, pollution reduction, and detrimental effects of resource use (Castellacci & Lie, 2017; Kemp & Pearson, 2007). Social innovations meet social needs and help beneficiaries with their access to resources and power (European Commission, 2015; Merlin-Brogniart et al., 2022; Mulgan, 2006) and are diffused by organizations with primarily social purposes and can also include for-profit business models (Mulgan, 2006).

Small- and medium-sized enterprises (SMEs) represent 99% of all businesses in the European Union (European Commission, 2021) and are positioned to make an impact through their sustainable activities (Patricio et al., 2018). One of the principal methods of obtaining returns from an innovation are formal appropriation mechanisms such as patents and trademarks, which are enshrined in law, and informal mechanisms such as secrecy, first-mover advantage, or product complexity, which are grounded on strategy. These mechanisms form part of an innovator's value capture strategy, which helps innovators profit from their innovation (James et al., 2013; Teece, 1986). The motives behind using or forgoing appropriation mechanisms for SI may have shifted or broadened compared to innovation in general, because SI entails unique business models (Bocken et al., 2014; Mignon & Bankel, 2022), drivers (Afeltra et al., 2021; Horbach, 2008), and unique motives to engage in creating SI (Science for Environment Policy, 2020; Triguero et al., 2016). Hence, appropriation mechanisms' motives for SI may include sustainability-driven motives or motives other than those identified in the general innovation literature. In contrast, the appropriation literature emphasizes economic motives to use patents and trademarks driven strongly by protection, blocking, signaling, and reputation-enhancing motives (e.g., Blind et al., 2006; Castaldi et al., 2019; Cohen et al., 2000; Flikkema et al., 2014).

The literature has only recently started to examine the role played by appropriation mechanisms in SI (e.g., Castaldi, 2021; Eppinger et al., 2021; Morales et al., 2022; Vimalnath et al., 2020). However, questions remain regarding whether appropriation mechanisms even have a role for SI (Corrocher & Solito, 2017; Hermundsdottir & Aspelund, 2021; Vimalnath et al., 2020). For example, the literature highlights a "facilitation versus impediment" debate regarding the place of appropriation mechanisms in helping to achieve sustainability outcomes (Castaldi, 2021; Eppinger et al., 2021). For example, one camp argues that patents help diffuse SI through licensing and by enabling the success of sustainable innovators, whereas another camp views patents as an obstacle because they are exclusionary and can inhibit or delay diffusion. The literature also indicates that the motives

to use appropriation mechanisms for SI are poorly understood (Castaldi, 2021). There are several advantages to establishing the motives to apply appropriation mechanisms. First, the motives offer an understanding of the place of formal and informal appropriation mechanisms in SI, specifically by providing insights on how and why these mechanisms are used. Second, the motives could explain whether extant appropriation strategy literature on motives also applies to SI. As such, this could indicate how appropriation strategy between SI and general innovation overlaps and differs and could also help sustainable innovators craft their appropriation strategy. Third, from a macro perspective, the motives could explain the propensities to patent and trademark SI and provide explanations for potentially low propensities. As such, the motives to not patent or not trademark could also highlight opportunities to improve access to patents and trademarks for sustainable innovators through policy initiatives. Moreover, they could inform research that seeks to establish the extent to which patents and trademarks can be used as valid indicators of SI. Accordingly, our research question is as follows: *Why do sustainable innovators use or forgo formal and informal appropriation mechanisms in the case of SI?*

To answer this question, we conducted 42 interviews with SME business leaders from different industries and involved in the development and commercialization of a sustainable product or service innovation. All of the innovations addressed a SDG target. The study is expected to make three main contributions. First, by finding the motives to use and not use appropriation mechanisms on SI, we contribute to an emerging literature stream examining formal and informal appropriation mechanisms for SI (e.g., Castaldi, 2021; Corrocher & Solito, 2017; Vimalnath et al., 2020). This is expected to reveal motives to use appropriation mechanisms unique to SIs. Second, we expect to uncover differences in appropriation mechanism motives from sustainable innovators, compared with appropriation literature based on general innovators (e.g., Blind et al., 2006; Castaldi et al., 2019; Cohen et al., 2000; Flikkema et al., 2014). This would, for example, establish whether general innovation literature on motives could also apply to SIs. Third, from a practical viewpoint, the study is expected to offer guidance for policy makers to potentially improve access to patents and trademarks for sustainable innovators and guide sustainable innovators with crafting their appropriation strategy.

In the following sections, we briefly review the appropriation literature and discuss extant literature on the specific findings for SI. We then describe the methods employed and present our empirical analysis and conclude by discussing theoretical and practical implications from the empirical findings.

## 2 | LITERATURE REVIEW

### 2.1 | Innovation and appropriation mechanisms

We examine the principal appropriation mechanisms that have been investigated in the appropriation strategy literature (Cohen et al., 2000; Levin et al., 1987; Zobel et al., 2017). These entail formal

appropriation mechanisms such as patents and trademarks<sup>1</sup> and informal mechanisms such as secrecy, first-mover advantage (also known as lead time advantage), and complexity, which enable the innovator to profit from their innovation. The theoretical literature suggests that appropriation mechanisms are an important element for protecting an innovation from copying and thereby ensuring the commercial success of an innovation (e.g., Teece, 1986, 2018). The economically driven motives proposed in theory have also been empirically demonstrated with general innovation for patents (e.g., Blind et al., 2006; Holgersson & Granstrand, 2017) and trademarks (Block et al., 2015; Flikkema et al., 2014, 2019). However, SIs are also driven by non-economic sustainability motives (e.g., Science for Environment Policy, 2020; Triguero et al., 2016). Accordingly, the present study also examines how appropriation mechanisms work in the context of SI and explores the boundaries of the profiting from innovation theory (Teece, 1986) by examining how appropriation mechanisms work under the condition of a SI.

### 2.1.1 | Formal appropriation mechanisms

A patent can be filed for a technological invention “which is a product or a process that provides, in general, a new way of doing something, or offers a new technical solution to a problem” (World Intellectual Property Organization, n.d.-a). Herein, the patent offices implement a stringent examination process. For example, in European Patent Office (EPO) member states, the process involves checking that the invention is new, contains an inventive step, is industrially applicable, and is not prejudiced by prior art (European Patent Office, n.d.). Patents can be filed in a state or region (for example, an EPO member state) and are only applicable in the state or region in which the patent is granted. A patent can generally be held for at least 20 years in a signatory state of the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) (World Intellectual Property Organization, n.d.-b), provided maintenance costs are paid.

The literature on motives to patent is broad. In one principal study, Blind et al. (2006) captured the motives that are broadly encountered in the patent literature. The authors conducted a review of patent literature and proposed motives, measured them, and subsequently derived the following groups of patenting motives: protective (for example, preventing imitation), blocking competitors (defensively and offensively), reputational enhancement, exchange (licensing, exchange of patents, etc.), and incentive-based (such as measuring performance). Other influential works on patents and appropriation strategy (e.g., Cohen et al., 2000; Graham et al., 2009; Holgersson & Granstrand, 2017) broadly align with the above motives and in some cases add detail, for example, by describing preventing lawsuits or infringement actions against the innovator as a patent motive (Cohen et al., 2000; Graham et al., 2009). The motives to forgo patents, on the other hand, are more dispersed in the literature. The principal

reasons for forgoing patenting are ineligibility driven by a lack of novelty (Cohen et al., 2000), lack of desire to apply patents or other protection mechanisms being sufficient (Capponi et al., 2019; Graham et al., 2009), or inadequacy as patent filing discloses the innovation and enables an imitator to “invent around” the innovation (Cohen et al., 2000; Graham et al., 2009). Other motives include difficulties detecting infringement and the financial costs of patent management (Athreye & Fassio, 2020). Table 1 presents a summary of the key motives for using or forgoing patents.

Trademarks can be filed for signs, such as names, colors, and shapes to distinguish and emphasize the origin of goods and services from a competitor (European Union Intellectual Property Office, n.d.; World Intellectual Property Organization, n.d.-c.). Trademarks help inform buyers about the innovator's products and services and reduce buyer uncertainty and search costs and can be used to ensure brand loyalty or create an entry barrier for competitors (Economides, 1988; Flikkema et al., 2014, 2019; Ramello, 2006). Like patents, trademarks are territorial rights and are valid in the region in which they are granted. Trademarks can be filed and granted at the national level, the regional level (for example, the EUIPO), or worldwide with an international trademark, which is facilitated by the Madrid System (World Intellectual Property Organization, n.d.-d). Trademarks can generally be filed and perpetually renewed for a modest fee. The trademark filing motives in the literature have been principally derived through a combination of conceptualizing motives from IPR and strategy literature and then measuring the extent to which these motives prevail, revealing key motives using statistical analysis. Herein, two influential works derived a basis for understanding trademarking motives. The first study, by Flikkema et al. (2014), derived three underlying motives: signaling strategic change, formally protecting IP, and building brand equity. The second study, by Block et al. (2015), also derived IP protection as a principal motive but differed by identifying marketing motives (to improve the firm or innovation image) and exchange motives (for example, to enable licensing). There is less empirical literature on motives to forgo trademarks. Athreye and Fassio (2020) conceptualized and measured three underlying trademark non-filing motives: not necessary, not possible, and existing trademarks in use. Castaldi (2018) conceptualized myopic motives (grounded on a lack of awareness of trademark benefits) and rational motives (based on the lack of awareness of the need to protect products with trademarks).

A summary of key motives to use or forgo trademarks is presented in Table 2.

### 2.1.2 | Informal appropriation mechanisms

Some knowledge behind inventions, particularly tacit knowledge, cannot be protected by patents. Thus, innovators instead use informal protection mechanisms (Gallié & Legros, 2012). For smaller firms, informal mechanisms such as secrecy and first-mover advantage may even be more important than patents (e.g., see Arundel, 2001; Leiponen & Byma, 2009; Thomä & Bizer, 2013).

<sup>1</sup>Other intellectual property rights, such as design rights and plant variety rights, and informal mechanisms like strategic disclosure, were not included in the analyses because of their scarce usage.

**TABLE 1** Summary of selected existing literature on patent motives and non-use motives.

Patent motives	Example references
Protection - Prevent/delay copying	Blind et al. (2006), Cohen et al. (2000), Holgersson and Granstrand (2017)
Exchange/bargaining - Licensing revenue - For use in/improve negotiations - Improve chances/quality of liquidity - Own to share (e.g., patent commons)	Blind et al. (2006), Castaldi (2021), Cohen et al. (2000), Holgersson and Granstrand (2017)
Reputation enhancement - Help secure funding/investment	Blind et al. (2006), Cohen et al. (2000), Holgersson and Granstrand (2017)
Blocking - Prevent lawsuits/infringement actions against us - Safeguard “technological room”	Blind et al. (2006), Cohen et al. (2000), Graham et al. (2009), Holgersson and Granstrand (2017)
Incentive - Measure performance	Blind et al. (2006), Cohen et al. (2000), Holgersson and Granstrand (2017)
Patent non-use motives	
Incompatible strategy - Avoiding disclosure caused by patenting - Other can invent around it - Slows down rate of SI	Castaldi (2021), Cohen et al. (2000), Eppinger et al. (2021)
Existing appropriation mechanisms sufficient - Secrecy is adequate - No need for legal protection	Capponi et al. (2019), Castaldi (2021), Graham et al. (2009)
Financially driven motives - Financial cost of application/maintenance/defense	Athreye and Fassio (2020), Cohen et al. (2000)
Ineligibility - Not new to the market/novelty - Not eligible for patent	Cohen et al. (2000)
Enforcement concerns - Difficult to detect infringement - Difficult to enforce	Sichelman and Graham (2010)

A secret is any knowledge or information that is valuable, where the value is tied to its secrecy and the subject of reasonable protection efforts (Hannah, 2005). A principal motivation behind secrecy is preventing disclosure, which is inevitable when applying for patents (Gallié & Legros, 2012). As such, secrecy may be a substitute for patents (Arundel, 2001). Unlike patents, secrets can be maintained perpetually, but the innovator bears the burden to ensure the secret does not become public—at which point little or no legal recourse can be taken to undo the disclosure (Hannah, 2006). Reverse engineering can also compromise secrecy (Gallié & Legros, 2012). Secrecy entails policies and procedures to limit information flows inside and outside the

**TABLE 2** Summary of selected existing literature on trademark motives and non-use motives.

Trademark motives	Example references
Protection - Prevent imitation	Block et al. (2015), Flikkema et al. (2014),
Exchange - Resource/investment attraction - Enable licensing or sale of the trademark - Increase negotiation power	Block et al. (2015)
Signal strategic change - Marketing - Differentiation - Demonstrate novelty	Flikkema et al. (2014)
Build brand equity - Strategic motives/securing market positions - Increase customer loyalty - Incentive to make quality products	Block et al. (2015), Economides (1988), Flikkema et al. (2014), Ramello (2006)
Orphaned motives - Support other appropriation strategies - Low cost - Substitute/complement patents	Flikkema et al. (2014) Flikkema et al. (2010) Castaldi (2021)
Trademark non-use motives	
Incompatible strategy - Not necessary - Not possible - Clash sustainable/commercial values and logic	Athreye and Fassio (2020), Castaldi (2021)
Existing IPRs sufficient - Already existing trademark used - Other IPRs were used	Athreye and Fassio (2020)
Financially driven motives - Little economic consequence/value - Financial cost	Athreye and Fassio (2020), Keupp et al. (2009)
Industry trend - Imitation is accepted in our industry - Not an industry practice	Castaldi (2018)
Myopic and rational motives - Lack of knowledge about trademarks - Did not think about it	Castaldi (2018)

firm to deter imitation (James et al., 2013). These procedures entail access restrictions, such as access privileges and restrictions on duplication, and handling procedures that indicate what may be done with the information once employees may access the information

(Hannah, 2005). Handling procedures are known as confidentiality agreements or non-disclosure agreements (NDAs). Secrecy can also be implemented structurally by compartmentalizing business units to avoid any unit having a complete function or understanding of a technology (Hall et al., 2014). Secrecy can also be motivated by controlling tacit employee knowledge (Gallié & Legros, 2012). In implementing the above steps, secrecy could slow down diffusion (Arundel, 2001), while Eppinger et al. (2021) proposed that secrecy and patents could also slow down SI diffusion and obstruct recycling and remanufacturing initiatives. However, some studies have suggested that secrecy is generally favored over and seen as more effective than patents (Cohen et al., 2000; Thomä & Bizer, 2013), particularly by smaller firms (Arundel, 2001; Gallié & Legros, 2012), or favored in the development stage of an innovation as opposed to later testing and commercialization stages (Capponi et al., 2019).

First-mover advantage refers to achieving advantage by being first in the market, by commercializing early and innovating faster than competitors (Hurmelinna-Laukkanen et al., 2008; Thomä & Bizer, 2013; Zobel et al., 2017). First movers achieve advantage by either technological leadership through R&D and protecting the outputs with appropriation mechanisms, learning to leverage economies of scale, possessing (co-) specialized complementary assets, or leveraging switching costs and brand loyalty (Lieberman & Montgomery, 1988). Technological leadership entails short innovation cycles so that any imitation is always too late (Blind et al., 2003) or versioning where applications are frequently updated to be ahead of competitors (Miric et al., 2019).

Complexity refers to attributes that raise the difficulty of understanding how an innovation (or a system or organization) functions or produces an outcome (McEvily & Chakravarthy, 2002). It also refers to the amount of competencies needed to create a product, and raising manufacturing complexity hinders the transfer or imitability of knowledge (Zander & Kogut, 1995). Complexity can slow the rate at which an innovation is imitated or reverse-engineered and can conceal how the components in an innovation contribute to innovation success. Complexity also delays imitation by preventing imitation over a short time frame and can complement first-mover advantage (Neuhäusler, 2012; Zobel et al., 2017). However, doubts persist regarding the effectiveness of complexity because it could introduce risks, uncertainties, and unnecessary challenges to project management (Hobday, 1998). Complexity could delay and increase knowledge transfer costs inside the firm (McEvily & Chakravarthy, 2002). It may also run contrary to reparability expectations of consumers and decrease product recommendations by consumers (Sabbaghi et al., 2016). A summary of the key motives for using and forgoing informal appropriation mechanisms is provided in Tables 3 and 4.

## 2.2 | SI and appropriation mechanisms

An SI is a specific type of innovation that delivers enhanced environmental and social performance and seeks to generate economic prosperity in a responsible manner (Bos-Brouwers, 2010). Within those goals, appropriation mechanisms assist the innovator in achieving

**TABLE 3** Literature summary on motives to use informal appropriation mechanisms.

Secrecy motives	Example references
Protect knowledge - Control tacit knowledge of employees (after departing organization) - Prevent disclosure - Prevent or delay imitation	Gallié and Legros (2012), Hall et al. (2014)
Patent complement/substitute - Substitute for patents - Preferred over patents - Can be applied perpetually	Arundel (2001), Cohen et al. (2000), Hall et al. (2014), Thomä and Bizer (2013)
First-mover advantage motives	
Gain competitive advantage - Create technological leadership - Gain first access to scarce complementary assets - Gain technological edge over competitor for limited time - Create barriers for second and late movers	Blind et al. (2003), Lieberman and Montgomery (1988), Thomä and Bizer (2013)
Secure a customer base - Lock in customers by building in switching costs	Lieberman and Montgomery (1988)
Complexity motives	
Protect knowledge - Prevent or delay reverse engineering - Prevent or delay imitation - Prevent understanding of how innovation creates an outcome	McEvily and Chakravarthy (2002), Neuhäusler (2012), Zobel et al. (2017)

economic prosperity. SI addresses grand societal challenges, such as those exemplified in the UN SDGs (D'Angelo et al., 2022; George et al., 2016). SIs often employ unique business models and goals that, for example, entail maximizing material and energy efficiency, turning waste into value, substituting non-renewables with renewable and natural processes, developing product-as-service offerings, and taking a sustainability stewardship role (Bocken et al., 2014).

The role of appropriation mechanisms in SI is a nascent field with limited research. Questions remain in this area, and the motives behind appropriation mechanisms appear poorly understood (e.g., Castaldi, 2021; Corrocher & Solito, 2017; Eppinger et al., 2021; Hermundsdottir & Aspelund, 2021; Morales et al., 2022; Vimalnath et al., 2020). Considering the general innovation literature, the motives to use appropriation mechanisms on SI may have broadened or shifted as SI is driven by unique sustainability motives (Science for Environment Policy, 2020; Triguero et al., 2016) and business models (Bocken et al., 2014; Mignon & Bankel, 2022). For example, secrecy might be avoided because it could obstruct SI diffusion, remanufacturing and recycling initiatives (Eppinger et al., 2021); similarly, complexity might be avoided due to reputational critiques by sustainability



**TABLE 4** Literature summary on motives to not use informal appropriation mechanisms.

Secrecy non-use motives	References
Hampers (sustainable) business processes - Prevents/obstructs diffusion of knowledge - Slows down rate of SI - Can obstruct recycling and remanufacturing initiatives	Arundel (2001), Eppinger et al. (2021)
Weak protection mechanism - Limited recourse upon disclosure	Hannah (2005, 2006)
First-mover advantage non-use motives	
High risks from being first - Imitator or follower appropriates from innovator's efforts - Late movers freeride on innovators' efforts (on, e.g., buyer education, infrastructure development, and R&D) - Might elicit incumbent inertia	Lieberman and Montgomery (1988)
Complexity non-use motives	
Hampers business processes - Delays or hinders knowledge transfer inside firm - Introduces uncertainties and risks - Introduces unnecessary feedback loops to manufacturing - Introduces unnecessary challenges to project management - Increases costs	McEvily and Chakravarthy (2002)
Reputational risk - Runs contrary to reparability expectations of customers - Risks decreasing customer recommendations - Reputational critique by sustainability advocates	Morales et al. (2022), Sabbaghi et al. (2016)

advocates (Morales et al., 2022). While some works have suggested motives driving the use of specific appropriation mechanisms, empirical evidence is scarce. For example, Higgins (2003) proposed that patents for environmental innovations have certain advantages, and Castaldi (2021) conceptualized motives (not) to file patents, trademarks, and design rights by sustainable innovators. Other works have examined appropriation mechanisms in SI from an implementation perspective: Vimalnath et al. (2020) examined green innovators' patenting strategies, whereas Corrocher and Solito (2017) examined how firms protect and exploit environmental innovation, and Morales et al. (2022) examined the association of formal and informal appropriation mechanisms with commercial success of SI. By measuring appropriation mechanisms' use, some motives—like protection and commercial gain—may be inferred, but this only presents a partial picture. A qualitative study offers an opportunity to link SI with the appropriation literature to empirically reveal the motives for using appropriation mechanisms on SI.

## 3 | METHOD

### 3.1 | Research design

Given the state of the literature, and considering the methodological fit guidelines proposed by Edmondson and McManus (2007), an opportunity to apply qualitative methods on predominantly mature research exists, for two reasons. First, appropriation mechanisms are used in a new context of SI, where the determinants and drivers (Afeltra et al., 2021; Horbach, 2008), business models (Bocken et al., 2014; Mignon & Bankel, 2022), and motives to engage in SI are unique (Science for Environment Policy, 2020; Triguero et al., 2016). Calls have also been made for more qualitative methods in SI research (Hermundsdottir & Aspelund, 2021), as much empirical SI literature is quantitative. Second, knowledge in the appropriation literature about patents and trademark motives relies heavily on either quantitative methods or conceptual designs whereby existing knowledge is synthesized into a new context, as discussed in the literature review. While these approaches have certain benefits, a lack of qualitative insights could result in missing new insights, mechanisms at play, and changing attitudes in practice (Eisenhardt, 1989). Thus, qualitative methods present an opportunity to gain new and unexpected insights (Yin, 2014) and an opportunity to extend theory (Eisenhardt, 1989).

A multiple-case study was appropriate because contemporary events were examined and behaviors could not be manipulated (Yin, 2014). This entailed examining the decision by an innovator to use (or not use) formal and informal appropriation mechanisms on SI. Direct observation was implemented through interviews with relevant persons involved with the development and commercialization of a SI. Therefore, for the purposes of this study, a “case” is an SI. The unit of analysis was a business manager involved with the development and commercialization of an SI. Secondary evidence such as a company website and innovation award contest website data were used to screen eligibility for this research and to classify innovations according to industry and sustainability impact. The secondary data then provided direction with theoretical sampling to ensure that broad industry coverage was achieved, which helped to attain multiple cases (across a diverse respondent characteristics) to enhance generalizability.

### 3.2 | Sample and data collection

Theoretical sampling (Eisenhardt, 1989) was used to acquire a sample of innovators responsible for introducing SIs. We sampled two SI award contests with product and service innovations introduced by SMEs, which enabled us to sample innovators that had a strong commitment to sustainability and to attain broad industry coverage. The contests made it possible to reach respondents that used (or chose not to use) formal or informal appropriation mechanisms on SI. The aforementioned attributes also yielded a sample suitable for potentially extending the profiting from innovation framework (Teece, 1986), particularly as the contests involve innovations recently introduced to the market. The first competition is the yearly “Top

100 innovation award” organized by the Dutch Chamber of Commerce. The sample consisted of entries between 2013 and 2020, where respondents achieved a rank in the Top 100. The contest is a ranking of SIs that met several criteria: a novelty threshold, having been introduced to the market and attained positive financial results, and a positive impact on society and industry. The second contest is the Blue Tulip Innovation award, of which we studied the editions held from 2016 to 2021. The contest invites SIs across multiple industries. The innovations must have been introduced within the last 3 years, been available (or with the intention of becoming available) on the Dutch market, with at least a beta release on the market, impacting at least one sustainability theme and presented in-person to a jury. At the time of the interviews, all innovations were on the market, apart from one that was removed from the market due to venture capital funder bankruptcy.

Our sampling approach considers geographic context and implications for generalizability, similarly to recent works (e.g., Cappa et al., 2022; D'Angelo et al., 2022). In our case, nearly all of the SMEs were established in the Netherlands. The Netherlands is a relevant geographic region for this study because it is a regional strong innovator, and within the state, provinces such as Noord-Holland, Utrecht, and Noord-Brabant are classified as regional innovation leaders (Hollanders & Es-Sadki, 2021). The Netherlands is also a patent-filing-intensive state: for example, in 2021, the Netherlands ranked fourth in the world for European patent applications filed per million people, only behind Switzerland, Sweden, and Denmark (EPO, 2022). Regarding sustainability, the Netherlands ranks near the European Union average in terms of progress towards achieving SDGs (Lafortune et al., 2022). As such, the outcomes of this study are generalizable to highly innovative, highly patent-intensive, and sustainability-oriented regions with similar legal frameworks for IPRs, such as TRIPS-signatory and Madrid System states.

Business leaders involved with the technical development and commercialization of the SI were approached for semi-structured interviews. Identifying information was anonymized to ensure anonymity to participants due to the sensitive nature of IP processes. A demographic summary is presented in Table 5.

We strived to capture a sample as representative as possible through diverse industries, product and service innovations, and sales oriented to businesses (B2B), consumers (B2C), and governments (B2G). The respondents were matched to the ISIC code that most closely corresponded to their activity. The SDG impact of each innovation was determined by examining the innovation, firm website, innovation award contest website, and from probing questions posed through the interview. The innovations were introduced in the period from 2013 to 2021; at the time of the interviews, the innovations had been on the market for between 1 and 9 years, with an average of 3 years. A majority of the service innovations were digital with either an application, platform, or web-portal, as also indicated by being active in ISIC Category 62. The innovations range from a complex innovation: “... it is difficult to imitate, and especially commercially, because in order to get this product approved ... you need scientific evidence” (R#9), to an easy to imitate innovation “... it's quite easy to

write down ... we need to do step A-B-C-D and then you will end up with this (innovation)” (R#5). For product innovations, the manufacturing took place either in-house or contracted out (for example, R#36: “... the manufacturing is done by a third party.”).

Data saturation, inductive thematic saturation, and sufficient ISIC section coverage led to the decision to end data collection. Data saturation occurs when redundancies emerge from interview data, whereas inductive thematic saturation is reached when no new codes or themes emerge from data analyses (Saunders et al., 2018). After approximately 23 interviews, diminishing returns from data collection began to emerge: data saturation began to occur, and as coding took place after each interview, inductive schematic saturation occurred—as fewer new codes emerged after each successive interview. However, data collection was continued to ensure a sufficient coverage of industries from different ISIC sections to account for motives that may exist in other industries and to ensure a broader generalizability. A decision was made to stop at 42 interviews, after nearly all ISIC sections had been covered, and data saturation and inductive thematic saturation were extensive.

### 3.2.1 | Ensuring a sample of SIs

To ensure a SI sample, interviewees were asked what makes their innovation sustainable. We found commitment to sustainability varies: innovators fell on a spectrum of motivated disruptors to reactive participants (European Commission, 2020a) or, similarly, on a spectrum of leaders to laggards (Triguero et al., 2016). For example, while discussing sustainability impact, R#3 described “... our mission is to help to stop deforestation, so we make a product where we replace the (unsustainable element in a leading product) with something else.” This example represents a mission-driven disruptor, taking a leadership role in replacing unsustainable ingredients. The respondent's answers were further substantiated with information from the innovation award website and company website describing the innovation. Accordingly, data triangulation (Eisenhardt, 1989) was used to evaluate the sustainability impact of the innovations.

### 3.3 | Interview protocol and data analysis

A semi-structured interview protocol was developed to ensure the innovations examined were sustainable and to understand the appropriability regime of the innovation (Teece, 1986). A discussion of the appropriability regime enabled subsequent probing questions about why patents and trademarks are effective (or not). Each innovator was asked about why (or why not) patents, trademarks, secrecy, first-mover advantage, and complexity were (or were not) used on their SI. Finally, we investigated whether sustainability motives also drove the use of the above appropriation mechanisms. The interview protocol was adjusted throughout the data collection, in line with the Gioia method (Gioia et al., 2013); the final version is included in Appendix A. The first author, together with graduate students,

**TABLE 5** List of interview respondents.

R#	Category	Sales target	ISIC	ISIC description	SDG	SDG target title	Position
1	Product	B2B	01	Crop and animal production, hunting, and related service activities	12	Responsible consumption and production	Founder
2	Product	B2C	01	Crop and animal production, hunting, and related service activities	12	Responsible consumption and production	Business manager
3	Product	B2C	10	Manufacture of food products	12	Responsible consumption and production	Founder
4	Product	B2C	20	Manufacture of chemicals and chemical products	14	Life below water	Business manager
5	Product	B2C	20	Manufacture of chemicals and chemical products	12	Responsible consumption and production	Founder
6	Product	B2B, B2C	20	Manufacture of chemicals and chemical products	12	Responsible consumption and production	Founder
7	Product	B2G	23	Manufacture of other non-metallic mineral products	11	Sustainable cities and communities	Business manager
8	PSS	B2B, B2G	26	Manufacture of computer, electronic, and optical products	3	Good health and well-being	CEO
9	Product	B2C	26 <sup>a</sup>	Manufacture of computer, electronic, and optical products	3	Good health and well-being	Founder
10	Product	B2B	27	Manufacture of electrical equipment	7	Affordable and clean energy	CEO
11	Product	B2B, B2G	28	Manufacture of machinery and equipment	6	Clean water and sanitation	Business manager
12	Product	B2B, B2C	28	Manufacture of machinery and equipment	7	Affordable and clean energy	Business manager
13	Product	B2B	28	Manufacture of machinery and equipment	7	Affordable and clean energy	CEO
14	Product	B2B	28	Manufacture of machinery and equipment	12	Responsible consumption and production	CEO
15	Product	B2B	28	Manufacture of machinery and equipment	12	Responsible consumption and production	CEO
16	Product	B2C, B2B	29	Manufacture of motor vehicles, trailers and semi-trailers	12	Responsible consumption and production	CEO
17	Product	B2C	31	Other manufacturing	12	Responsible consumption and production	CEO
18	Product	B2B, B2G	35	Electricity, gas, steam and air conditioning supply	7	Affordable and clean energy	CEO
19	Product	B2C	38	Waste collection, treatment, and disposal activities; materials recovery	12	Responsible consumption and production	Founder
20	Product	B2B	39	Remediation activities and other waste management services	14	Life below water	Business manager
21	Product	B2B	39	Remediation activities and other waste management services	13	Climate action	Founder
22	Product	B2B	43	Specialized construction activities	7	Affordable and clean energy	Business manager
23	Service	B2C	45	Wholesale and retail trade and repair of motor vehicles and motorcycles	11	Sustainable cities and communities	CEO
24	Service	B2B, B2C	46 <sup>a</sup>	Wholesale trade, except of motor vehicles and motorcycles	8	Decent work and economic growth	Founder
25	Service	B2C	52 <sup>a</sup>	Warehousing and support activities for transportation	13	Climate action	CEO
26	Service	B2C	53 <sup>a</sup>	Postal and courier activities	12	Responsible consumption and production	Founder
27	Service	B2C	56 <sup>a</sup>	Food and beverage service activities	12	Responsible consumption and production	CEO



TABLE 5 (Continued)

R#	Category	Sales target	ISIC	ISIC description	SDG	SDG target title	Position
28	Service	B2B	66 <sup>a</sup>	Activities auxiliary to financial service and insurance activities	12	Responsible consumption and production	Business manager
29	Service	B2B	70 <sup>a</sup>	Activities of head offices; management consultancy activities	8	Decent work and economic growth	CEO
30	Service	B2B	70 <sup>a</sup>	Activities of head offices; management consultancy activities	8	Decent work and economic growth	CEO
31	Service	B2B, B2G	70 <sup>a</sup>	Activities of head offices; management consultancy activities	9	Industry, innovation, and infrastructure	CEO
32	Service	B2G	71	Architectural and engineering activities; technical testing and analysis	13	Climate action	Founder
33	Service	B2B, B2G	72	Scientific research and development	3	Good health and well-being	Business manager
34	Service	B2C	74	Other professional, scientific and technical activities	13	Climate action	Founder
35	Service	B2C	77 <sup>a</sup>	Rental and leasing activities	12	Responsible consumption and production	Founder
36	PSS	B2B	81 <sup>a</sup>	Services to buildings and landscape activities	2	Zero hunger	CEO
37	Service	B2B, B2C	82 <sup>a</sup>	Office administrative, office support, and other business support activities	13	Climate action	CEO
38	PSS	B2B, B2C	82 <sup>a</sup>	Office administrative, office support, and other business support activities	12	Responsible consumption and production	Founder
39	Service	B2B, B2C	86 <sup>b</sup>	Human health activities	3	Good health and well-being	Business manager
40	Service	B2B	86 <sup>a</sup>	Human health activities	3	Good health and well-being	Business manager
41	Service	B2B	86 <sup>a</sup>	Human health activities	3	Good health and well-being	CEO
42	Service	B2C	91 <sup>a</sup>	Libraries, archives, museums, and other cultural activities	12	Responsible consumption and production	Founder

Abbreviations: B2B, business to business; B2C, business to consumer; B2G, business to government; CEO, chief executive officer; ISIC, International Standard Industrial Classification; PSS, product-service solution; R, respondent; SDG, sustainable development goal.

<sup>a</sup>Also active in ISIC Division 63 (data processing, hosting, or web portal activities).

<sup>b</sup>Also active in ISIC Division 62 (computer programming activities).

conducted all interviews. Interviews were held through online video-conferencing and lasted approximately 1 h.

Post-interview notes, contest website, and innovator website information were also taken into account to double-check information. Interviews were transcribed using software-assisted transcription. Manual corrections were performed by listening to the audio files and correcting the software-generated transcript. Speech elisions, which mainly manifested as incomplete sentences or lack of clear endings in speech, were carefully corrected to preserve the intent and emphasis of the interviewee's answers (McLellan et al., 2003). The qualitative data analysis software used was Atlas.ti 9.0. The first author analyzed the data using the Gioia method (Gioia et al., 2013). The analysis entailed categorization into first-order concepts, followed by deducing similarities and differences into second-order themes, which can then be conceptualized into aggregated dimensions. Four resulting data structures were created, each corresponding to formal or informal appropriation mechanisms and their motives for use or forgoing.

## 4 | DISCUSSION OF FINDINGS

A set of motives emerged from an iterative comparison of extant literature and empirical evidence, from which two principal findings emerged. First, some new motives were found compared to the extant general innovation appropriation literature. Second, known motives from the general innovation appropriation literature broadly also apply SIs, which suggests that sustainable innovators do not protect their IP very differently from general innovators. The results of the data analysis are summarized in Table 6, which lists the aggregated dimensions—or over-arching motives—from the four data structures covering the use or forgoing of the formal and informal appropriation mechanisms examined in this study.

The narratives below present the outcomes in further detail. The results examine the novelty—in our case the new motives for appropriation mechanisms for SI—conforming with the Gioia method (Gioia et al., 2013). Because our results supplement existing knowledge, in the narratives, we chose to not revisit motives in depth that are

**TABLE 6** Summary of findings by overarching motives (aggregated dimensions).

	Formal appropriation mechanisms	Informal appropriation mechanisms
Motives to use	Protection-driven motives (patent and trademark) Distinguishing motives (patent and trademark) Support other business strategies (patent and trademark) Ensure commercial success (patent and trademark) Low cost (trademark) Extrinsically driven motives (patent and trademark) <sup>a</sup>	Complement other appropriation strategies (complexity, first-mover advantage, secrecy) Ensure competitive advantage (complexity, first-mover advantage) Orderly and controlled knowledge sharing (NDA) Protect the innovation (NDA and secrecy) Prevent imitation (complexity and secrecy) Prevent disclosure (NDA and secrecy) Restrict knowledge flows (secrecy) Signaling and reputation building (first-mover advantage) <sup>a</sup> Enable business transactions (NDA) <sup>a</sup> Extrinsically driven motives (NDAs, secrecy) <sup>a</sup> Involuntary choice (complexity) <sup>a</sup>
Motives to forgo	Insufficient firm resources (patent and trademark) Insufficient protection against imitation (patent) Incompatible/unsuitable mechanism (patent and trademark) Ineligibility (patent and trademark) Myopically driven motives (trademark) No desire to protect (trademark) Administrative burden (patent and trademark) <sup>a</sup> Distraction aversion (patent and trademark) <sup>a</sup> Rather rapidly or continuously innovate (patent) <sup>a</sup> Incompatible with sustainability (patent) <sup>a</sup> Insufficient benefits (patent and trademark) <sup>a</sup>	Clash with innovation strategy (complexity and secrecy) <sup>a</sup> Risks and costs introduced through implementation (complexity and secrecy) <sup>a</sup> Ineffective protection mechanism (NDA and secrecy) <sup>a</sup> Implementation disincentive (NDAs) <sup>a</sup> Myopically driven motives (secrecy) <sup>a</sup>

Abbreviation: NDA, non-disclosure agreement.

<sup>a</sup>Denotes new over-arching motive.

already known and have been broadly examined in extant literature. Data structures illustrating all of the motives found as a result of our research are presented at the beginning of each subheading detailing the motives. The left-sided boxes in Figures 1, 2, 4, and 5 contain the first-order concepts, which are motives concisely rephrased from the innovators into workable statements for the analysis. The central boxes to which the first-order concepts connect are the second-order concepts—from which similarities have been deduced and combined into one concept. These are the motives to apply the appropriation mechanism in question. Finally, the right-sided boxes represent the aggregated dimension: an over-arching motive that captures underlying similar motives—in some cases from more than one appropriation mechanism.

#### 4.1 | Motives to apply formal appropriation mechanisms

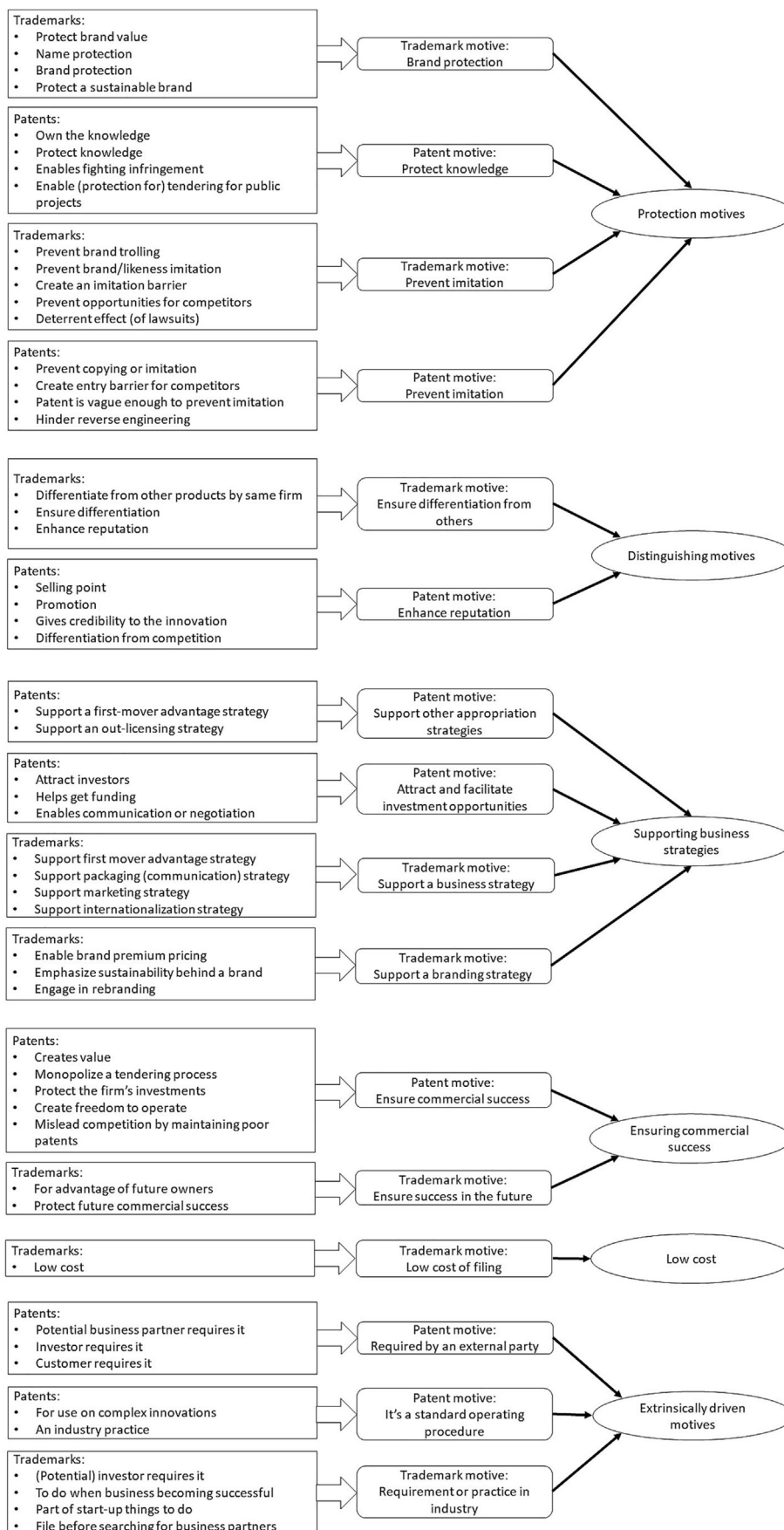
The principal over-arching motives (Figure 1) to use formal appropriation mechanisms on SI are protection-based motives (protecting knowledge or the brand, preventing imitation), distinguishing-based motives (through differentiation or of enhancing reputation), supporting other business strategies (such as branding strategy, other appropriation mechanisms, or facilitating investment), ensuring commercial success, and low cost (for trademarks). These motives broadly correspond with existing motives indicated in Tables 1 and 2. A new aggregated dimension that emerged from the coding is extrinsically driven motives, which occur when external parties force innovators to use appropriation mechanisms.

External parties' requirements drove patent filing. For example, a buyer—a large firm or government—demanded a patented SI to prevent legal risks because the innovation's uniqueness is validated by the patent office, which lowers the chance that the buyer is using infringing technology, as suggested by #14:

... our end customers ... absolutely do not want to work with a product that infringes on someone else's patent. This is also stated, for example, in the purchasing conditions that the supplier must then compensate for all damages ...

Similarly, for public entities, R#7 highlighted: "... there is also a responsibility before national governments or (public) authorities to make sure that the products they use are not infringing any other patent." Some SI patents or trademarks were filed because they are an expected course of action or an industry practice. As R#25 indicated for trademark filing, "When you decide to found a company, you start to do things because you think it's the right thing to do." Similarly, for patents, R#10 indicated "It's a requirement from the financial markets to give you some protection."

**FIGURE 1** Formal appropriation mechanism motives.



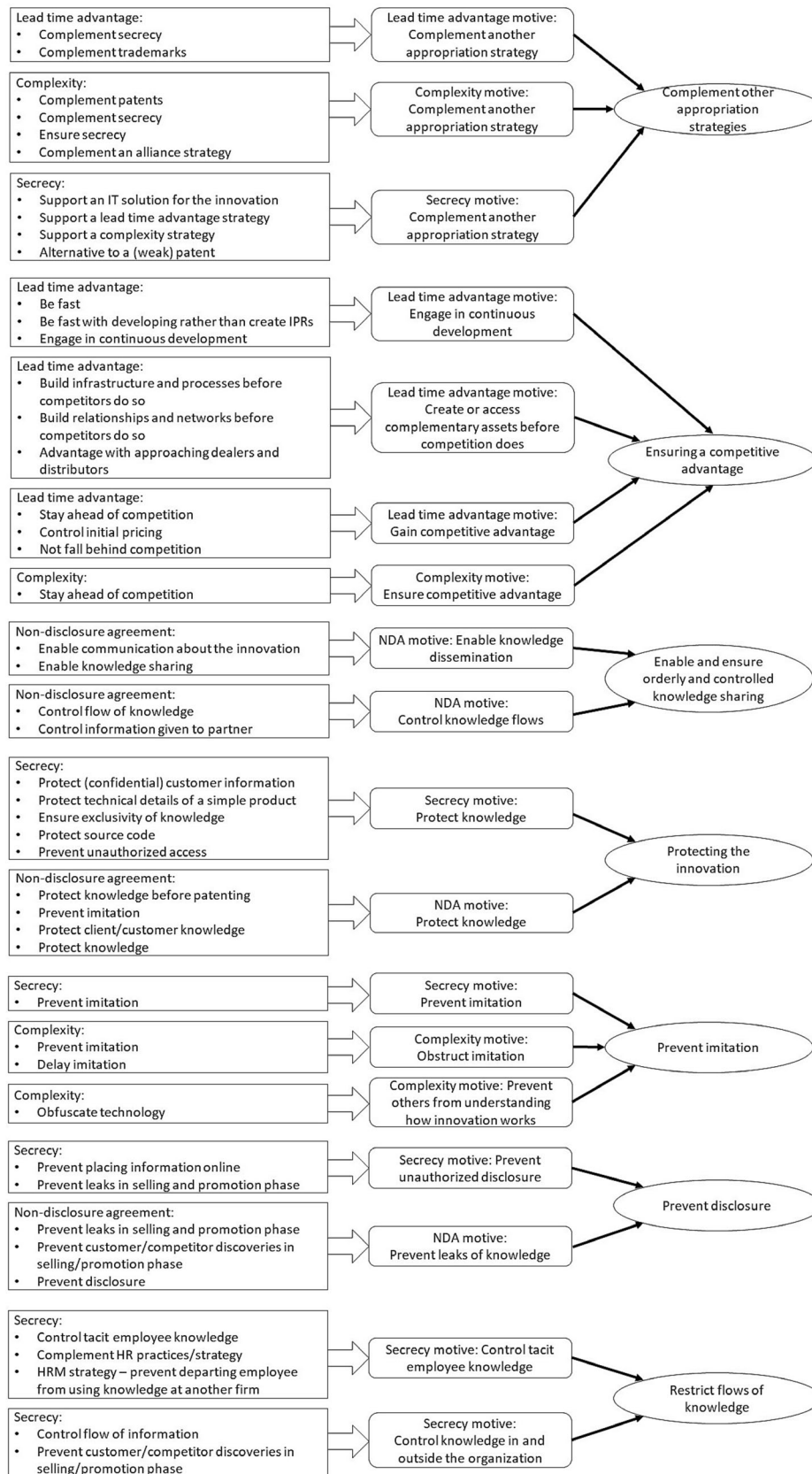


FIGURE 2 Informal appropriation mechanism motives.

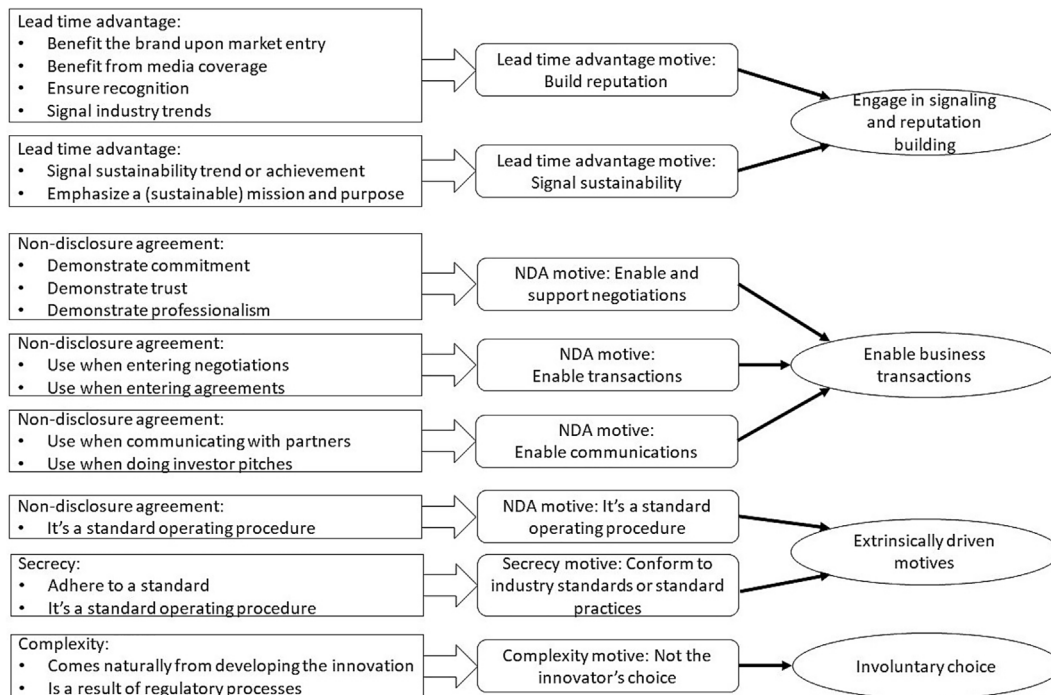


FIGURE 2 (Continued)

## 4.2 | Motives to apply informal appropriation mechanisms

The principal overarching motives (Figure 2) to apply informal mechanisms on an innovation were complementing other appropriation strategies, ensuring a competitive advantage, ensuring orderly and controlled knowledge sharing, protecting the innovation, preventing imitation, preventing disclosure, and restricting knowledge flows. New dimensions were signaling and reputation motives, which include sustainability (for first-mover advantage), enabling business transactions with NDAs, extrinsically driven motives, and an involuntary choice.

Throughout the course of the interviews, interviewees recognized the term “secrecy” as referring to access privileges and restrictions to protect knowledge. Upon probing, interviewees distinguished secrecy from NDAs and provided differing motives for their use. Secrecy and NDAs were probed and analyzed separately because the respondents considered them as two separate things. Figure 3 visualizes the aggregated dimensions for secrecy and NDAs. While both secrecy and NDAs aimed to prevent disclosure, they diverged with, for example, restrictiveness (emphasized by secrecy) and enabling sharing and transactions (emphasized by NDAs).

### 4.2.1 | Signaling and enhancing reputation with first-mover advantage

First-mover advantage was driven by signaling and reputation enhancing motives. While discussing IP protection, the execution of innovative ideas, and the balancing of both processes, R#37 stated concerning first-mover advantage that:

We made it to the front page of *Het Financieel Dagblad* (“The Financial Daily”) about a new upcoming law about CO<sub>2</sub> emissions that have to be monitored by businesses. And that’s a great example of first-mover advantage because we are basically throwing the first punch. We have a solution that is ready to help businesses monitor and reduce CO<sub>2</sub> emissions caused by mobility ... we have the solution that’s perfect for that new legislation. So, there we have a big advantage.

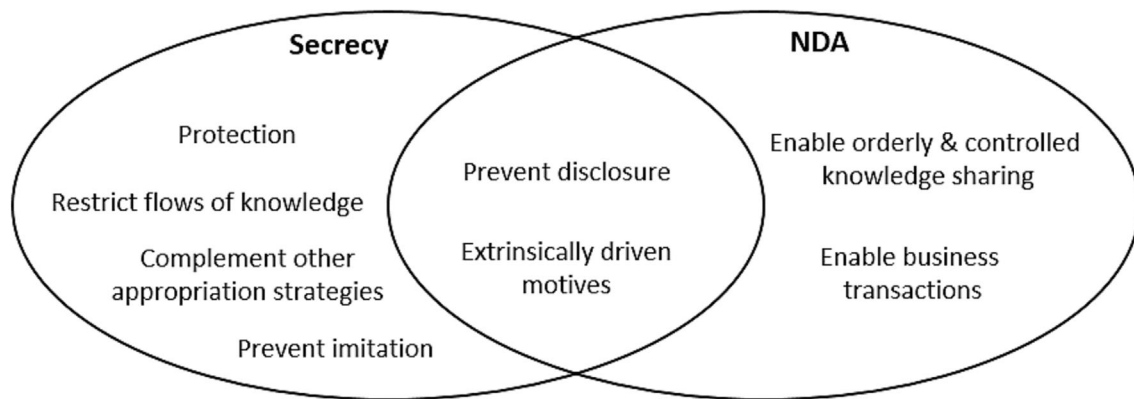
In the above example, the innovator signaled sustainability by being the first in the market with a sustainable solution and placed their SI at a reputational advantage over competitors. Being a first mover can also enhance a firm’s reputation, as indicated by R#16:

... once you’re the first player, you get a lot of free advertising, either directly or indirectly, word of mouth, and all this it becomes much easier to do, and then it becomes important to have your image – your branding then becomes very important.

### 4.2.2 | Enabling transactions with NDAs

NDAs functioned as enablers of business transactions, beyond their scope of ensuring secrecy. First, NDAs enabled communication concerning a prospective transaction as indicated by R#12 “... if we were talking with partners, yes: NDA.” R#18 elaborated to include investors: “If we are looking for new investors, we have a pitch to attract new investors, they have to sign an NDA before we go into the





**FIGURE 3** Aggregated dimensions of secrecy and NDAs and their overlap.

details.” However, this depended on the bargaining position of the innovator, as some investors were reluctant to sign NDAs, potentially forcing the disclosure of knowledge without protection. Second, the NDA demonstrated professionalism to engage in a relationship, as suggested by R#17 NDAs “give a form of professionalism ... it was more to show that we’re professional about the idea.” R#5 elaborated and indicated that NDAs also show commitment: “... it is showing the partner we are serious about a partnership.” R#2 detailed further by indicating that NDAs signal trust:

... what we are trying to say with (NDAs) is that we trust you and we trust you with our information. And I think it's more like personal relationship building than really making sure that legally it's air tight ...

Together, the NDA motives suggest a forward-looking commitment to engage and work towards a negotiated outcome on a business transaction concerning SI. Finally, NDAs enabled business activities to occur, as indicated by R#10: “NDAs – we have sometimes with suppliers or customers.” R#20 elaborated: “If they want to be our agents, for instance ... then we make an agreement and then also there's an NDA in that agreement.”

#### 4.2.3 | Extrinsically driven motives for NDAs and secrecy

NDAs and secrecy were driven by extrinsically driven motives, suggesting their application is driven by external parties or by existing rules and standard procedures in an organization. For example, NDAs were perceived as a standard operating procedure, as indicated by R#19: “I thought it was just good business procedure.” R#2 elaborated: “... we just have standard contracts ... but there is an NDA in it. I do believe that's the same for almost every company.” Furthermore, R#26 indicated that NDAs are a standard operating procedure for freelancers working with sensitive company data: “... for software development, freelancers or data analyst freelancers, we always use an NDA.”

Secrecy was sometimes a necessity rather than a choice. An innovator could have been forced to adhere to standards, such as the General Data Protection Regulation (GDPR) or ISO 27001, to manage information security. While discussing concerns about potential imitation or theft of intellectual property, R#28 indicated that secrecy broadly entails managing:

The client relationship of [customers], that is very sensitive information. And with that, basically, we need to fulfil the highest IT security protocols. (For) which we have ISO certification, internal guidelines, you name it. And of course, the technical structures for secrecy, double verification, need to know access – those kinds of things.

In the above example, secrecy was motivated by adhering to standards.

#### 4.2.4 | Involuntary choice for complexity

Complexity was seen as an integral but involuntary aspect of an innovation. Innovators from chemicals, manufacturing, and specialized electronics and some digitalized service innovations indicated this circumstance. For example, for a chemical, R#5 indicated:

... we improve that product from a recipe perspective ... not to make it more complex, but to make the product more usable and user-friendly, but the side effect is that it becomes more complex.

Similarly, R#9 indicated the regulatory approval of medical devices forced complexity to a SI:

So, imagine that a [foreign] company would make a copy of our device; they cannot refer to the same trial. So, nobody would believe that the device works, even if it was an exact copy.

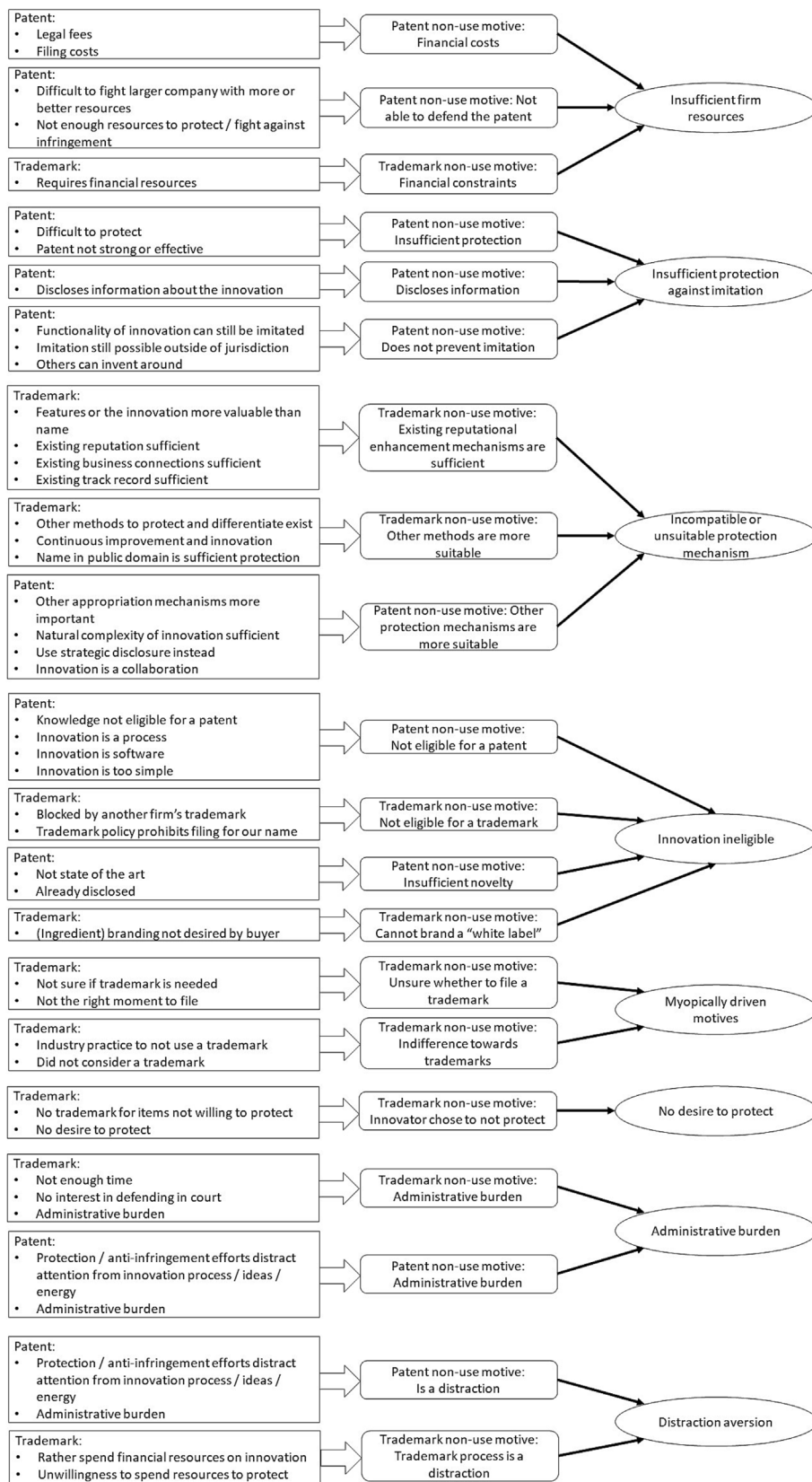


FIGURE 4 Formal appropriation mechanism forgoing motives.

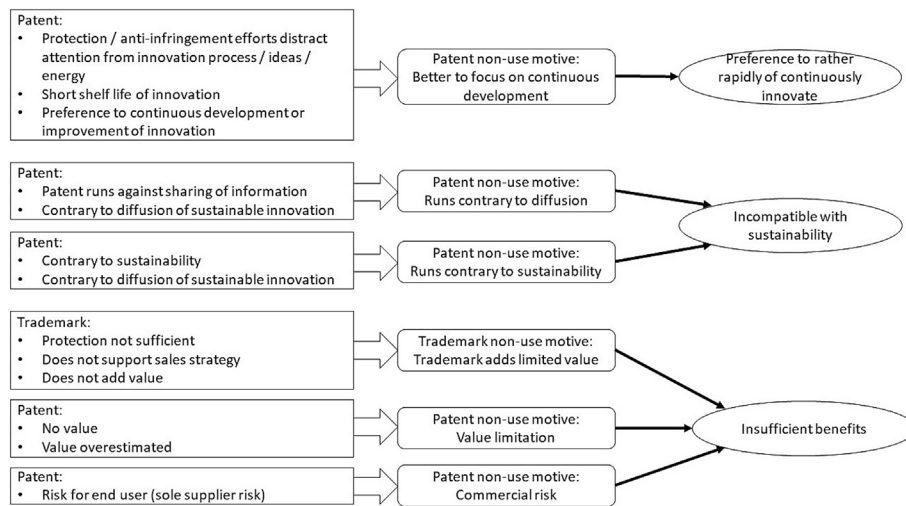


FIGURE 4 (Continued)

### 4.3 | Motives to forgo formal appropriation mechanisms

SI innovators' overarching motives to forgo formal appropriation mechanisms (Figure 4) were driven by insufficient firm resources (for example, financial costs and restraints and the inability to defend patents), insufficient protection against imitation (for patents), incompatibility or unsuitability, ineligibility, myopically driven motives (for trademarks), and no desire to protect (for trademarks). New dimensions entail forgoing appropriation mechanisms because of the administrative burden, averting distraction, and preferring to rapidly or continuously innovate. They also entail incompatibility with sustainability (for patents) and insufficient benefits (patents only).

#### 4.3.1 | Administrative burdens, averting distraction, and preference to innovate

Reasons given for forgoing patent and trademark filing were the administrative processes of filing, maintaining, and enforcing. These processes also distracted the innovator from their innovative activity, to the extent that some innovators would rather focus on innovating than seeking patent or trademark protection. Sustainable innovators avoided filing patents and trademarks because of the time and energy required to manage them. For example, R#1 indicated "... it's time consuming, and that's time that cannot be used in other steps." The time and energy issues also include addressing infringers, as R#8 indicated while discussing trademark management: "We find that there's often so much work to fight infringements." Attention is also a resource held by the innovator; in particular, sustainable startups prefer to rather spend time on innovative activity than fighting to protect IP. While discussing rapid innovation and reasons to forgo IPRs, R#30 stated:

... you can create a patent, but if you don't monitor whether everyone is copying it ... that will just distract

basically the innovation power ... tech startups have a limited amount of resources and I would rather funnel that into growth than in protecting what is good for six months.

#### 4.3.2 | Patent incompatibility with sustainability objectives

Patents were perceived as potentially obstructing or running contrary to SI; hence, some sustainable innovators decided to forgo patent filing. While discussing knowledge protection for SI, the innovators' concerns reflected a negative view of patents because of its exclusionary nature. Herein, R#3 highlighted: "I would love to share instead of protect the recipe or the strategy or mission. We are a company that wants to share." Similarly, some held the perception that patents diminish the diffusion of a SI, as indicated by R#5: "I am still a little bit uncomfortable with protecting the innovation since I think that innovation should be widely available for everyone."

#### 4.3.3 | Insufficient benefits from patents

Innovators may avoid patent filing due to little to no perceived benefits. Some innovators questioned the value of patents, for example, R#26 "... the technology we build is not worth a patent." R#39 elaborated, stating:

There's a lot of what we call "marketing patents," you just file it. But if you really start shaking down the patent, there's not much left ... So it's always, you know, with the investors, you sometimes get what they desire; if they focus too much on patents, they get patents, but the question is, what's the value?

A patent might also be avoided to reduce the commercial risk perceived by buyers, as suggested by R#18, in the case of specialized machines:

[The customer] is afraid that we will ask for too much money or that we will collapse and not be around anymore, but this stuff is still patented – then how the heck can you get replacement parts?

#### 4.4 | Motives to forgo informal appropriation mechanisms

The overarching motives for not using informal appropriation mechanisms (Figure 5) were a clash with innovation strategy, avoiding

risks and costs introduced through implementation, viewing an appropriation mechanism as ineffective for protection, an implementation disincentive, and myopically driven motives. Because the motives found on this research are different from those identified in the literature, all of the aforementioned motives will be covered below.

#### 4.4.1 | Clashes with innovation strategy for secrecy and complexity

Innovators avoided secrecy and complexity due to strategic incompatibilities. For example, R#3 suggested that secrecy can also run contrary to open innovation, sharing, and diffusion initiatives:

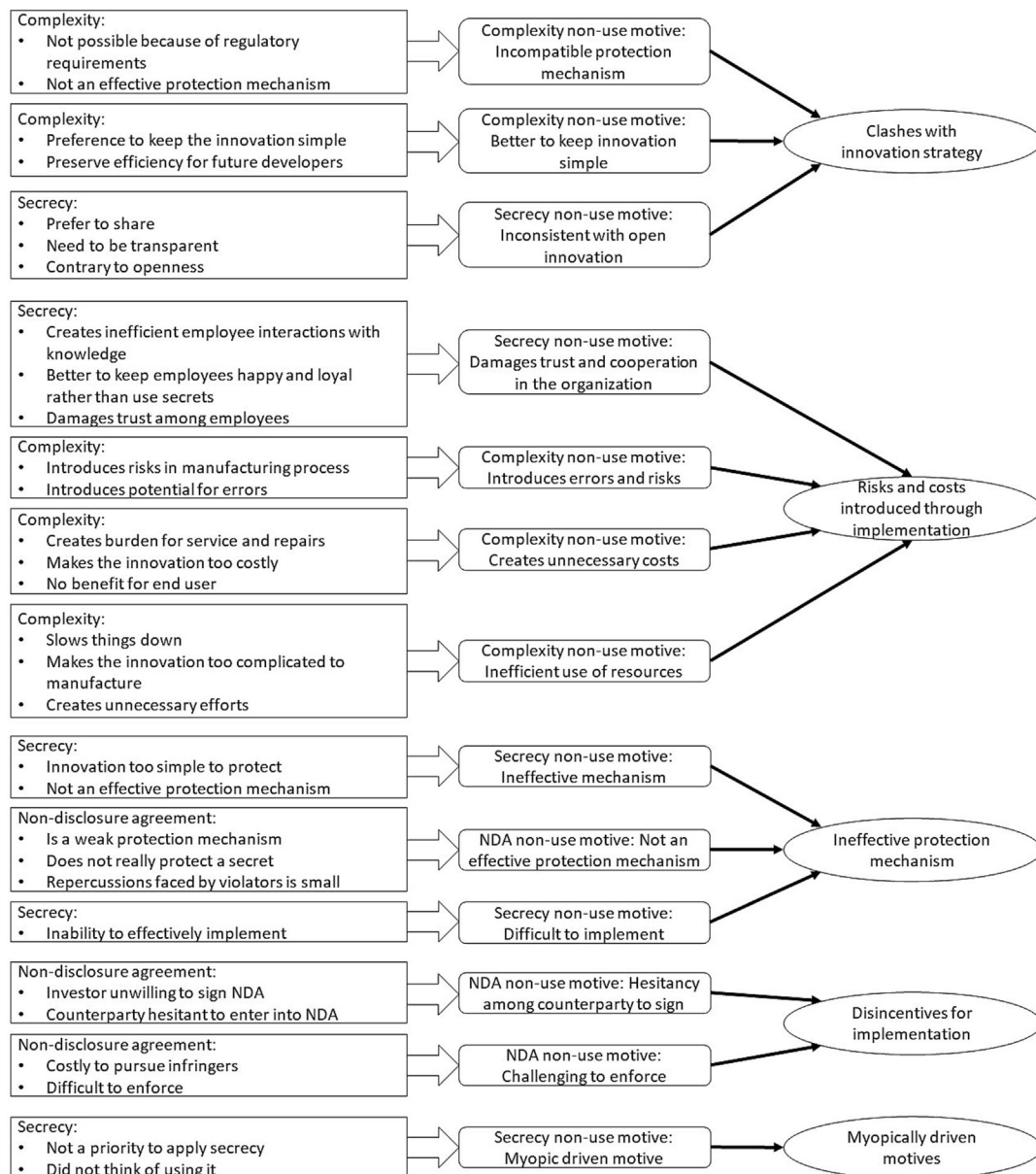


FIGURE 5 Informal appropriation mechanism forgoing motives.

... the knowledge we have, we would like to share that with as many people, companies as possible because we would like to spread the fact that those products can be produced without [the unsustainable ingredient].

Complexity was also found to be strategically incompatible; an innovator may prefer to keep the innovation simple, as suggested by R#18:

... we love to make our product as simple as possible because it has to be produced at the end of the day – it has to be low cost, and it has to be easy to manufacture, because ... if there are too many components in it and too complex structures, then it will be too costly, too complicated to manufacture it in a cost-effective way.

For digital service innovation, complexity can be avoided by ensuring comprehension of code for future hires, as indicated by R#26:

... we tried to make the code as simple as possible. And developers are actually writing instructions in every line of code, like “I wrote this to get this and this done and it connects to this and that” because when you hire a new software developer, you want him or her to get around to code very fast to become productive very soon. So, we make the code very simple ... because we want to innovate every week.

#### 4.4.2 | Risks and costs introduced with secrecy implementation

Some innovators chose to forgo secrecy because, in practice, it led to problems resulting from implementation. For example, secrecy damaged trust and cooperation in an organization. While discussing an organizational configuration of secrecy whereby knowledge is divided in order to prevent the workers having a full understanding of the innovation (e.g., Hall et al., 2014), R#27 stated, “... building trust is most important. So, in that sense, having this kind of secrecy like partial secrecy of projects, kind of backfires.” Secrecy can also be difficult to implement, particularly for innovations that require transparency with components or ingredients, such as chemicals, as indicated by R#4: “With [chemicals] you already have a bit more transparency towards the consumer, which makes you have so much transparency with your competition.”

#### 4.4.3 | Ineffectiveness and the implementation disincentive for secrecy and NDAs

The choice to forgo secrecy was also driven by challenges in finding out how a breach occurred, as indicated by R#10: “I always think it

will be really hard to pinpoint: where was the leak of knowledge?” Similarly, some viewed the effectiveness and effort invested into enforcing NDAs as questionable, as indicated by R#38: “... you really need proof that someone gave information. And most of your time, it's not even worth the whole hassle of getting a lawyer and solving it that way.” The ineffectiveness of secrecy was also driven by the simplicity of an innovation, as indicated by R#14: “someone who builds [our type of product] can easily see how the product looks and how they must construct it.”

Innovators had a disincentive to consider NDAs because of counterparties' unwillingness and hesitancy to enter into an NDA. This was often the case when having to disclose information about the innovation to potential investors, and investors refused to enter into NDAs. R#27 elaborated further:

... most investors will say no. The reason is that, as an entrepreneur, most people think “oh, my idea is the first one, we are the most brilliant on the planet, we are the next Steve Jobs,” even though that's not true. So, most ideas are recycled to a certain extent. And most investors would also say: “Sorry, we won't sign the NDA” - it's especially because of this.

#### 4.4.4 | Myopically driven motives for secrecy

Some innovators expressed myopically driven motives to avoid implementing secrecy. This implies that the innovators had a lack of awareness or insights about using secrecy. For example, R#5 indicated: “It's quite a funny question, because I never thought about it.” Similarly, while discussing informal protection mechanisms, R#3 indicated that secrecy is simply not a priority: “We don't have any secrets. We're just very motivated.”

## 5 | CONCLUSION

This paper addresses an ongoing debate regarding the place of appropriation mechanisms in the context of SI (Corrocher & Solito, 2017; Hermundsdottir & Aspelund, 2021; Vimalnath et al., 2020). Our research addressed the need to better understand the motives for using appropriation mechanisms on SI (Castaldi, 2021; Morales et al., 2022). Through a qualitative study of 42 semi-structured interviews, we found that sustainable innovators' motivations for using or not using formal and informal appropriation mechanisms have broadened compared to motives identified in the general innovation appropriation literature. The motives we found included enabling of business transactions by NDAs, patents' incompatibility with sustainability aims, and the administrative burden barriers preventing patent and trademark filing. We also found that motives from the general innovation appropriation literature also apply to SI—such as protection motives for patents and secrecy—and we found similar over-arching motives to use formal and informal appropriation mechanisms. The findings in aggregate suggest that sustainable entrepreneurs have



many similar motives behind appropriation mechanisms as entrepreneurs in general. The sections below compare the results with extant literature from the SI literature covering appropriation mechanisms and the general innovation literature, followed by theoretical implications, policy and practical implications, and concluding with limitations and suggestions for future research.

## 5.1 | Towards appropriation mechanism motives for SI: a comparison of literature

This study confirms or refines proposed and conceptualized motives in the SI literature and likewise known motives from the general innovation appropriation literature. As most of the motives identified in the literature match with the over-arching motives from Table 6, we chose to not divulge into results repeating findings of prior studies. However, the observed differences with the SI literature examining appropriation mechanisms and empirical results of this study are outlined in Table 7, whereas the observed differences between the general innovation literature on appropriation mechanisms and the empirical results are outlined in Table 8.

While the nascent literature on SI and appropriation mechanisms lacks empirical observations on motives, the literature has proposed motives, either by conceptualizing motives (e.g., Castaldi, 2021), inferring motives (e.g., Morales et al., 2022), or otherwise indirectly proposing motives (e.g., Eppinger et al., 2021). Our results refine these works by, for example, showing how a sustainable-commercial clash might not apply to trademarks, which can help to emphasize a sustainable brand strategy. The results also refine knowledge in the general innovation literature (e.g., Athreye & Fassio, 2020; Blind et al., 2006; Block et al., 2015). For example, the exchange motive to trademark did not manifest itself among the respondents. In contrast, among our sample, trademark filing was an extrinsic reactionary step to meet an investor's expectations, rather than filing with the motive of attracting investors. This suggests that innovators might be using methods other than trademarks (or IPRs) to initially attract an investor's attention and the question of trademarking enters discussions later as an investor's requirement.

The interpretation of motives in the extant literature that do not appear in our empirical results should also be carefully interpreted. This does not imply the motive is non-existent. Rather, the non-appearance of a motive in our results could be due to the sample. For

**TABLE 7** Differences from comparing sustainable innovation literature and empirical results.

Appropriation mechanism motive	Most related empirically observed motive	Potential explanation
Patent motive: participation in patent commons (Castaldi, 2021)	Support other appropriation strategies (such as out-licensing)	Innovators might prefer individual arrangements with other parties rather than collective arrangements
Trademark motive: complement or substitute patents (Castaldi, 2021)	None	Results indicated that innovators could instead be motivated to complement patents with complexity or use secrecy as an alternative to a (weak) patent. As trademarks protect the origin-based features rather than technology, they might not complement patents very well.
Trademark non-use motive: clash of sustainable-commercial values and logic (Castaldi, 2021)	None	Results show that trademarks could support a branding strategy that emphasizes sustainability. A trademark does not necessarily preclude sharing, openness, or otherwise potentially favorable licensing of a (sustainable) technology.
Patent and secrecy non-use motive: slows down rate of sustainable innovation (Eppinger et al., 2021)	Administrative burden and distraction aversion	For patents, the results suggest that the administrative burdens and distraction aversion motives are not driven by sustainability: these motives might apply to innovation in general, sustainable or otherwise. For secrecy, results show that specific first-order concepts, such as avoiding an appropriation mechanism because it "slows things down," "creates unnecessary efforts," and "creates burden for service and repairs," were found with complexity, but not secrecy, suggesting that complexity slows down the rate of (sustainable) innovation.
NDA motive: helps to contract-out SI knowledge (Morales et al., 2022)	Enable knowledge dissemination and control knowledge flows	Results suggest that NDAs help contract-out general innovation knowledge, not only SI-specific knowledge.
Complexity non-use motive: over-manufacturing and introducing inefficiencies for SI (Morales et al., 2022)	Inefficient use of resources	Results suggest the motive is general innovation rather than SI-specific
Complexity non-use motive: reputational critique (Morales et al., 2022)	None	An innovator may be unable to initially assess a potential reputational impact internally from their organization on a new to the market innovation.

**TABLE 8** Differences from comparing general innovation literature and empirical results.

Appropriation mechanism motive	Most related empirically observed motive	Potential explanation
Patent motive: exchange/bargaining (e.g., Blind et al., 2006)	Attract and facilitate investment opportunities, support another appropriation strategy (such as out-licensing), required by external party (an investor or potential business partner may require a patent)	The exchange/bargaining motive from the literature is dispersed in the findings of the present study. A potential external partner with whom to exchange or bargain may require a patent.
Patent motive: blocking (e.g., Blind et al., 2006)	Ensure commercial success by protecting firm's investments, creating a freedom to operate	SMEs might not be able to patent (more) for the purpose of blocking others from occupying their technological room.
Patent motive: incentive/measure performance (e.g., Blind et al., 2006)	None	SMEs might not file enough patents compared to large firms to use them as incentives or for measuring performance.
Patent non-use: existing appropriation mechanisms sufficient (e.g., Capponi et al., 2019)	None	While the precise motive was not articulated by the interviewees, informal appropriation mechanism motives hinted their substitutability with a patent. For example, secrecy could be used as an alternative to a (weak) patent, which could be strengthened with first-mover advantage and complexity. However, only secrecy was mentioned by interviewees as a direct substitute to patents.
Trademark motive: exchange (Block et al., 2015)	Required by an external party	The results suggest trademarking motives connected with investors were driven extrinsically as a requirement set by investors, rather than as tools to attract investors.
Trademark non-use motive: existing IPRs sufficient (Athreye & Fassio, 2020)	Other methods are more suitable	The "existing IPR is sufficient" non-use motive could be part of a broader motive that includes other strategies as well, such as using an unregistered mark already in the public domain, or (rather) continuously improving and innovating (than trademarking).

example, as SMEs do not patent as much as their larger counterparts, they might not be able to use patents as tools to measure performance or patent to the extent of blocking others from occupying their technological room.

## 5.2 | Theoretical contribution

The principal theoretical implication of this study is that we identify new motives for using and forgoing the use of appropriation mechanisms. Some of these new motives clearly pertain to the sustainable nature of the innovations we researched. Examples are signaling sustainability with first-mover advantage and avoiding patent filing because of perceived incompatibility with sustainability objectives. Other new motives do not appear to be exclusive to SIs. The administrative burdens of patent and trademark filing may be a reason for not applying for these intellectual property rights for any innovator, sustainable, or otherwise. These newly discovered motives may be incorporated in further empirical research into the efficacy of appropriation mechanisms and thus open up new avenues for research.

Second, our results indicate that the known motives from the general innovation literature also apply broadly to SIs. The results suggest that sustainable innovators have similar motives to use and not use appropriation mechanisms as general innovators. In combination

with our first contribution, this raises the question of the extent to which sustainable innovators actually differ from other innovators. The results suggest that appropriation mechanisms, as understood under the profiting from innovation theory (Teece, 1986, 2018), operate similarly for SI. Our interviews suggest that these differences may be limited, but we need more larger-scale research to confirm this thesis. The strength of the motives may be decisive here. For example, when sustainable entrepreneurs feel very strongly about the incompatibility between patent filing and sustainability, this feeling may override a motive to patent. Such tensions and trade-offs between the motives provide an interesting avenue for further research. The first and second contributions extend the SI literature (e.g., Castaldi, 2021; Corrocher & Solito, 2017; Eppinger et al., 2021; Hermundsdottir & Aspelund, 2021; Vimalnath et al., 2020) by showing how appropriation mechanisms have (or do not have) a place in SIs. As it appears that some new motives were not exclusive for SI, our results might also enrich the general innovation and appropriation strategy literature (e.g., Blind et al., 2006; Block et al., 2015; Flikkema et al., 2014; Holgersson & Granstrand, 2017).

A third contribution to the appropriation literature emerges through having examined secrecy. Our results indicate the scope and implications of secrecy are broader than typically suggested. The outcome of secrecy is not only the protection of a secret. There are multiple ways of achieving secrecy, including through access restrictions

and handling procedures such as non-disclosure and confidentiality agreements. However, NDAs have been neglected in the appropriation literature, and our results show they play a broader role than ensuring secrecy. For example, NDAs also enable transactions, negotiations, and communications concerning an innovation. Future research should consider the broader purpose and scope of secrecy and how secrecy is achieved so that future studies on innovation performance, open innovation, and IPR strategy can produce more precise and meaningful results.

### 5.3 | Policy and practical implications

First, our results highlight the administrative burdens of IPR management, which prompted some sustainable innovators to forgo patent and trademark filing and instead focus on innovative efforts. This could indicate obstacles to accessing IPRs by sustainable innovators, as these innovators may have wished to benefit from patents or trademarks but might have instead settled for informal appropriation mechanisms. This also represents a missed opportunity for IPR offices to register IPRs and, from a policy angle, non-filing of eligible innovations for IPR protection could distort the measurement of (sustainable) innovation through patents and trademarks. IPR registrars could take initiatives to simplify IPR filing and maintenance procedures, which could, for example, contribute to reducing barriers to access not only IPRs but also the European Union Single Market (European Commission, 2020).

Second, over-arching motives behind informal appropriation mechanisms (such as protection, signaling, or enhancing reputation) could be mentioned in educational material for (sustainable) SMEs to advise on alternatives in case they are unable to use patents or trademarks. Informal mechanisms should be an integral part of SMEs' appropriation strategy. Furthermore, our results showed that the scope of NDAs is broader than merely protecting knowledge or ensuring controlled sharing of knowledge and that they also serve to enable business transactions by supporting negotiations and enabling communications about a SI. Accordingly, educational material for SMEs can include material on leveraging NDAs for appropriation purposes.

From a practical perspective, the results can also help sustainable innovators to craft an appropriation strategy. Knowledge of the new motives could prepare sustainable innovators to foresee, for example, patenting requirements for large buyers and governments. Sustainable innovators could also position themselves to exploit NDAs beyond their intended protective scope to enable communication, demonstrate professionalism, and indicate a forward-looking commitment, thus facilitating business transactions. We also observed how some appropriation mechanisms are driven by similar over-arching motives (such as the signaling-driven motives shared by patents, trademarks, secrecy, and first-mover advantage). This adds evidence to the potential complementarity of these mechanisms and could help innovators construct appropriation strategies for SI. For example, an innovator that wishes to enhance the reputational standing of its innovation and is unable to patent or trademark could consider an alternative. For

example, such an entrepreneur may focus on first-mover advantage by using NDAs and thus still achieve a commercial success or contribution to tackling grand societal challenges.

### 5.4 | Limitations and suggestions for future research

Our chosen design and sample present certain limitations. First, the study was scoped to sustainable SMEs; multinational enterprises (MNEs) may have different motives to use or not use the appropriation mechanisms because of their superior access to resources. Second, no insights were generated regarding reasons for forgoing the first-mover advantage strategy. Since our sample consisted of SIs entered into SI awards with a novelty requirement, it was unlikely that late movers were encountered. Therefore, less innovative or incremental innovations may have been missed, and such innovations may have had differing appropriation mechanism motives. A future study could replicate this study with a different sample and include market late movers. Third, as mentioned in the methods, this study is generalizable to regions that are highly innovative, patent-intensive, and sustainability oriented with similar legal frameworks. Accordingly, generalization to other regions should be undertaken with care.

Future research can integrate the newly discovered motives together with the known motives into quantitative IP strategy surveys. The aggregated dimensions and/or the second-order concepts attached to each appropriation mechanism in the result could, for example, be used in a future quantitative survey to measure the motives behind a certain appropriation mechanism. These studies could compare the motives to use (in)formal appropriation mechanisms, particularly the IPRs, between sustainable and general innovators to determine whether the motives are shifting or broadening in an increasingly relevant SI context. This will also enable researchers to measure the extent of, for example, avoiding patent and trademark filing due to perceived administrative burdens, which could be of interest to IPR registrars. Here, the relative weight given to motives may be important and may shed light on the question of whether sustainable entrepreneurs use different appropriation mechanisms. Future studies can also examine the complementarity among patents, trademarks, and informal appropriation mechanisms in the context of SI. As many of the service innovations were digitalized, future research could examine digital transition issues—such as transitioning to mobile applications, blockchain implementation, and artificial intelligence use—and how these may impact appropriation mechanism use on an SI or even a general innovation. Future research can also investigate whether appropriation mechanisms help or impede sustainable business models (e.g., Bocken et al., 2014).

Finally, future research should examine secrecy as a concept through its constituent components (see Hannah, 2005). This is because NDAs—an implementation mechanism of secrecy—have motives that differ from secrecy as understood in literature (e.g., Gallié & Legros, 2012; Hall et al., 2014; Hannah, 2005; James et al., 2013). Also, interview respondents were better triggered to

discuss secrecy by using practitioner terms such as NDAs, access policies and procedures, or secrecy clauses on employment contracts. Hence, employing the umbrella term “secrecy” could lead to rich data being missed and provide incomplete measurement of its implementation. The extent to which NDAs are utilized could also be measured, and the results could provide a framework under which future appropriation literature conceptualizes and measures secrecy.

## AUTHOR CONTRIBUTIONS

**Pablo Morales:** Methodology; validation; formal analysis; investigation; resources; data curation; writing—original draft; visualization; project administration. **Meindert Flikkema:** Writing—review and editing. **Carolina Castaldi:** Writing—review and editing. **Ard-Pieter de Man:** Conceptualization; writing—review and editing.

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## APPENDIX A: SEMI-STRUCTURED INTERVIEW PROTOCOL

### Innovation in general:

- Could you describe your innovation and the way it was developed?
  - What were the motives for developing the innovation?

### Sustainability

- Why is the innovation considered sustainable?
- Is there a “sustainability” message or drive behind the innovation? (If so, what/how/why?)

### Appropriability regime

- Do you consider the innovation easy to imitate? Or complex? (Why?)
- Is the knowledge behind the innovation easy to transmit to others? (Is it easy to codify/write down? Or is it dependent on being explained/taught by someone?)
- (Product innovations only): Do you manufacture it in-house or contract manufacturing out? (Are you concerned vis a vis loss/theft of IP in the latter case?)

### IP protection motives

- How do you protect the knowledge (IP) of this innovation?
  - Check: Patent, trademark, design right, complexity, secrecy, first mover advantage
  - Why do you (not) use this specific IP mechanism for this innovation?
- Do you protect your IP in a non-conventional manner? (Different from the previously discussed methods?)
- If you do not protect your IP (or just protect it minimally) then how do you ensure that you profit from the innovation?
- How concerned are you about imitation or theft of IP?
- If subsidies for patents or trademarks were available, would you then consider filing for patents or trademarks? (If not, why?)

### IP protection and sustainability

- Do appropriation mechanisms protect or emphasize a sustainability element of the innovation? If so, how?
  - Do they help you to reach sustainability goals of your innovation/firm?
- Do you emphasize the sustainability of the innovation in the brand or innovation name? Did you use a trademark for that? Why (not)?
- If this would be a purely profit-oriented innovation (as in not sustainable), would you do something differently regarding IP protection?



### Conclusion

We talked a lot about innovation, sustainability and protecting IP today. We may have followed a structure “from the books” and

perhaps missed something. Is there something on the topics above, or combined with the topics above, that you think we might have missed – which is relevant to this conversation?