

## Bridging the Gap: Intellectual Property Rights and Sustainable Development Goals in Innovation Ecosystems

YunQi, Yang and Grace T.R. Lin

Corresponding author : Grace T.R. Lin

**ABSTRACT** : In today's highly developed society, start-ups are proliferating in various fields. However, most start-up teams lack relevant management knowledge, resulting in a high failure rate. Entrepreneurial activity is a complex social phenomenon, and businesses must integrate intellectual property rights (IPRs) management to yield positive outcomes. This study reviews the literature on IPRs in the innovation and entrepreneurship ecosystem. From over a hundred existing research papers, highly relevant literature was identified and analyzed to conclude that IPRs management has contributed significantly to knowledge dissemination, sharing, and protection among companies in the innovation and entrepreneurship ecosystem. Simultaneously, companies and universities should also take social responsibility, and contribute to the achievement of the United Nations Sustainable Development Goals.

**KEYWORDS**: *Intellectual Property Rights; Patent Protection; Innovation and Entrepreneurship Ecosystem; Systematic Literature Review Analysis Method; SDGs*

### I. INTRODUCTION

This section contains four subsections, the first of which is the relevant research background and the current status of intellectual property rights (IPRs); the second section describes the motivation for this study and provides analyses of the choice of this thesis topic; the next section describes the purpose of the study, outlining the value and contribution of this literature review; and the final section introduces the research process and briefly explains how the literature analysis methodology was conducted to complete this literature review.

#### 1.1 Background of the study

IPRs have a long history of development, dating back to ancient Greece, Babylon, Egypt, and so on. In those ancient times, patent-like institutions for technological inventions did not exist. The concept of IPRs gradually began to be acknowledged in the Middle Ages due to the development of trade and technology (Granstrand 2006). Before the emergence of a definitive system of IPRs, country leaders used property-like rights to encourage the masses to innovate. In the contemporary discourse, the term "Intellectual Property Rights" is commonly employed to encompass a broad spectrum of rights. These rights include, but are not limited to, patents pertaining to inventions, corporate trade secrets, copyrights, trademarks, and design rights. Furthermore, with the advent of the 21st century, this terminology has expanded to incorporate novel rights such as plant breeders' and database rights, reflecting the evolving landscape of intellectual property (IP) in the digital age.

The conceptual framework of IPRs, in its most comprehensive form, was primarily developed by the United States and other industrially advanced nations during the mid-20th and early 21st centuries. This period marked a significant evolution in the understanding and application of these rights, reflecting the complex interplay between technological advancements and legal structures (Baker, Jayadev, and Stiglitz 2017). The reason for the development of IPRs was to ensure that innovators (e.g., inventors of technologies or authors of books) had the right to receive fair remuneration from their creations. Furthermore, IPRs reduce the knowledge leakage of core technologies and imitation by competitors, which result in a large number of similar technologies or products flooding the market, continuously violating the interests of original patent holders or entrepreneurs. If IPRs protection had not been established, it would be unfavorable to the rational dissemination of knowledge, leading to serious knowledge spillover, a decline in innovation speed and the core competitiveness of enterprises, and unbalanced development of regional and holistic economies.

Schumpeter (2017) highlighted the relationship between innovation and entrepreneurship, emphasizing the decisive role of these relationship categories in innovation growth and economic development. He promoted the view that the innovation process is generated by entrepreneurs who are equipped with a high level of perception and creativity and are also seen as a powerful force in promoting and stimulating the economy with their innovative performance. IPRs, as an essential element of the ecosystem, are the link between innovation and entrepreneurship and are indispensable to the functioning of the innovation and entrepreneurship ecosystem. Entrepreneurship, IPRs, and innovation involve a variety of economic programs that can converge in an institutional environment to undertake, produce, protect, and commercialize innovative assets (Reis, Moura, and Aragão 2021). IP protection plays a fundamental role in this process, constituting innovative strategies that companies and countries should adopt.

## 1.2 Research Motivation

In the modern world, where innovation and entrepreneurship ecosystems continue to flourish and expand, questions regarding IPRs have arisen. Many managers of small- and medium-sized enterprises (SMEs) are unfamiliar with or rarely pay attention to IPRs management. They frequently develop incorrect IPRs strategies, leading to failure in the innovation ecosystem. Teece (1986), in his article on how to profit from innovation, raised two issues that have been overlooked in the literature: first, why are some innovators able to derive significant benefits from their innovations while others end up failing? Second, how can innovators improve their ability to capture the benefits of their innovations? Teece also created a framework for the three pillars of innovation profitability: distributability mechanisms, complementary assets, and dominant design.

Based on Teece's research, mainland Chinese scholars have further argued that knowledge is a quasi-public product, and competitors in the same industry could imitate and use knowledge innovation at little or no cost without the fixed costs of knowledge creation. At this point, the problem of the exogenous nature of innovation becomes apparent, as producers of innovative knowledge are unable to fully distribute the full benefits of innovation. This causes fewer resources to be invested in knowledge production and private investors or financial institutions to underinvest in innovation activities (Wu and Xu 2009). As of 2022, globalization has led to rapid changes in science and technology and formed a new transnational competitive pattern, with an increasing emphasis on innovation and entrepreneurship in international academia and industry. The emergence of new technologies, such as blockchain, AI algorithms, 5G, and fintech, have greatly facilitated and benefited society. However, companies' core technologies must be protected, which requires them to employ robust IPRs strategies to combat the threat of competitors imitating and profiting from theft.

Thus far, this thesis is motivated by the fact that the failure rate of start-ups is still very high, indicating that entrepreneurial activity is a complex social phenomenon. When innovative entrepreneurial activities actively promote the progressive development of society, they are strongly influenced by all areas, levels, and types of economic agents in the national economy (Lin 2011). This means that research on entrepreneurship cannot insist on a single business strategy. IP management should be integrated into entrepreneurship to achieve favorable outcomes. The broad spectrum of IP management encompasses the environment, society, institutional policies, and actors in the innovation and entrepreneurship ecosystem, such as corporate groups, suppliers, customers, competitors, consultants, governments, and universities (Audretsch, Belitski, and Guerrero 2022). As such, reviewing and analyzing the findings of previous literature in this field is highly beneficial and worthwhile.

## 1.3 Research Gap

There is a significant gap in the literature, despite the extensive research on IPRs management and its role in innovation and entrepreneurship ecosystems. Most studies have focused on isolated areas of IPRs management and corporate performance, knowledge sharing and dissemination in innovation ecosystems, or alliance innovation. However, few have attempted to integrate these areas into a comprehensive cross-disciplinary study. Moreover, IPRs management's role in promoting environmental sustainability, a key goal advocated for by the United Nations, is often overlooked. For instance, the global objective of achieving net-zero carbon emissions by 2050 underscores the urgency of environmental protection. This goal is closely linked to IPRs management and the responsibility of various social organizations. Yet, the existing literature scarcely addresses this connection.

To bridge these research gaps, this study conducts a systematic literature review and analysis. By exploring the intersection of IPRs management and innovation ecosystems with a particular emphasis on environmental sustainability, it aims to provide a more holistic understanding of these complex relationships and contribute to the ongoing discourse on sustainable development.

## 1.4 Purpose of the Study

As innovation and entrepreneurial activities continue to develop in the ecosystem, many start-ups and university research institutions have begun to promote social responsibility to project a positive image. The business activities and technologies developed by these companies and institutes are gradually aligning with the 17 Sustainable Development Goals (SDGs) proposed by the United Nations, in which IP management plays a vital

role, with Goal 2 on poverty eradication, Goal 3 on health and well-being, Goal 4 on quality and equitable education, and Goal 13 on climate being particularly prominent (Sideri2021). This phenomenon contributed to the formation of this study: “The Role of IntellectualProperty Rights Management.”

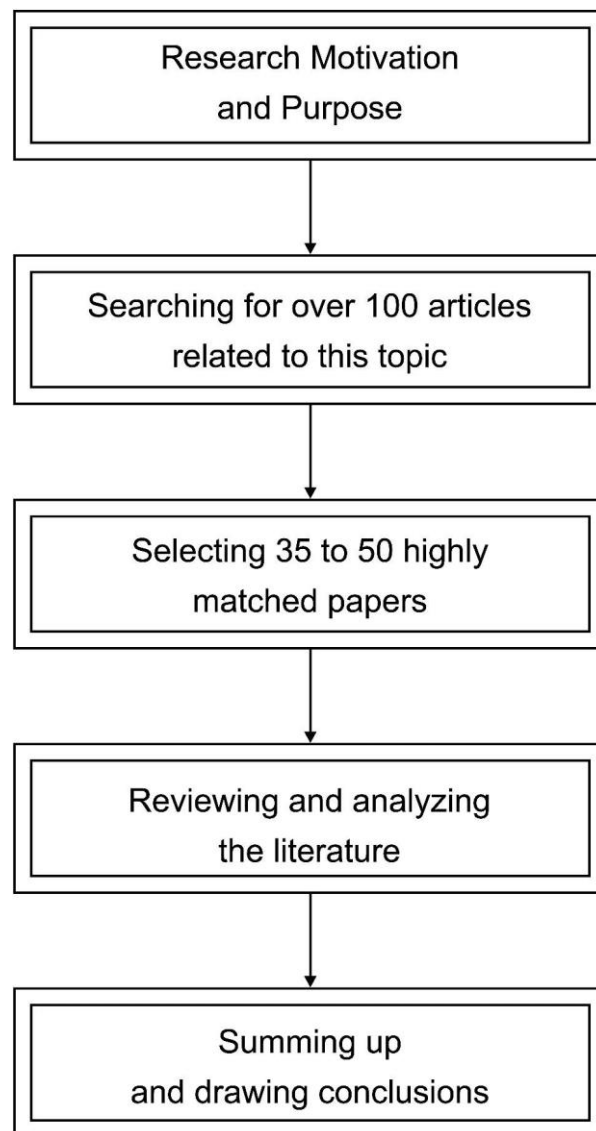
This study reviews and analyzes the relevant literature, aiming to answer thefollowing research questions:

- a) What is the role of IP management in the innovation ecosystem?
- b) How can IP management be implemented in a sustainable innovation and entrepreneurship ecosystem while fulfilling social responsibilities (Corporate SocialResponsibility [CSR], University Social Responsibility [USR], and SDGs)?

## II. RESEARCH PROCESS

The research flow of this study is illustrated in Figure 1. Section 1 introduces the background and current status of the research topic; Section 2 reviews the relevant literature on the role of IP management in innovation and entrepreneurship ecosystems and defines key terms and theories; and Section 3 analyzes the research questions based on the reviewedliterature and concludes this study.

**Figure 1.** The research process of this study



## III. EXPLORING THE LITERATURE

### a. IPRs and the innovation and entrepreneurship ecosystem

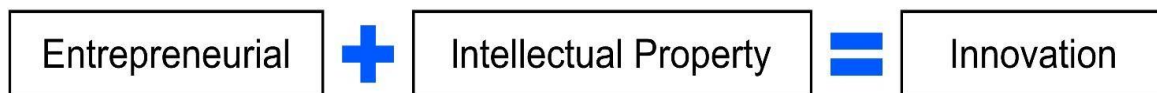
Previous literature shows that the definition of innovation and entrepreneurship ecosystems is relatively wide; they can be regarded as holistic or split into two separate concepts: innovation ecosystems and entrepreneurship ecosystems.

First, scholars treated the innovation ecosystem as a single research goal, defining it as “a network of interconnected organizations revolving around a focal firm or a platform that includes both producer and user participants; the innovation ecosystem focuses on developing new value through innovation.” Expanding on this notion, a substantial portion of the academic literature places significant emphasis on the application of the “ecosystem” metaphor. This metaphor underscores the interconnectedness and mutual complementarity of the physical, human, and intellectual resources within a specific market or niche. The key players in the development of this system include large corporations, academic institutions, and government, all of which contribute to the overall structure and function of the ecosystem. The central premise of this perspective is that innovation is not an isolated phenomenon but rather a cumulative output of this complex, interdependent ecosystem (Panetti et al. 2020).

Innovation ecosystems are characterized by a dynamic interplay of relationships among various actors, encompassing both collaborative and competitive interactions. Furthermore, these ecosystems feature a diverse array of relationships between technological elements, including but not limited to patents, components, applications, and systems. These relationships can be complementary, where one element enhances the function or value of another, or alternatively, where one element can substitute for another. This intricate network of relationships contributes to innovation ecosystems’ robustness and adaptability (Holgersson, Granstrand, and Bogers 2018).

Nonetheless, it is imperative to consider entrepreneurial ecosystems as integral components of the broader innovation ecosystems given that entrepreneurial activity plays a pivotal role in this context. In 2021, Reis, Moura, and Aragão introduced a novel concept that delineates the intersection of IPRs and innovative entrepreneurial ecosystems. This groundbreaking perspective offers a fresh lens through which to understand and navigate the complexities of innovative ecosystems (Figure 2):

**Figure 2.** Reis, Moura, and Aragão’s innovative entrepreneurial ecosystem model



An important feature of the innovation-entrepreneurship ecosystem is the strong interconnection of its constituent units, which largely support start-ups. The existing literature explores the supporting and promoting role of entrepreneurial activities by external organizational structures, such as investment institutions, incubators, competitors, suppliers, and so on (Arthurs and Busenitz 2003), which form the micro-components of innovation and entrepreneurship ecosystems.

IPRs management systems and environments are also part of the ecosystem. A good innovation and entrepreneurship system should be equipped with two key elements: strong basic research and development (R&D) capabilities in universities and scientific institutions and the ability to commercialize research results. MIT pioneered a university-led model of innovation and entrepreneurship that combines universities, governments, and industry. This “university-industry-government” model is known as the “triple helix model” (Wan 2019). Ideally, the innovation and entrepreneurship ecosystem should foster sufficient interaction between industry, the public and private sectors, investors, the government, and academia to create a symbiotic ecosystem.

## **b. Review of technology transfer offices and university spin-offs in intellectual property rights**

### **3.2.1 Intellectual property rights and technology transfer offices**

In the innovation and entrepreneurship ecosystem, one institutional unit occupies an important position in the triangle model: universities’ R&D institutions. In the field of innovation and entrepreneurship, a growing number of scholars have investigated the intersection between IPRs management and technology transfer offices (TTOs) in the university context to gain a more comprehensive understanding of how TTOs can manage IPRs more efficiently (Holgersson and Aaboen 2019). IP management is an important issue, as it can both facilitate and limit the exploitation of research results and affect technology- based competitiveness, while also determining how technology outcomes are commercialized.

Research on Korean SMEs collaborating with universities and using IP management revealed that even highly innovative SMEs face challenges in actively seeking best practices in IP tools and collaborative innovation management. The literature mentions that SMEs are not proactive or even willing to engage in IP protection and management, so the conclusion is that there is a comparatively low rate of use of intermediaries (e.g., TTOs) between IP tools and collaborative management in industry-university collaboration (Deschamps, Macedo, and Eve-Levesque 2013). However, this study’s analysis of a single country cannot be generalized for all other countries, thus providing future research implications to fill the research gap.

The role of TTOs in universities is to support the protection of technological inventions, the launch of innovative products by companies, and technology transfer from universities. This study found that most TTOs could never be profitable because of insufficient financial support and understaffing, thus depleting limited university resources and potentially hindering innovation and knowledge transfer while creating barriers to knowledge sharing between actors (Wang 2015). In addition, individuals and SMEs have limited resources to acquire, regulate, and enforce IPRs, suggesting that patents are less useful to small businesses compared to large ones, as researchers with public funding are more likely to obtain patents than those with private funding. Therefore, both university R&D institutions and companies must ensure that IPRs are legally sound, well-defined, and protected, before attempting to pursue commercial interests.

From the medical case study literature, the role of TTOs is quite important, as the process of developing medical devices and biopharmaceuticals is difficult and can easily be imitated by other developers owing to a lack of IP management. The role of the TTO in the commercialization of medical inventions has been frequently discussed in many studies.

According to the current research, TTOs play the roles of IP protectors (to prevent competitors from stealing technology and infringing copyrights), IP promoters (to seek interested companies to cooperate with), funding advisors, patent legal advisors, patent licensing agents (for licensing), and patent applicants (Brantnell and Baraldi 2022).

### 3.2.2 Intellectual property rights and university spin-offs

A university spin-off (USO), also known as a university spin-off company, treats the university as a parent body and extends from it to become a separate subsidiary. It also commercializes the technological inventions of the university's research results, which are likely to be unavailable in the marketplace if not commercialized, resulting in a waste of research resources (Kulkov et al. 2020). They are a sub-category of research spin-offs through which most universities around the world can declare their IPRs regarding technological inventions developed in their laboratories. Most research universities now have technology licensing offices to promote and pursue these value-creating opportunities.

This is an important role that IP management plays in the innovation and entrepreneurship ecosystem. The existing literature illustrates how USOs have become a widespread method for commercializing scientific discoveries as they create more value for society, which could be returned to the university. Additionally, IP policymakers view the USO as playing an important role in stimulating the structural development of a particular region's economy and growth of the university's prestige with students and scholars (Rossi, Baines, and Smith 2021). The founders of USOs are usually professors and teachers at universities. However, researchers argue that venture capitalists are more inclined to fund promising technologies that include higher risk in the short term, and that these teachers and individuals who focus on academic work are inexperienced in management (Baum and Silverman 2004). The literature on venture capital investment propensity suggests that venture capitalists tend to replace managers with more experienced staff, which positively affects USOs' prospects. First, universities generate significant income from this activity, although the associated costs for universities and regional entrepreneurship support centers is higher than the income; second, it creates more benefits for the business innovation ecosystem and society. Collaborative research between universities and industry, participation in conferences, and the joint supervision of doctoral students all contribute to patenting and USO formation (Cohen, Nelson, and Walsh 2002). Scholars have highlighted the necessity of enacting government schemes for patenting research and creating strong links between universities and industries.

## 3.2 Strategizing the management of IPRs

### 3.2.1 National policy and environmental factors

It is critical that companies in the innovation and entrepreneurship ecosystem adopt the correct IP strategy, as this could influence the growth of companies, especially for start-ups and SMEs. The failure to use correct strategies may lead to the poor management of enterprises and even bankruptcy. Within the innovation and entrepreneurship ecosystem, many countries, regions, states, and universities have adopted policies to stimulate innovation in startups and foster ecological growth. Examples of such policies include local, regional, and national initiatives to promote university-based start-ups (Grimaldi et al. 2011). Initiatives include technology-based economic development (e.g., incubation centers) and formal government schemes. It is worth noting that strategy development is not only influenced by IP regime policies; the environmental contexts of innovation and entrepreneurship are also crucial. Autio et al. (2014) proposed an organizational framework for innovation and entrepreneurship by dividing the environmental context of innovation and entrepreneurship into six main categories: industrial and technological, organizational, institutional and policy, social, temporal, and spatial geographical environments. Based on this framework, researchers consider that the interactions between these environment-based elements and entrepreneurs constitute different innovation and entrepreneurship ecosystems, giving rise to different types of innovation and entrepreneurship.

The form of national government also has a great impact on the extent to which the IPRs system affects new ventures' adoption of new technologies. Governments regulate the impact of IPRs on the use of new technologies by entrepreneurship in the innovation ecosystem. With stronger regulation of enterprises' IPRs when the polity is democratic, start-ups are more likely to enter the market with new technologies. When the polity tends to be autocratic, start-ups are less likely to use new technologies (Laplume, Pathak, and Xavier- Oliveira 2014).

### 3.2.2 IPRs Modularity and Strategy Development

IPRs modularity aims to protect and capture the value of IPRs. It is divided into four types of module treatments, the first three of which are split IP modules, and the fourth is incorporative modularity. The first one is where a company creates value extensively by publishing its own IPRs and "opening them up" to the outside world through the surrounding ecosystem. In this context, enterprises must ensure that some of their IPRs are protected to maintain their value. The second is where companies share their IPRs with chosen suppliers, employees, and alliance partners to create value in a narrow sense. In this case, the company must manage the risk of both the disclosure of key IPRs and launch risk management to limit external IP owners. The third is when a company is uncertain about its own development strategy or when the intentions of a third party are unclear, and it seeks to create a solution that allows it to modify the IPRs status of a component to deal with a future situation (Henkel, Baldwin, and Shih 2013). The final type is the incorporative IP module, which combines weakly and strongly protected IPRs within an enterprise in one module to provide strong control over weakly protected IPRs. Previous research has found that the protection of weaker IPRs can come from both internal and external sources; however, the protection of stronger IPRs must originate from the core internal sections of an enterprise.

The astute management of IPRs is of paramount importance for firms striving to sustain a competitive edge and actualize the concept of open innovation. Open innovation, a paradigm that underscores the bidirectional flow of knowledge and technology between an organization and its external environment, necessitates a strategic approach to IPRs to ensure the effective exchange and protection of proprietary information (Grimaldi, Greco, and Cricelli 2021). A novel IP strategy structure has been established, comprising defensive strategies designed to mitigate knowledge spillover and construct competitive barriers.

Additionally, this structure includes collaborative strategies that emphasize forging alliances with other organizations and penetrating new markets. This strategic framework underscores the multifaceted role of IP management in fostering competitive advantage and facilitating organizational growth. Improvisation strategies refer to how enterprises protect their IP rights, in the absence of explicit intentions. This study found that the adoption of cooperative strategies by companies facilitates their foreign investment activities and that effective IPRs protection mechanisms could protect their business activities.

### 3.2.3 Discussion on the distributability regime for IPRs

IPRs are increasingly becoming a source of corporate wealth and risk, and leaders involved in the management of innovation and entrepreneurship are required to fully understand their complexities (Candelin-Palmqvist, Sandberg, and Mylly 2012). The distributability regime in IP management is divided into strong, weak, and free distributability, with strong distributability regimes reflecting a phenomenon in which imitation is difficult because of strong legal protection and difficulty in technological imitation. Firms can also leverage the opportunities arising from weakly allocatable regimes, as weak adaptability determines the source of returns to other value-capture mechanisms, such as the development of complementary assets. Even if the innovation itself is not profitable, rewards could be possible (Pisano and Teece 2007). As a frequently mentioned case in a number of studies, open-source code is available to a wider range of developers, being modified from the original code but not encroaching on the underlying code source.

In a strategic approach based on firm scales, when a company is in a very strong distributability regime, it could specialize its familiar and skilled businesses only requiring a small range of "core competencies," and could also limit the returns to its innovation through the market. It is not necessary for enterprises to own complementary assets. However, in a weak distributability regime, complementary assets are necessities for a company (Pisano 2006). Under such circumstances, "core competencies" become less meaningful. Capturing the value of innovation requires firms to master complementary capabilities (e.g., manufacturing and distribution). Many large multinational firms prefer to invest in countries where IPRs are weak, with no concerns about the imitation of their core technology by others because it is only valuable when combined with complementary knowledge and resources within the firm. Even if imitation occurs, the value that other companies can take away is limited. As Zhao (2006) mentions, a tightly integrated internal innovation structure can act as an immune system against adverse external environments.

### 3.3 Implementing IPRs and fulfilling SDGs, CSR, USR responsibilities

#### 3.3.1 Promoting SDGs

SDGs, with 17 goals in total, are conducive to sustainable human survival. Published by the United Nations in 2015, they put forward a series of measures to enable humanity to protect the planet and reduce energy pollution. IPRs do not seem to be closely linked to SDGs, corporate responsibility, or USR at a superficial level; however, the reality is the opposite.

The UN SDGs explicitly call for the reintegration of IP regulations into global knowledge governance to manage the knowledge needed to achieve these goals. This includes knowledge governance activities such as capacity building, technological learning, and technology sharing for cross-border development.

As one of the three pillars of IP law, trademark law is relevant to the sustainable advancement of the UN SDGs. In Barrera's (2020) study on IPRs, the Monitoring and Evaluation system, and sustainable development, geographical indications were found to be more useful for achieving SDGs. A geographical indication is a sign used for goods with a specific geographical origin, which is mainly attributed to the quality and reputation of the place of origin. That geographical indications are not exactly equivalent to trademark law, but are protected by special IP laws, is noteworthy here. Many geographical indications have acquired a valuable reputation that, if not properly protected, could be falsified by those engaged in unfair commercial practices. The use of false geographical indications by unauthorized persons is detrimental to consumers and businesses. Geographical indication protection contributes to SDGs by ensuring the safety of food production, promoting local and indigenous products, providing benefits from innovation, and fighting poverty in society.

Studies have also been conducted on the protection of copyright laws and appropriate open licensing. The World Intellectual Property Organization (WIPO) sponsors the Accessible Books Coalition (ABC), which promotes inclusive publishing, because most book copyrights are protected by strong IP laws and the cost of licensing downloads of books or articles is too high for the poor and some people with disabilities. WIPO aims to provide greater access to published materials for the visually impaired community (Chon 2018). ABC is related to SDG 4 on quality education, where the international community aims to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Finally, we discuss the extent to which IPRs facilitate or hinder the development and global diffusion of technologies that may reduce greenhouse gas emissions or otherwise mitigate climate change (referred to as climate change technologies). As highlighted in the previous section on geographical indications and agriculture, poorly designed IPRs may exacerbate the impacts of climate change (GSTC 2013).

#### 3.3.2 Fulfilment of CSR and USR responsibilities by companies and universities

In the 21st century, sustainable and responsible entrepreneurship in the innovation and entrepreneurship ecosystem is becoming increasingly important, as it reflects companies' level of commitment to ethical, sustainable, responsible, and transparent practices (Popescu 2021). An enterprise must also fulfill its social responsibilities when carrying out innovative and entrepreneurial activities. These responsibilities are also interconnected with IPRs. At the same time, CSR constitutes a key element for all businesses worldwide, bringing competitive advantage, encouraging competitiveness, ensuring corporate interests, enabling excellence, and promising a safe and sustainable environment. To illustrate, consider the case of blockchain technology; increasingly, companies are now applying for patent protection for blockchain innovations while also assuming responsibility for the products they develop. This enables consumers to trust the companies and feel confident when using decentralized account transfer platforms for transactions. This study found that there is a likelihood of blockchain technology to develop into a permanent "innovation disruptor" in the future, with its potential to change CSR practices (Ly 2019).

USR is a term derived from CSR. In addition to pursuing profits, companies should consider the social, environmental, and ecological impacts of innovative research and development. In the context of USR, university education is obligated to teach students to be innovative and entrepreneurial while ensuring the promotion of a sustainable and circular economy. This fosters a sustainable mindset of caring for the social and natural environment in which they live, while encouraging students to engage in public service (Altbach, Reisberg, and Rumbley 2019). Through innovation and deepening knowledge about IP management, students can contribute to their own social responsibility and that of the universities.

## IV. CONCLUSION AND DISCUSSION

Within the context of innovation and entrepreneurship ecosystems, the role of IPRs management is incalculably significant. This is manifested in the facilitation of knowledge dissemination, sharing, and protection. The strategic management of these rights serves as a linchpin in the promotion of knowledge exchange, while simultaneously safeguarding proprietary information, thereby striking a delicate balance between openness and protection in the innovation landscape. For an enterprise, innovation and entrepreneurship, attracting foreign investment, developing valuable corporate value chains, and providing serious and responsible products and services will ensure the competitive ability of the company on a global scale, and this is intrinsically linked to

IPRs and a supportive innovation ecosystem. Elements such as innovativeness and competitiveness, the right IPRs, an effective legal framework, a strong operational infrastructure, and efficient financial support from the public and private sectors are crucial when driving the development of an innovation and entrepreneurship ecosystem. Innovative activities can be significant drivers of economic development. Patents are important for the sustainability of innovation, fundamental to building successful businesses, and attract greater investment and business opportunities.

The knowledge and technologies created by universities and research institutions have the potential to generate significant economic benefits for society, and this demonstrates the importance of industry-university collaboration. Significant research results and technological innovations must be managed through the IPRs of universities' specialist laboratories before they reach consumers.

IPRs are important for stimulating innovation and creativity, which are crucial for the realization of SDGs. Only through human ingenuity can new solutions be developed to achieve this goal, and new solutions can be applied to different fields to eradicate poverty, increase agricultural sustainability, guarantee food security, fight disease, improve education, protect the environment, accelerate the transition to a low-carbon economy, increase productivity, and enhance the competitiveness of enterprises.

CSR and USR's adoption and implementation have emerged as prevailing trends in the contemporary global landscape. Corporations and academic institutions can effectively actualize CSR and USR through various strategies. Among these, the most effective approach is the promotion of environmental sustainability and development planning, achieved by mitigating adverse environmental impacts. This aligns with the social responsibility mandates of many corporations and universities.

In the face of pressing challenges such as disease and climate change, R&D models have evolved and associated resources have proliferated in recent years. However, there remains a pressing need for researchers to address the gaps in the literature within these domains. Concurrently, there is a call for government bodies to facilitate the integration of knowledge, technology, and infrastructure across private, nonprofit, and university-based R&D institutions.

IP regimes can serve as catalysts for innovation by fostering collaboration between private and public sectors. This can contribute to the advancement of global SDGs and promotion of a circular economy, thereby enhancing societal well-being and environmental sustainability.

We have compiled Table 1, which encapsulates diverse themes from the literature, to underscore the central theme of this study. This table aims to furnish robust evidence of the intimate link between SDGs and intellectual property within the context of innovative and entrepreneurial ecosystems. This not only highlights the research potential at the intersection of SDGs and intellectual property, but also underscores the substantial contributions of this study.

**Table 1.** Summary of past literature

Topic of literature analysis	Related literature discussion and research article
Intellectual property protection	Arthurs and Busenitz (2003); Granstrand (2006); Henkel, Baldwin, and Shih (2013); Holgersson, Granstrand, and Bogers 2018; Pisano (2006); Pisano and Teece (2007)
Innovation ecosystem	Autio et al. (2014); Baum and Silverman (2004); Brantnell and Baraldi (2022); Holgersson and Aaboen (2019); Laplume, Pathak, and Xavier-Oliveira (2014)
Sustainable development and Intellectual Property	Barrera (2020); Chon (2018); Popescu (2021); Sideri (2021)
Entrepreneurship and innovation	Audretsch, Belitski, and Guerrero (2022); Grimaldi, Greco, and Cricelli (2021); Grimaldi et al. (2011); Kulkov et al. (2020); Reis, Moura, and Aragão (2021)
Institutions of higher education and research	Altbach, Reisberg, and Rumbley (2019); Candelin-Palmqvist, Sandberg, and Mylly (2012); Deschamps, Macedo, and Eve-Levesque (2013); Rossi, Baines, and



	Smith (2021); Wan (2019); Wang (2015)
Global Standards for sustainable tourism	Ross, Moura, and Aragão (2021)
Regional entrepreneurial ecosystem	Ross, Moura, and Aragão (2021)
Regional entrepreneurship support policy	Cohen, Nelson, and Walsh (2002); Lin (2011); Wu and Xu (2009)
Regional entrepreneurial environment	Wang (2015); Zhao (2006)

## V. LIMITATIONS AND FUTURE DIRECTION

Despite the comprehensive and in-depth nature of this study, it is not without its limitations. The primary constraint lies in the absence of a detailed case study that tightly integrates IP management with SDGs. Such case studies are instrumental in providing compelling evidence, thereby encouraging increased attention from the academic and business communities to this research area and facilitating the practical application of research findings. Another limitation of this study is its potentially broad methodological approach, as opposed to a focus on a specific area of research. For instance, a more concentrated interdisciplinary study on one of the 17 SDGs, integrating intellectual property management with the innovative entrepreneurial ecosystem, could yield more profound research outcomes. For future research, we recommend a deeper exploration of the field of IP management and innovative entrepreneurial ecosystems, particularly in relation to SDGs and Environmental, Social, and Governance standards. Additionally, scholars could consider incorporating quantitative research output data analysis results to make more significant academic contributions to this field.

In summary, this study serves as a foundation for future research in this field. By identifying gaps and limitations in the current literature, it provides a constructive roadmap for future scholars. We anticipate that this research will stimulate further exploration of the complex interplay between IP management, innovative entrepreneurial ecosystems, and sustainable development.

## REFERENCES

- [1]. Altbach, P. G., Reisberg, L., and Rumbley, L. E. 2019. "Trends in Global Higher Education: Tracking an Academic Revolution." Brill.
- [2]. Arthurs, J. D., and Busenitz, L. W. 2003. "The Boundaries and Limitations of Agency Theory and Stewardship Theory in the Venture Capitalist/Entrepreneur Relationship." *Entrepreneurship Theory and Practice*, 28(2), 145–162. <https://doi.org/10.1046/j.1540-6520.2003.00036.x>
- [3]. Audretsch, D. B., Belitski, M., and Guerrero, M. 2022. "The Dynamic Contribution of Innovation Ecosystems to Schumpeterian Firms: A Multi-Level Analysis." *Journal of Business Research*, 144, 975–986. <https://doi.org/10.1016/j.jbusres.2022.02.037>
- [4]. Autio, E., Kenney, M., Mustar, P., Siegel, D., and Wright, M. 2014. "Entrepreneurial Innovation: The Importance of Context." *Research Policy*, 43(7), 1097–1108. <https://doi.org/10.1016/j.respol.2014.01.015>
- [5]. Baker, D., Jayadev, A., and Stiglitz, J. E. 2017. "Innovation, Intellectual Property, and Development: A Better Set of Approaches for the 21st Century." 1–89. <https://doi.org/10.7916/d8-xg80-ct59>
- [6]. Barrera, A. G. 2020. "Geographical Indications for UN Sustainable Development Goals: Intellectual Property, Sustainable Development and M&E Systems." *International Journal of Intellectual Property Management*. <https://www.inderscienceonline.com/doi/10.1504/IJIPM.2020.108099>
- [7]. Baum, J. A. C., and Silverman, B. S. 2004. "Picking Winners or Building Them? Alliance, Intellectual, and Human Capital as Selection Criteria in Venture Financing and Performance of Biotechnology Startups." *Journal of Business Venturing*, 19(3), 411–436. [https://doi.org/10.1016/S0883-9026\(03\)00038-7](https://doi.org/10.1016/S0883-9026(03)00038-7)
- [8]. Brantnell, A., and Baraldi, E. 2022. "Understanding the Roles and Involvement of Technology Transfer Offices in the Commercialization of University Research." *Technovation*, 115, 102525. <https://doi.org/10.1016/j.technovation.2022.102525>

- [9]. Candelin-Palmqvist, H., Sandberg, B., and Mylly, U.-M. 2012. "Intellectual Property Rights in Innovation Management Research: A Review." *Technovation*, 32(9), 502–512. <https://doi.org/10.1016/j.technovation.2012.01.005>
- [10]. Chon, M. 2018. "Recasting Intellectual Property in Light of the U.N. Sustainable Development Goals: Toward Global Knowledge Governance." *American University International Law Review*, 34, 763.
- [11]. Cohen, W. M., Nelson, R. R., and Walsh, J. P. 2002. "Links and Impacts: The Influence of Public Research on Industrial R&D." *Management Science*, 48(1), 1–23. <https://doi.org/10.1287/mnsc.48.1.1.14273>
- [12]. Deschamps, I., G. Macedo, M., and Eve-Levesque, C. 2013. "University-SME Collaboration and Open Innovation: Intellectual-Property Management Tools and the Roles of Intermediaries." *Technology Innovation Management Review*, 2013(3), Article 3. <https://doi.org/10.22215/timreview/668>
- [13]. Granstrand, O. 2006. "Innovation and Intellectual Property Rights." *The Oxford Handbook of Innovation*. <https://doi.org/10.1093/oxfordhb/9780199286805.003.0010>
- [14]. Grimaldi, M., Greco, M., and Cricelli, L. 2021. "A Framework of Intellectual Property Protection Strategies and Open Innovation." *Journal of Business Research*, 123, 156–164. <https://doi.org/10.1016/j.jbusres.2020.09.043>
- [15]. Grimaldi, R., Kenney, M., Siegel, D. S., and Wright, M. 2011. "30 Years After Bayh–Dole: Reassessing Academic Entrepreneurship." *Research Policy*, 40(8), 1045–1057. <https://doi.org/10.1016/j.respol.2011.04.005>
- [16]. GSTC 2013. *Global Sustainable Tourism Criteria for Destinations (GSTC-D)*.
- [17]. Henkel, J., Baldwin, C. Y., and Shih, W. 2013. "IP Modularity: Profiting from Innovation by Aligning Product Architecture with Intellectual Property." *California Management Review*, 55(4), 65–82. <https://doi.org/10.1525/cmr.2013.55.4.65>
- [18]. Holgersson, M., and Aaboen, L. 2019. "A Literature Review of Intellectual Property Management in Technology Transfer Offices: From Appropriation to Utilization." *Technology in Society*, 59, 101132. <https://doi.org/10.1016/j.techsoc.2019.04.008>
- [19]. Holgersson, M., Granstrand, O., and Bogers, M. 2018. "The Evolution of Intellectual Property Strategy in Innovation Ecosystems: Uncovering Complementary and Substitute Appropriability Regimes." *Long Range Planning*, 51(2), 303–319. <https://doi.org/10.1016/j.lrp.2017.08.007>
- [20]. Kulkov, I., Berggren, B., Eriksson, K., Hellström, M., and Wikstrom, K. 2020. "The Importance of Financial Resources and Ownership of Intellectual Property Rights for University Spin-Offs: The Cases of Finland and Sweden." *Journal of Small Business and Enterprise Development*, 27(7), 1125–1147. <https://doi.org/10.1108/JSBED-09-2019-0308>
- [21]. Laplume, A. O., Pathak, S., and Xavier-Oliveira, E. 2014. "The Politics of Intellectual Property Rights Regimes: An Empirical Study of New Technology Use in Entrepreneurship." *Technovation*, 34(12), 807–816. <https://doi.org/10.1016/j.technovation.2014.07.006>
- [22]. Lin S. 2011. "Entrepreneurial Ecosystems: Conceptual Development and Operational Mechanisms." *Journal of Central University of Finance and Economics*, 4, 58-62.
- [23]. Ly, P. 2019. "Blockchain Technology: Its Ability to Transform Corporations' Corporate Social Responsibility Practices." *International Trade and Business Law Review*, 22, 1.
- [24]. Panetti, E., Parmentola, A., Ferretti, M., and Reynolds, E. B. 2020. "Exploring the Relational Dimension in a Smart Innovation Ecosystem: A Comprehensive Framework to Define the Network Structure and the Network Portfolio." *The Journal of Technology Transfer*, 45(6), 1775–1796. <https://doi.org/10.1007/s10961-019-09735-y>
- [25]. Pisano, G. 2006. "Profiting from Innovation and the Intellectual Property Revolution." *Research Policy*, 35(8), 1122–1130. <https://doi.org/10.1016/j.respol.2006.09.008>
- [26]. Pisano, G. P., and Teece, D. J. 2007. "How to Capture Value from Innovation: Shaping Intellectual Property and Industry Architecture." *California Management Review*, 50(1), 278–296. <https://doi.org/10.2307/41166428>
- [27]. Popescu, C. R. G. 2021. "Sustainable and Responsible Entrepreneurship for Value-Based Cultures, Economies, and Societies: Increasing Performance Through Intellectual Capital in Challenging Times [Chapter]." *Sustainable and Responsible Entrepreneurship and Key Drivers of Performance*; IGI Global. <https://doi.org/10.4018/978-1-7998-7951-0.ch002>
- [28]. Reis, D., Moura, F., and Aragão, I. 2021. "Entrepreneurship, Intellectual Property and Innovation Ecosystems." *International Journal for Innovation Education and Research*, 9(2), 108–134.
- [29]. Rossi, F., Baines, N., and Smith, H. L. 2021. "Which Regional Conditions Facilitate University Spinouts Retention and Attraction?" *Regional Studies*, 1–17. <https://doi.org/10.1080/00343404.2021.1959909>
- [30]. Schumpeter, J. A. 2017. *The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle*. Routledge.

- [32]. Sideri, L. 2021. "Leveraging CSR for Sustainability: Assessing Performance Implications of Sustainability Reporting in a National Business System." *Sustainability*, 13(11), Article 11. <https://doi.org/10.3390/su13115987>
- [33]. Teece, D. J. 1986. "Profiting from Technological Innovation: Implications for Integration, Collaboration, Licensing and Public Policy." *Research policy*, 15(6), 285–305.
- [34]. Wan, Y. 2019. "An Analysis of the Innovation and Entrepreneurship Model Based on 'Entrepreneurship' in Foreign Universities." *Educational Inquiry*, 1.
- [35]. Wang, Y. E., 2015. "A Study on the Policy of Decentralization of Intellectual Property Rights of R&D Results: Policy Compliance of University Stakeholders." *Technology Innovation Management Review* 3 (2013): 33-41.
- [36]. Wu, H., and Xu, G. 2009. "Profiting from Innovation: The PFI Analysis Framework and Its Development." *Science Management Research*, 27(05), 19-23+38. <https://doi.org/10.19445/j.cnki.15-1103/g3.2009.05.004>
- [37]. Zhao, M. 2006. "Conducting R&D in Countries with Weak Intellectual Property Rights Protection." *Management Science*, 52(8), 1185-1199. <https://doi.org/10.1287/mnsc.1>