Oilfield Services Blockchain Smart Contracts & Intellectual Property Issues

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Introduction

Blockchain smart contracts are the only existing effective method by which smart agreements can work without a centralized checks-and-balances system relying on the distributed ledger, enabling counterparties in the oil and gas industry, in general, and in oilfield services, in particular, to automate transactions optimizing tasks that are typically performed manually, including, among many, supply chain transparency; waste management; regulatory compliance; well equipment identification and maintenance; workforce security and quality training certification[2]; and the verification of the origin, development, use and ownership of the technology used by the contractor and subcontractors. Blockchain smart contract mechanisms can result in integrated processes that are faster and more accurate and cost efficient for all parties involved, thus maximizing profitability for all and mitigating disputes.

What is Blockchain?

Briefly, "Blockchain is a shared, immutable ledger that facilitates the process of recording transactions and tracking assets in a business network."[3] In English and by analogy, Blockchain is a note pad.[4] Unlike a regular notepad however, Blockchain can be shared by the whole world at the same time and if anyone tries to change any of the information in the leger, warnings go off everywhere making it effectively impossible.[5] The block in blockchain is analogous to a page in the example. The blocks are linked in a chain in order to keep the information safe and orderly.[6] The order allows a network to store chunks of the information and to validate what is being stored. As a side benefit, providing storage services can get you bitcoins as compensation.[7] All sorts of stuff gets encoded in the block where it can be referenced in future. Because you can't really erase or change content, this is a safe, permanent record of a transaction.[8]

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[2] Majors and national oil companies (NOCs) rely on oilfield services companies to complete some of the more specialized tasks in well creation, maintenance, and operation. The workers who perform these tasks must have specific certifications for legal, safety, and regulatory purposes. With the integration of a federated identity construct on the blockchain – i.e., an identity associated specifically with one's company through a hierarchy of subcontractors – all oilfield services companies can collectively manage the certifications of their employees.
See **https://media.consensys.net/blockchain-use-cases-for-upstream-oil-gas-bd6affd887e5**

[3] MANAV GUPTA, BLOCKCHAIN FOR DUMMIES 3 (2nd IBM ltd. ed., John Wiley & Sons 2018).

[2] (to extend the analogy, the note pad is numbered, forming the chain. If we removed a page it would be obvious to everyone information is missing making shenanigans difficult.)

[5] GUPTA, 10 – 11.

[6] id, 7.

[7] id, 3 – 12.

[8] id.

Application in Oil & Gas Transactions

The upstream segment of the oil and gas industry is regarded as one of it's most complex and technology-intensive portions, with oilfield services companies deploying the majority of the applicable technology. Services companies invest a large amount of money on research and development; acquire new companies with big intellectual property asset portfolios; and seek new technology from universities and laboratories, competing for the best and the most efficient solutions to problems in the exploration and production of hydrocarbons for their operator clients. In addition, during the provision of oilfield services, a large amount of confidential information (including seismic, geological, petrophysics and production data owned by the parties) are exchanged among them and such information must be delivered to regulatory agencies that control the upstream activities in the jurisdiction in which the services are performed. By allowing lots of individualized transactions, Blockchain smart contracts offer obvious possibilities, including evidence of creatorship, delivery of data, intangible property ownership and provenance authentication, registering and clearing intellectual property rights, and solving very common problems in the provision of services and products in the oil and gas industry. In addition, applying blockchain technology and smart contracts is the most efficient method of controlling and tracking the distribution of (un)registered IP and geological and production data, along with providing evidence of genuine and/or first use in or during the exploration and production of hydrocarbons.

The sheer size and volume of contracts and transactions necessary to execute an upstream oil and gas project has historically caused significant intellectual property reconciliation, validation and tracking issues, including the exchange of technology and trade of intellectual property assets among operators, contractors, subcontractors and suppliers, in addition to significant challenges in managing logistics for supplies and tracking orders, and deploying inventory and exchanging proprietary data.

Here we analyze the benefits and challenges for business actors in the upstream oil and gas industry to adopt blockchain smart contract technology in upstream project activities, along with some intellectual property issues that may arise in technology and data transfer during the provision of such oilfield services. These issues will be examined under the context and perspective of both the operator and services companies in order to help understand the reality of smart contract technology and its potential use in upstream activities.

Oilfield Service Contracts

Services contracts can be classified in several ways, starting from the simplest contracts of pure services, as they are known in the industry, to the most sophisticated, complex and structured contracts, where management and execution of services are integrated with complex forms of compensation, and possibly financing, and may even assume or share production risks, in some cases.

The simplest form of services contract is a contract for pure services ("discrete services contracts"). These contracts can be defined as agreements in which a services company, acting as a contractor and on behalf of the operator, undertakes to provide a service related to the exploration and/or extraction of hydrocarbons in favor of the operator, for an agreed price. Classic examples of these contracts include contracts for drilling, cementation, testing and casing. In these cases, the services are provided individually by a services company that performs its services in an area where other contractors exist or provide similar services. By contrast, the operating company coordinates, manages, decides and orders when, how and where such services will be executed in relation to the other activities and/or services provided in the area. The operator is thereby fulfilling its drilling or development plan, whichever may be the case.[9]

[9] According to the definition of "pure service contracts," drawn up by the Society of Petroleum Engineers, the World Petroleum Council, and the American Association of Petroleum Geologists, "the service must be provided within a certain time or be completed within a specific period of time." In industry practice, the term of execution of the service contract is lower than that of concession contracts, or of shared operations, associations, or, in general, oil (exploration and production) contracts.

Among many other benefits, the use of smart contracts for discrete service projects maximizes transparency, expedites payments and verifies compliance with the technical obligations in the contract. Done correctly, smart contracts can also reduce negotiation and facilitate understanding of the contract terms among the parties. Oilfield services companies that are performing discrete services are often not efficiently compensated after fulfilling their obligations under the service contracts because they have to prove that such obligations or tasks were performed under the terms, conditions and satisfaction of the client ("operator"). Such proof relies on the performance of a separate team, other services companies or individuals, to prove completion of their tasks in order for the operator to compensate them. This causes a tremendous backlog in the reconciliation process, making staggering amounts of money liable as companies wait for compensation. By additionally not always contracting clearly such that the terms are well defined, the problem is exacerbated. With a blockchain smart contract as a shared, accessible ledger that collects and structures data, manages identity and ensures transparency, the financial reconciliation process would be more efficient, thus cutting down compensation time[10] and fulfilling payment terms in the discrete services contracts.

Given the existence of large services companies that integrate a number of product and service lines,[11] that these services companies organize and deploy in a structure of their choosing, services group contracts or bundled services contracts ("bundled services contracts") have come into being. These rely on the same contractual structure, risk allocation and payment mechanisms as discrete services contracts. Under these bundled services contracts, the same services company offers several services at the same time, thus reducing costs and increasing operational efficiency for its customer. This bundled services contract was, at the time, the traditional mechanism of improving efficiency in the financial reconciliation problems explained above, because the payment scheme was separately attributed to each of the services provided and paid by and to the same services company. The operator benefits because the same company provides these services, and this ideally results in the reduction of operating costs, less reconciliation of different services companies' accounts payable, less services companies relying on other third parties' performances, and, consequently, in the prices the operator must pay. On the other hand, the benefit for the services company is that it increases its participation by the volume and diversity of work provided and reduces payment time, thus increasing its profitability. However, other contract administration problems that can be resolved with blockchain smart contracts persist, such as supply chain transparency, cost of negotiation, waste management, regulatory compliance, well equipment identification and maintenance, workforce security, and quality training certification.

The Challenges Of Blockchain

All of these contracts are complex and negotiating the terms of these transactions is a slow, laborious process with the resulting terms not always being well understood or effectively communicated. This makes it difficult for the parties to effectively execute on agreed to terms. Parties rely on tradition and existing expectation and tend to overperform or fail to perform work contracted for because it is not part of the anticipated work.

Despite these contract administration problems, bundled services contracts were and are successful in the industry, and services companies (in order to obtain a greater presence in the market and also in response to the requirements of its customers' operators) began to be more creative and aggressive by offering turnkey services contracts. In a turnkey service contract, the number of services to be executed by the same services company grows substantially, and greater operational efficiencies should be achieved; however, the contract administrative problems described above persist and increase for services companies.

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[10] See "Blockchain Use Cases and Benefits for Upstream Oil & Gas" at **https://media.consensys.net/blockchain-use-cases-for-upstream-oil-gas-bd6affd887e5** visited 2/27/1019.

[11] Within this group of major transnational services companies, we may name Schlumberger, Halliburton, Baker Hughes and Weatherford International.

Integrated Contracts

From there, the natural evolution has been, in light of the demands and requirements of operators and from their own risk-averse business model, the adoption of contractual models in which all the services and payments have variables directly or indirectly related to the performance of the services provided and the results these services deliver for the operator's exploration and/or production campaigns ("integrated performance-based contracts or IPBCs"). The remuneration for the executed services can be variable or mixed – incorporating the reduction of costs through reduced execution times, the optimization of resources, and the use of new technologies by the services companies.[12]

IPBCs are agreements in which operators compensate services companies for the provision of all production services based on the completion of such final task, production or incremental productions. Collectively, everyone involved (operator, services company and subcontractors of services companies) has the long-term goal of maximizing resource output from the ground. Individual services companies' subcontractors, however, have more immediate goals that relate to their separate sub-contracts. When incentives are misaligned, inefficiencies emerge, safety is compromised, and profit is affected. Blockchain-based IPBCs are an opportunity to align short- and long-term goals among all stakeholders to support a more profitable, safer and more efficient well.

In addition, services companies take on operating risks and payment risks based on the outcome of operations. This is true even though the title and record put the oil company in the position of operator, and the services company remains as the contractor (providing integral services; assuming exploratory, production or geological risks; and receiving a variable consideration for said services). This metamorphosis is a consequence of different factors – in particular, the advent of the era of nationalization of the oil industry,[13] which contributed to modifying the supremacy of contractual negotiation power of the international oil companies against the states that own the resources.[14]

From the earliest days of the oil industry, service contracts have been evolving, especially in response to the demands of the actors in the sector; the production demands of state oil companies; the shortcomings of same; and the appetite of some transnational services companies to seek greater profitability by assuming greater risks. In addition, some operators have been willing to accept lower profits by acting as contractors either providing services or creating complex contracting relationships that incorporate ideas that are novel. Giving effect to these contracts requires consistency and repetition in terms such that the parties' expectations line up with the language of the contract.

A primary role of the operator in any service contract, whatever the type of contract, is to pay for services. On the basis of the nature of the compensation, a service contract can be characterized into our groupings of service contracts, bundled services contracts and turnkey service contracts, in which the remuneration that must be paid by the operator to the contractor is not contingent on production; and risk contracts, where the remuneration in favor of the services companies is based on production – and, consequently, it assumes (or, eventually, shares) the risk of the exploration and/or the extraction. Within this category, we find financed integrated services contracts, the integral contracts of increasing production, the integrated contracts of advanced services or performance contracts, and the so-called services contracts at risk for the exploration and extraction of hydrocarbons.

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[12] In this sense, the glossary prepared by the Society of Petroleum Geologists indicates, when defining the pure services contract, that "the payments, in some cases, may be linked to the reduction of operating costs and other relevant parameters."

[13] In Latin America, Bolivia and Mexico were the first countries to nationalize their respective oil industries in 1937 and 1938, respectively.

[14] For more details, see PINTO OLIVEROS, Sheraldine, "Oil Contracts in Latin America: An Introduction," in Energy Law in Latin America, HERNÁNDEZ-MENDIBLE, V. (Dir), Universidad Externado de Colombia, Bogotá, 2017.

Regardless of the type of services contract used in an upstream operation, the activity is very complex and technology intensive. This activity often requires wells be drilled, completed, tested, cased and cemented, etc. in very remote areas, in geopolitically unstable regions, and in highly regulated jurisdictions. Although the exploration and production activities are coordinated by the operator, the actual extraction and production of resources are governed by services contracts with many services providers and/or one services provider and many subcontractors and separate companies. These companies all operate under different deliverables, performance metrics and contract details, and use different technologies protected by intellectual property. The coordination, payment reconciliation, performance attestation and origin, development, use and ownership of technology and data used by the contractor across these dozens of companies is consistently a point of friction for energy companies – leading to inefficiencies that cost time and affect the bottom line.

The challenge for the industry is to streamline contract terms. By breaking up a series of transactions covered by a contract into a variety of micro-transactions, Blockchain risks exacerbating the negotiation problem.[15] Legal tech makes Blockchain friendly terms negotiation possible; oil and gas as an industry would benefit substantially from the effort.[16]

Benefits of Blockchain for Oilfield Services

Operators execute their exploration and production activities through contracts with services companies (discrete, bundled, turnkey or integrated performance-based contracts). Blockchain smart contracts are the only existing, effective method in which smart agreements can work without a centralized checks-and-balances system. By relying on the distributed ledger, enabling counterparties to automate transactions that optimize tasks and that are typically performed manually. In addition to the account reconciliation explained above, there are many areas in which the implementation of blockchain smart contracts can provide many benefits, including:

i. The services company's workforce must have specific certifications for legal, safety and regulatory purposes described in the services contract as an obligation for the services companies. With the integration of a federated identity construct on the blockchain – i.e., an identity associated specifically with one's company through a hierarchy of subcontractors – all oilfield services companies can collectively manage the certifications of their employees, proving full compliance with the terms and conditions of the contract.

ii. It takes significant time to prove that a well or rig was staffed in the appropriate order and with the appropriately certified individuals. Data must be drawn from dozens of companies, worker identities affirmed, certification identities affirmed, and sequences affirmed. On a shared blockchain-based system, employee identities and related certifications are automatically recorded when they board the rig, and the sequence of workers is transparent and immutable to all who have data access.

iii. It is not always clear what operator well has received what work, from what services company, or what services company has received what services for subcontractors that are linked to a one-man contract (services contract). With this integration, there is a clear trail of work attached to each well and what services company or subcontractor provided what service, thus allowing oilfield services to continue with production without having to stop to confirm previous work. Additionally, having all parties and other identifier information drawing from the blockchain, with its complete audit history, would eliminate one of the most common sources of errors.

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[15] For instance which terms apply here, do they make sense for this transaction, should we be negotiating the terms for this particular activity, and are we sure all this makes sense in context.

[16] See e.g. **www.docjuris.com** (a legal tech company with which the author has a working relationship)

iv. Services companies must identify and describe the source, development, use and ownership certification of the technology applied in the services that they are providing as a substantial obligation of the services contract. With the integration of a federated identity construct on the blockchain – i.e., an information and certification associated specifically with one's company through a hierarchy of subcontractors – all oilfield services companies can collectively manage the compliance of such contractual obligations.

v. By integrating all of this with service company e-commerce platforms, service companies can substantially upgrade their own distribution and delivery networks and provide higher quality information in real time.

Before elaborating more on the verification of origin, development, use and ownership of the technology used by the contractor and subcontractors, an explanation of how the technology in the industry is protected through intellectual property rights is necessary.

Intellectual Property in the Oil and Gas Industry

Within the upstream oil and gas industry, technology can be defined as the systematic knowledge of how to explore and produce hydrocarbons, with such knowledge being reflected in inventions, utility models, know-how, designs, and in data forms protected by intellectual property law.[17] Intellectual property law can be viewed, in a broad sense, as a system that provides protection for the creations of intellectual activity.[18]

The promotional justification of the intellectual property system has an economic implication,[19] as well as an impact on the transfer of technology in the oil and gas industry. It serves as a layer of protection for the technology that parties in the oil business generate, and provides insurance for their investments. Specifically, there are three categories of intellectual property that are essential for the oil and gas industry: copyrights, patents and trade secrets.

i. Copyrights. A copyright is a bundle of exclusive rights granted for a period of time to authors for their creative expression.[20] Unlike patents, "the enjoyment and exercise of these rights are not subject to any formalities."[21] The touchstone of a copyright is often thought to be originality, or the related concept of intellectual creation. One modern area of copyright law that directly impacts the oil and gas industry involves computer software. "Software has assisted a large number of companies in the oil and gas industry improve equipment longevity, increase performance, and decrease risk through a wide range of engineering simulation capabilities."[22] The software helps the upstream oil and gas industry turn critical information into useful knowledge by processing data and converting it into a readily analyzable form.[23] With this knowledge, operating companies can see farther, drill deeper, and gain a more comprehensive picture of underground reservoirs. The oil and gas industry must continue to invest resources in the development of computer programs in order to accelerate the replacement of oil reserves and maximize production.[24]

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[17] See note 3.

[18] See World Intellectual Property Organization, "Introduction to Intellectual Property," (Kluwer Academy, 1997), 3. See also Article 1, TRIPS, which establishes "2. For the purposes of this Agreement, the term 'intellectual property' refers to all categories of intellectual property that are the subject of sections 1 through 7 of Part II."

[19] "The history of the development of international standards for protecting intellectual property largely reflects the history of the growth of trade and technology" Doris Estelle Long & Anthony D'Amato, International Intellectual Property (West, 2000), 10.

[20] The term of protection granted by the Berne Convention shall be the life of the author and fifty years after his death. See specific terms of protection standards article 7 and 7bis. Berne Convention.

[21] "(2) The enjoyment and the exercise of these rights shall not be subject to any formality; such enjoyment and such exercise shall be independent of the existence of protection in the country of origin of the work. Consequently, apart from the provisions of this Convention, the extent of protection, as well as the means of redress afforded to the author to protect his rights, shall be governed exclusively by the laws of the country where protection is claimed." Berne Convention, Article 5.2. Applicants must register their copyright with the U.S. Copyright Office before they are legally permitted to bring a lawsuit to enforce it.

[22] "Oil and Gas Industry" Fluid Codes Ltd., accessed January 29, 2010, **http://www.fluidcodes.com/oilgas.html**

[23] See Gregory A. Stobbs, Software Patents, United States Patent and Trademark Office, Second Edition (Aspen Law & Business, 2004). See also Public Hearing on Patent for Software Related Inventions, San José, California January 26–27, 1994. Exxon Production Research Company. Mr. Cassamassima.

[24] National Petroleum Council, "Topic Paper 26" 34.

In addition to software, databases are another important asset for operators and services companies in the industry. As technology changes in the oil and gas sector due to the impact of globalization, new challenges have arisen concerning possible copyright protection for databases. As such, databases should receive the same protection as computer software. However, such protection should not extend to the actual data or material within the database, nor should it interfere with any copyrights of the data or the material itself. [25] Affording copyright protection to databases is consistent with the copyright theory that requires some intellectual creativity and recognizes the fact expression dichotomy.[26] Nevertheless, some countries take the issue a step further and offer databases additional protection beyond that of traditional copyright law.[27]

ii. Patents. A patent is a government grant that entitles the recipient to exclusive rights over an invention for a period of time.[28] Where the subject matter of a patent is a product, the owner can prevent third parties from making, using, offering for sale, selling or importing the product without the owner's consent.[29] Where the subject matter of a patent is a process, the owner can prevent third parties from using the process, or from using, offering for sale, selling or importing a product obtained directly by that process, without the owner's consent.[30] No country will grant these rights without official registration of the patented invention, and, once the rights are conferred, they are only enforceable within the granting country.[31]

The oil and gas industry is a high-technology industry. This has been amply demonstrated by the boom in US production and the cost reductions realized over the past fifteen years. Although this fact is not widely recognized by the general public, industry leaders know it,[32] and patents play a key role in protecting new technology in this highly competitive industry.[33] For example, seismic surveying and the resulting data processing require enormously powerful and expensive computers. Patent law protects such hardware, as well as the new processes or structures embodied in the computer software.[34] Developments in the areas of horizontal drilling, completion tarnishes, directional drilling and remote operation are all protected primarily by patents.

iii. Trade Secrets. Data, pure ideas and information are seldom protected under the law, unless they are held as trade secrets. Trade secrets are often discussed in connection with patents, since both forms of intellectual property may apply to know-how. Know-how can be loosely defined as the practical understanding of how to perform or create something useful, often in the context of a commercially valuable item or process.[35] Under international standards, countries must offer a legal mechanism that affords both lay and legal people the ability to prevent information that is lawfully within their control from being disclosed, acquired or used by "another in a manner contrary to honest commercial practices, without their consent."[35] "So long as such information is secret… it has commercial value… and is subject to reasonable steps… by the person lawfully in control of the information."[37]

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[25] See TRIPS, Article 10.

[26] Edward Samuels, "The Idea-Expression Dichotomy in Copyright Law" Tennessee Law Review, 56 (1989):325.

[27] See Directive on the Legal Protection of Databases, Directive 96/9/EC of the European Parliament and of the Council of March 11, 1996, on the Legal Protection of Databases.

[28] (Patent), accessed January 29, 2011, http://www.investorwords.com/3621/patent.html.

[29] TRIPS, Article 28(1)(a). See also TRIPS Note: "This right, like all other rights conferred under the TRIPS in respect of the use, sale, importation or other distribution of goods, is subject to the provisions of Article 6."

[30] TRIPS, Article 28(1)(b).

[31] This is understood to mean that the grant of patent by a particular country has effects only within the territory of that country. Abbot, Cottier and Gury, International Intellectual Property in an Integrated World Economy (Aspen, 2007), 75.

[32] Dr. Claude E. Cooke Jr. and John J. Love, "Patent Infringement: Liabilities and Opportunities in the Oil and Gas Business," Oil and Gas Finance Journal (2010).

[33] Cooke, "Patent Infringement."

[34] Merges, Menell, Lemley, Intellectual Property, 855.

[35] Daniel C.K. Chow, Edward Lee, International Intellectual Property, Problems, Cases and Materials (Thomson West Group, 2006), 335.

[36] For the purpose of this provision, "a manner contrary to honest commercial practices" shall mean at least practices such as breach of contract, breach of confidence and inducement to breach, and includes the acquisition of undisclosed information by third parties who knew, or were grossly negligent in failing to know, that such practices were involved in the acquisition. See also TRIPS, Article 39.

Trade secrets typically encompass any undisclosed information of commercial value, including (a) technical know-how, such as designs, processes, formulas and other technological knowledge resulting from experience and intellectual ability, and (b) data of commercial value, such as 3D seismic data and other operationally related information that provide an advantage over other competitors.[38]

Oil and gas companies often consider some of the technology they develop or use, and the information gained through that technology, to be confidential or a trade secret.[39] In addition to the business and commercial information related to the services, pricing and operations, specific technical information is also subject to large efforts to keep it secret. Hydraulic fracturing and 3D seismic information are two good examples of this theory, since seismic data is generally protected under the law of trade secrets.[40]

Intellectual Property, Oilfield Activities and Blockchain Smart Contracts

The intellectual property legal framework encompasses a number of multilateral, regional and bilateral agreements.[41] Coupled with national legislation regarding patents, copyrights and trade secrets, a sophisticated structure of intellectual property law has been established. This legal structure interacts with international and national contract law to form the legal framework that governs the transfer of technology and intellectual property assets.[42] Within this framework, a transfer of technology takes place through a contractual relationship during the provision of oilfield services by which the owner of a patented technology, copyrighted work or know-how sells or grants a license to use the said technology, work or know-how to another person or legal entity.[44] Access to the technology can consist of the transfer of complete ownership through a sale or assignment of any intellectual property right over the technology, or the transfer of a more limited intellectual property right, such as a right to use the technology through a license obligation in the oilfield services contract.[45]

These types of contract obligation related to licenses and assignments must include a number of specific provisions, some of which are common to other oil and gas contracts. These can include indemnities, warranties, origin of the technology, new technology development, title of ownership, delivery and inspection terms, payment terms, cross licensing, duration, audit and accounting terms, limitation of liabilities, choice of law, and choice of forum. These provisions are mainly governed by national contract laws and are subject to third manual verification of fulfillment. Blockchain smart agreements can work without a centralized checks-and-balances system relying on the distributed ledger, and enable counterparties to automate transactions optimizing these fulfillment verification tasks.

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[37] Secret in the sense that it is not, as a body or in the precise configuration and assembly of its components, generally known among or readily accessible to persons within the circles that normally deal with the kind of information in question. TRIPS, Article 39.

[38] 18 U.S.C. § 1839 (3).

[39] Chris E. Wolfe, Matt W. Holley, Scott M. Nelson, Allison Claire Frazer, Trade Secrets and Proprietary Information, 26th Annual Ernest E. Smith Oil, Gas and Mineral Institute, 2000, Tab 10, page 1.

[40] F. Lindsey Scott, "Intellectual Property: How Do You Keep It and When Can You Sell It?" 13th Annual Advanced Oil, Gas & Mineral Law Course, September 21–22, 1995, Paper M, page M-16, State Bar of Texas.

[41] "Trade Agreements in Force," Sociedad Ibérica de Construcciones Eléctricas, S.A., accessed February 6, 2011, at **http://www.sice.oas.org/agreements_e.asp.**

[42] Fredrick M. Abbot, "The Problems of Intellectual Property in Latin America and How to Address Them" (United Nations, 2007) accessed February 11, 2011, at **http://www.eclac.org/comercio/publicaciones/xml/7/32117/The_Problems_of_Intellectual_Property_in_Latin_America_How_Address_Them__164.pdf**

[43] In general terms, a contract is a binding legal agreement between two or more parties that creates an obligation to do or not to do a particular thing.

[44] "Secrets of Intellectual Property," International Trade Centre UNCTAD/WTO, World Intellectual Property Organization (Geneva 2004).

[45] Chow and Schoenbaum, International Business Transactions, Second Edition (Aspen), 324.

These types of contract obligation related to licenses and assignments must include a number of specific provisions, some of which are common to other oil and gas contracts. These can include indemnities, warranties, origin of the technology, new technology development, title of ownership, delivery and inspection terms, payment terms, cross licensing, duration, audit and accounting terms, limitation of liabilities, choice of law, and choice of forum. These provisions are mainly governed by national contract laws and are subject to third manual verification of fulfillment. Blockchain smart agreements can work without a centralized checks-and-balances system relying on the distributed ledger, and enable counterparties to automate transactions optimizing these fulfillment verification tasks.

An important provision related to the use of technology in services contract that can be verified by blockchain smart contracts are related to export control provisions. The U.S. Department of Commerce governs the cross-border movement of technology to and from the United States.[46] The U.S. government also restricts the export of certain types of products and technology to certain countries and/or parties. The verification of use of specific technology in a specific country or party through a blockchain smart contract will centralize checks-and-balances systems and verify compliance with laws and regulations. In the oil and gas business, many exports are restricted due to the type of technology and products that are used in the exploration and production of hydrocarbons.[47] However, the U.S. is not the only country that restricts the export of certain types of products that could be used for military or nuclear purposes.[48] A violation of any of the export control laws could result in large fines, penalties, operational disruptions, seizures of goods at the border, loss of import and/or export privileges, possible blacklisting, and individual exposure to civil and criminal penalties.[49] This problem can be easily resolved by the use of block chain verification.

These are just some of the blockchain smart contract applications related to technology use in services contracts; however, many of them can be analyzed under the scope and benefits of all parties involved in the services contracts and subcontracts likened to a main service contract, despite the type of nature of services contract that the upstream project is specifically using.

Conclusion

The upstream oil and gas segment has a lot to benefit from blockchain technology, from efficiency to transparency to much more. Unique among oil and gas processes, upstream operations require the involvement of dozens of stakeholders and proprietary technologies – all of which rely on the data and certification of others. This sort of wide-scale, multi-party coordination is what blockchain technology succeeds so well at optimizing.

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[46] "Mission and Organization of the Department of Commerce," United States Department of Commerce, accessed February 6, 2011, at **http://www.osec.doc.gov/omo/dmp/doos/doo1_1.html**

[47] See **http://www.bis.doc.gov/licensing/exportingbasics.htm** (for instance, some items subject to export control regulations are accelerometers, aluminum tubes, chemicals, chemical injection pumps with internals of high nickel/chromium alloys or stainless steel, densitometers, exploding bridge wire detonators and firing sets, gravitometers, etc.)

[48] "Sanctions and Export Controls by Country," Foreign and Commonwealth Office [U.K.], accessed February 6, 2011, at **http://www.fco.gov.uk/en/about-us/what-we-do/services-we-deliver/export-controls-sanctions/country-listing/**

[49] "Penalties for Violating Export Controls," Berkley Research, University of California, accessed February 6, 2011, at **http://vcresearch.berkeley.edu/export-controls/penalties-for-violating-export-controls**