

Protection of Intellectual Achievements in the Oil Industry

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Highlights

- Intellectual property rights are crucial to the survival and growth of the oil and gas industry.
- Technological advancement in the oil industry has consistently been the primary driver of the industry's success.
- Patent systems and trade secrets represent the principal mechanisms for protecting intellectual achievements in the oil industry.

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Abstract

The need to accelerate the creation of innovation in the oil industry and to support it effectively, in response to the growing demands of the modern world, has led industry stakeholders to adopt various forms of intellectual property protection. Patent systems and trade secrets are the primary mechanisms for safeguarding intellectual achievements in the oil industry. During periods of economic downturn, such as the COVID-19 pandemic, which adversely affected production levels and revenue generation in oil companies, intangible assets, including trade secrets and registered inventions, can serve as significant sources of income. The technological complexity and long development cycles characteristic of upstream oil and gas operations have, however, led to a reluctance among companies to register patents, a tendency that can hinder knowledge dissemination and slow the creation and development of innovation. Nevertheless, given the critical importance of energy production, resource constraints, and the reliance on complex and integrated technologies in this sector, patenting ultimately becomes unavoidable.

Keywords: Trade secrets, Patents, Upstream, Oil company and innovation

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1. Introduction

The advancement of technology in the oil industry has consistently been the primary factor driving the success of this sector. Technological innovation, including technologies for the exploitation of both conventional and unconventional resources, is therefore vital and highly valuable. Accordingly, efforts should focus not only on the development or acquisition of innovative technologies but also on their rigorous protection. Recognizing the central role of intellectual achievements and technological innovation in the oil industry helps explain why major industry players, even when they do not develop such achievements internally, are willing to pay substantial fees to companies that lead technological

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innovation. The protection of intellectual property, particularly portfolios of registered patents, can contribute significantly to the business success of oil companies even during industry downturns. For instance, after the COVID-19 pandemic subsided and economic activity gradually returned to normal, global oil demand and, consequently, oil prices increased. Companies operating in the oil sector that had recognized the importance of safeguarding their intellectual achievements and effectively managing their intellectual asset portfolios were able to obtain strategic advantages from the subsequent rise in oil prices.

On the other hand, as the depletion of conventional oil and gas resources approaches, meeting the continuously growing global demand for energy increasingly depends on the development and exploitation of unconventional resources, which require the application of advanced and complex technologies. Moreover, the contemporary emphasis on safety, health, and environmental considerations, through the imposition of increasingly stringent standards, necessitates the adoption of technologies that comply with these requirements. Consequently, technological change and the use of up-to-date and efficient technologies are unavoidable, and their protection poses significant challenges for industry stakeholders.

Despite the critical importance of intellectual property rights in the oil industry as a means of supporting intellectual achievements that drive growth, competitiveness, and substantial revenues, comprehensive research in this area remains limited. Accordingly, this article explains the necessity of protecting intellectual achievements in the oil industry and examines the challenges associated with technological change and its impact on the effective utilization of intellectual property rights. By considering intellectual achievements as valuable assets and sources of income for oil companies, the article analyzes the principal mechanisms for protecting technological innovation, along with their benefits and challenges, within the oil industry. Given the strategic importance of the upstream sector, particular attention is devoted to methods for protecting intellectual achievements in this field. The article further explores the reasons behind companies' reluctance to register patents and emphasizes the growing importance of patent protection in light of increasing energy demand, resource constraints, and the accelerating pace of innovation. Finally, the challenges associated with joint investment in the oil industry are discussed, and potential approaches to addressing intellectual property-related issues in such collaborations are proposed.

2. The necessity and methods of protecting intellectual achievements in the oil industry

To protect intellectual achievements, intellectual property rights are generally classified into two categories: soft intellectual property rights, which include confidential information, trade secrets, and know-how, and hard intellectual property rights, which include patents, trademarks, and copyrights (Bolisani, E., Paiola, M., and Scarso, E., 2013, pp. 192–211). Soft intellectual property rights refer to protection mechanisms in which intellectual achievements do not benefit from formal legal protection, yet can still be effectively safeguarded. This approach is typically adopted when there is confidence that valuable information and innovation-related secrets, which provide a competitive advantage to their owner, will remain undisclosed and inaccessible to competitors through reverse engineering or independent development. Hard intellectual property rights, by contrast, refer to forms of protection that are supported by legally enforceable guarantees. Copyright, as one type of hard intellectual property right, does not require technological innovation in the same manner as patents; however, conditions such as originality and expression of the work, which are mandatory, and registration of the work, which is optional, must be satisfied to benefit from the protection offered under this system. Through patent registration, an inventor is granted exclusive rights for a specified period, enabling the inventor to derive

economic benefits from the invention. After the expiration of the protection period, however, the invention enters the public domain and may be freely used by others without restriction.

Patent systems and trade secrets constitute the principal mechanisms for protecting intellectual achievements in the oil industry. Within the patent system, protection is contingent upon formal registration, and inventors are required to disclose the technical details of their inventions to the public, in contrast to the trade secret regime. When oil companies rely on trade secrets as a protection mechanism, information related to intellectual achievements remains confidential unless it is independently disclosed or obtained through reverse engineering. To sustain a competitive advantage, oil companies must pursue innovation actively and integrate the protection of intellectual achievements into their overall business strategies. Highly competitive and profitable markets, such as oil and gas, demand strong marketing capabilities and continuous branding efforts. Moreover, fundamental transformations in the oil industry, including the exploration and production of unconventional resources that depend on complex technologies, have intensified the importance of intellectual property strategy. Effective management and targeted development of intellectual property portfolios are therefore essential, as the emergence of new technologies presents both challenges and opportunities for the industry. Countries possessing substantial oil reserves provide a favorable environment for oil companies to achieve economic growth through innovation and the formulation of robust intellectual property strategies that enhance competitive advantage (Lee, J., Tiedrich, G. S., Discher, F., and Rios, D., 2020, p. 2). Adopting a multifaceted scientific approach, combined with a thorough understanding of the technological competitive landscape, enables oil companies to create, protect, and exploit intellectual achievements to their fullest potential. Such an approach further facilitates the formulation and implementation of a comprehensive intellectual property strategy and ensures the effective enforcement of the rights arising from these achievements.

3. Technological change and the utilization of intellectual property rights

The growing demand for energy resources, coupled with the inability of conventional resources to meet this demand, has driven oil and gas companies toward the development of innovative technologies and the need to protect these technologies in order to create competitive advantage and ensure survival in the industry. Accordingly, companies operating in this sector must pay particular attention to intellectual property rights, as these rights play a central role in shaping business strategies aimed at sustaining competitive advantage. Moreover, given the inherently volatile nature of the oil industry, intellectual property rights are essential for adapting to technological change, especially as the increasing adoption of technology to comply with safety, health, and environmental standards is unavoidable. In this context, the focus of industry participants on innovation and advanced technologies is not a discretionary choice but a fundamental requirement for survival in a highly competitive environment.

Domestic companies engaged in the supply of oil-related goods and services are exposed to greater uncertainty and volatility than many other market participants, as transactions in this segment are highly profitable and consequently characterized by intense competition (Teece, D., 2006, pp. 1131–1146). Intellectual property assets, including inventions, trade secrets, and trademarks, can serve as significant barriers to the success of competing firms operating in similar fields. In such a competitive and profit-driven environment, it is essential for oil industry players to leverage intellectual property rights as strategic market instruments. Oil companies face fluctuating market conditions and rapid technological change, both of which pose challenges to growth and long-term development. Under these circumstances, increased emphasis on research and development activities, together with the

implementation of strategic processes for identifying, protecting, and commercializing intellectual achievements, can help firms overcome market stagnation and achieve sustainable growth.

4. The importance of intellectual achievements under conditions of stagnation in the oil industry

The coronavirus pandemic caused industrial stagnation, travel restrictions, and, consequently, a sharp decline in global energy demand. This situation, coupled with the failure of OPEC Plus member countries and Russia to reach an agreement to reduce oil production in 2020, led to oversupply and a further steep drop in oil prices. Confronted with declining oil prices and uncertainty regarding future demand, companies in the oil industry responded by reducing both operational and capital expenditures. These reductions affected all sectors of the industry, including drilling operations, service companies, and equipment manufacturers. As these companies faced an uncertain—almost bearish—oil market during and after the pandemic, they recognized that future sustainable success depended on leveraging their intellectual assets, which had often been neglected in past innovation and support efforts. During the period of declining oil prices, patent applications by oil companies increased, even as producers implemented various cost-reduction measures. The significance of patenting was so pronounced that, even when facing the brink of bankruptcy, oil companies invested substantial resources in securing patents. Therefore, the intellectual assets of oil companies, including patents and trade secrets, should not be overlooked in challenging circumstances; rather, they should be actively developed to promote growth, generate revenue, and enhance long-term resilience (Stephen Ezell and Nigel Cory, 2019, pp. 43–45).

5. The patent protection system in the oil industry

Survival in the highly competitive oil industry requires that companies continuously strive to explore resources more efficiently and economically. Such exploration not only reduces costs but also saves time, which is highly valuable in this sector. Technological advances over the past twenty years have enabled production and drilling programs to be executed successfully and economically on the first attempt. Prior to these developments, drilling operations and production programs often experienced repeated failures, resulting in substantial costs for companies. Similarly, these technological improvements have rendered previously unexploitable oil resources accessible. Continued progress in drilling and production technologies is essential for the oil industry and necessitates significant investment of time and capital in the research and development units of oil companies (Shiravi, Abdul Hossein, Moradi Mazrae Noo, Abdul Hossein, 2018, pp. 16–18). In this context, it is imperative for oil companies to protect the intellectual achievements generated by these efforts. One key mechanism for supporting intellectual accomplishments in the oil industry is the patent system, which provides various benefits and protections. The following sections will discuss these advantages and the principal approaches employed within this system.

5.1. The benefits of patents and their protections in the oil industry

One undeniable fact is that, whether the price of oil is \$10 per barrel or \$100 per barrel, intellectual property protections for innovative technologies enable companies to remain competitive in an uncertain environment. Therefore, oil companies should prioritize the protection of their intellectual assets, either through the patent system or via trade secrets. The following outlines some of the key benefits of protecting innovations through patent registration.

A) Prevention of Imitation: The holder of a patent certificate has the legal right to prohibit others from using, selling, buying, or otherwise exploiting the invention. Under many legal frameworks, including

the United States Patent Act, patents prevent competitors from attempting to imitate protected technologies. In uncertain market conditions, where competitors may be more tempted to replicate innovations, intellectual property protections become even more critical (Anderson, R, 2000, pp. 632–635).

B) Tension-Relieving Effect of a Strong Patent Portfolio: Maintaining a robust portfolio of patents serves as a deterrent against potential patent infringement lawsuits from competitors. The existence of a strong patent portfolio allows a company to file counterclaims if necessary, discouraging competitors from initiating litigation. Furthermore, such a portfolio provides strategic leverage in negotiations, enabling companies to settle disputes or grant licenses effectively.

C) Facilitation of Oil Company Mergers: Protecting innovations through patents helps an oil company secure its share of the technology market. A strong portfolio of patented technologies can enhance a company's attractiveness for mergers or acquisitions, thereby increasing its overall market value (Ranaei, Habib Allah, Alavi, Seyyed Moslem, 2019, p. 11).

5.2. Patents as a tool for wealth creation and gaining competitive advantage

Companies operating in the oil industry often place significant emphasis on generating revenue from their intellectual assets, a priority that becomes especially critical during periods of recession and low oil prices. One approach is to register patents and subsequently grant licenses to other companies to exploit the patented technologies. However, competitors may be unwilling to obtain a license and pay for the associated proprietary rights, using the technology without authorization instead. This situation creates a dilemma for the patent owner: whether to ignore the infringement or to initiate legal action against the infringing company, thereby compelling compliance.

It should be noted that competitors may preemptively file lawsuits to invalidate a patent, potentially involving the oil company in unintended litigation. Assuming a competitor agrees to acquire an exploitation license, the patent owner permits them to compete in the relevant technological field for the duration of the license. In granting such licenses, the oil company must carefully estimate the immediate benefits of licensing against potential future losses, particularly if oil prices increase. In other words, during a recession, the company must weigh the revenue from licensing against the potential competitive disadvantage if a license enables a rival to gain a market position when prices rise.

Alternatively, the oil company may choose to remove the competitor from the market by filing an infringement lawsuit and obtaining a temporary injunction, rather than granting a license. This strategy not only protects the company's market share as prices recover but also prevents ongoing damage caused by rights violations. By pursuing legal action, the company can secure commercial benefits and reinforce its position as the undisputed patent owner, thereby gaining a competitive advantage and improving its conditions in both the short and long term (Mirshamsi, Mohammad Hadi, Nazeri, Amir, 2024, p. 104).

Furthermore, oil companies should continuously review their portfolio of inventions to identify technologies that are no longer strategically critical. Selling such patents provides an opportunity to generate revenue during periods of economic downturn (Mercy K., 2022, p. 2).

6. The trade secret protection system in the oil industry

The choice of an appropriate intellectual property protection system depends on the type and structure of the company. The trade secret system is suitable for intellectual achievements that can be effectively kept confidential, as once such information is disclosed, others may exploit it without restriction. Therefore, trade secret protection is particularly appropriate for oil companies engaged primarily in

project implementation, given their operational nature and the relatively low likelihood that they will be required to develop and share technology with other firms.

In the modern industrial environment, extensive communication among operating companies, contractors, and service providers, coupled with the movement of personnel between companies and departments, poses a significant challenge to maintaining the confidentiality of intellectual achievements. Additionally, when companies compete to develop specific innovations, revealing details of their findings can undermine the effectiveness of trade secret protection (Alizada, F, 2014, p. 3). Oil companies active in service provision and technology development are particularly exposed to the risk of trade secret disclosure through interactions with other firms, making this form of protection less suitable. In such cases, patent protection—granting exclusive rights to the inventor for a limited period in exchange for public disclosure—is the preferred method.

Furthermore, during periods of stagnation and uncertainty in the oil industry, which often result in the termination of numerous employment relationships alongside ongoing project contracts, the risk of trade secret misappropriation increases. Employees seeking new positions may establish competing businesses using former employers' trade secrets or disclose these secrets to improve their conditions with new employers (Bagheri, Seyyed Kamran, Bagheri Moghadam, Nasser, Shafiei Alawijeh, Amir, 2017, p. 3). The temptation to misuse trade secrets is heightened in volatile and uncertain environments. Consequently, oil companies must remain vigilant regarding confidentiality and other employment contract restrictions and actively monitor the behavior and performance of former personnel to identify and mitigate potential trade secret abuses at the earliest opportunity.

7. Protection of intellectual achievements in the upstream sector of the oil and gas industry

Today, many of the most significant challenges in the upstream sector of the oil industry are addressed through innovation and technological development. Innovation is a critical factor in reducing costs, enhancing competitiveness, and overcoming operational obstacles. Consequently, active engagement in technology and innovation is essential for companies operating in the upstream segment of the global oil industry. Given the slow pace at which innovations and technical knowledge are realized in this sector, protecting intellectual achievements and innovative technologies in the upstream field is of paramount importance.

The partnership structure of assets in the upstream sector presents additional challenges for safeguarding technological innovations. Moreover, companies in this sector often adopt a "fast follower" approach, waiting for competitors to implement new technologies first due to the risks associated with first-mover failures. However, with the increasing recognition of the critical role of technology and innovation in the oil and gas industry, many companies with substantial research and development investments have strengthened their capacity to acquire new technologies and actively protect their intellectual achievements using various mechanisms.

Decision-makers in the upstream segment of the global oil industry have increasingly acknowledged the value of intellectual achievements, prompting many companies to establish specialized committees dedicated to intellectual property management. One key responsibility of these committees is to identify the most suitable protection mechanisms for the company's innovations (Perrons, R. K, 2014, pp. 301–312). Innovative companies recognize that the acquisition, utilization, and protection of technological innovations must be integrated with overall management. Consequently, intellectual asset management is closely linked to business strategy, and strategic planning requires a thorough understanding of intellectual property considerations. This perspective helps explain why small and entrepreneurial

companies in the upstream oil sector are generally more proactive in registering their innovations than large corporations; large companies often have a broader range of alternative strategies to capture the value of both their own and others' innovations.

7.1. Patent protection mechanism in the upstream sector of the oil industry

Innovation and technical knowledge provide a significant competitive advantage for companies operating in the upstream sector of the oil industry, making their support and protection essential. The high costs associated with research and development, the relative ease of imitation, the inherent risks of upstream activities, the slow pace of technological change, the need for integrated technologies, and the existence of large markets for the commercialization of technological outputs are key reasons for protecting intellectual achievements through patents (Stevens, P, 2016, p. 17).

Despite these motivations, several factors reduce companies' willingness to use patents in this sector. The disclosure of technical information inherent in the patent mechanism, the complex and evolving nature of upstream technologies, and the cumulative characteristics of most innovations in this field discourage patenting.

Although upstream technologies in the oil and gas industry are complex, have long lifecycles, and target large markets capable of covering protection costs, some companies hesitate to patent. They are concerned that, despite substantial investment in research, development, and commercialization, patent disclosure facilitates imitation. Consequently, the competitive advantage of being a technology leader may be undermined, and patent protections alone may be insufficient to prevent replication by competitors (Castellaneta, F., Conti, R., and Kacperczyk, A, 2017, pp. 834–853).

The patent mechanism cannot fully shield companies from competitors entering upstream research and development fields. Because services in this sector are continuous, competitors can develop alternative approaches without infringing existing patents at relatively low time and cost. Furthermore, patenting inevitably reveals the knowledge of "why" and "how" an innovation works, prompting many innovative companies to avoid this mechanism. Given the generalizability of technological advances, disclosed knowledge can enable competitors to leverage prior technologies to create new services, depriving the original innovator of substantial profits.

One of the primary functions of a patent is to enable technology transfer and licensing. However, licensing is uncommon among upstream oil companies, which typically prefer to avoid competitors in specific technologies, as granting a license creates opportunities for others to exploit the innovation. Additionally, due to the complexity of upstream technologies, reverse engineering through commercial products is often difficult. In such cases, trade secrets may be a more effective means of protecting technological knowledge.

From another perspective, the nature of technology in the upstream oil and gas industry is largely service-oriented. Core technological competencies are often skill-based and cannot be adequately protected through patents or copyrights. These proprietary skills are specific to the company and are safeguarded as trade secrets (Rodrigo d'Oliveira e Souza, Adelaide Maria de Souza Antunes, Luiz Fernando Leite, 2020, p. 22).

7.2. Protection of intellectual achievements in the upstream sector of the oil industry over time

In the past, protection in the form of a trade secret system, which was commonly used in the upstream sector of the oil industry, slowed the dissemination of knowledge, technological development, and innovation. Because technologies in this sector are often continuous and cumulative, the non-distribution of knowledge forced companies to repeatedly retrace the steps of technology creation and

development, sometimes imposing prohibitive costs that limited entry into the field. The unique characteristics of the oil industry—such as its technological focus, intense competition, and high operational costs—led industry participants to treat effective technologies as trade secrets. This approach aimed to prevent the loss of investments made in research and development, preserve innovation, and generate competitive advantages and potential revenue for the companies involved.

However, the growing global demand for energy, much of which is supplied by the oil industry, coupled with the depletion of conventional resources and the increasing need to explore and produce unconventional resources using complex and innovative technologies, highlighted the limitations of relying solely on trade secret protection. Industry participants recognized that trade secrets alone were insufficient to safeguard their interests. Consequently, companies increasingly turned to patenting to protect their intellectual achievements. Although patent disclosure can still impact certain competitive interests, the collective benefits and the urgent demand for technology have made patent protection necessary. As a result, some innovative companies—particularly oilfield service providers and technological start-ups—have embraced patenting, leading to accelerated innovation and more rapid growth of technological knowledge in the upstream sector.

8. Challenges of joint ventures in the oil industry from the perspective of intellectual property rights

The formation of joint ventures has been a longstanding practice in the oil industry, and many companies continue to operate in this manner. In an oil joint venture, two or more companies collaborate to conduct economic activities, typically agreeing to create a new entity and share profits, losses, and expenses. While joint ventures can offer strategic advantages, they have historically faced challenges related to intellectual property, which are discussed below along with potential solutions.

A) Disputes Regarding Ownership of Intellectual Achievements: Ownership conflicts may arise when it is unclear which company contributed to the creation, development, or improvement of a particular innovation. Such disputes can threaten the viability of a profitable project. These issues can be mitigated through joint venture agreements that clearly define ownership rights. For example, appointing a joint committee composed of representatives from all participating companies can help review and provide regular, accurate reports on the creation and development of intellectual achievements during the joint venture. This committee can be granted authority to determine ownership, either provisionally or definitively, with mechanisms to address disputes effectively.

B) Disputes Regarding Employment Relationships: Conflicts may also emerge if it is unclear under whose authority or for which entity an innovation was created. Resolving these disputes requires clearly defining the employment relationships of individuals involved in the innovation process, including whether they are employed by a joint venture party, the joint venture entity itself, or an external organization. Additionally, protocols should be established to limit unnecessary interaction among employees engaged in innovation, minimizing the risk of informal disclosure or overlap in intellectual contributions (Cody B. Johnson, 2021, pp. 74–83).

C) Determining Duties Regarding Benefits After Liquidation: Although the primary goal of a joint venture may not be the creation of intellectual achievements, innovations often arise during the course of collaboration. Problems can occur if the joint venture agreement does not specify how benefits from intellectual property are allocated after the project ends or the legal entity is dissolved. For instance, if the joint venture entity owns the intellectual property and licenses it to third parties, the distribution of resulting revenues may be unclear. A practical solution is the establishment of an independent legal entity to manage proprietary rights, oversee licensing, cover legal protection costs, and coordinate all

intellectual property matters. This entity would continue to operate after the dissolution of the joint venture, ensuring clarity and continuity in managing the intellectual assets generated.

9. Conclusions

The world's growing demand for energy, coupled with the depletion of conventional resources and the increasing reliance on unconventional resources—subject to environmental and safety constraints—necessitates the adoption of innovative technologies that provide a competitive advantage for oil companies. Accordingly, the acquisition, protection, and exploitation of intellectual achievements are critical factors for the success of companies in this sector. Intellectual achievements represent valuable assets, and in conditions of industry uncertainty and stagnation, companies that actively develop and safeguard these assets can benefit as market conditions improve and oil prices rise.

The primary mechanisms for protecting intellectual achievements in the oil industry are patents and trade secrets. Patents offer several advantages, including the prevention of imitation, the deterrent effect of a strong patent portfolio, and enhanced opportunities for mergers and acquisitions. Trade secret protection is recommended for areas of the oil industry where personnel interactions, organizational structures, and operational conditions make the likelihood of unauthorized disclosure low.

Given the strategic importance of the upstream sector, companies operating in this segment must carefully select the appropriate protection mechanism. To accelerate innovation and facilitate the dissemination of knowledge, the use of patents in the upstream sector has become essential, providing foundational information that supports the development of new, integrated technologies.

Joint ventures remain a common organizational form in the oil industry, and it is crucial that agreements clearly define the management and ownership of intellectual achievements, both during the existence of the joint venture entity and after its dissolution.

Nomenclature

IPR	Intellectual property rights
OPEC	Organization of Petroleum Exporting Countries

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