


How transnational rules can contribute to the improvement of the Brazilian regulatory system for unitization—an analysis under the transnational legal order perspective

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ABSTRACT

Unitization is the most effective method to avoid irrational, wasteful and environmentally unsustainable production of oil and natural gas. Therefore, it is important to notice that unitization is a complex practice. It is effective for the equitable production division of a deposit shared by different owners. However, compulsory membership can result in costly negotiation and make exploration and production projects less attractive. In the pre-salt, the most productive Brazilian oil province, unitization processes are common and even more complex due to the following factors: (i) there are three different tax regimes in the pre-salt polygon; (ii) when the reservoir is shared with an area not granted yet (referred to as an open area), the Brazilian regulation establishes that the unitization process must be carried out with the public company, Pré-sal Petróleo S.A., representing the Government; (iii) moreover, due to the high productivity of the pre-salt layer, the financial values involved in this process are substantial, even with a participation of less than 1 per cent in the shared reservoir. Brazil established a robust regulation on unitization in 2013, which was amended in 2017 and, again, in 2020. This demonstrates that the regulatory improvement process, in the search for a more efficient regulation—that balances the attraction of investments and protection of the public interest—is continuous. This article proposes that in this process of regulatory improvement, good international petroleum industry practices (good practices), contractual models drawn up by industry associations and codes of conduct shall be used as a reference. These non-state rules, which are the result of self-regulation by the upstream sector of the oil industry, will be considered in this article as transnational rules, following the approach of Halliday and Shaffer, who propose the existence of a transnational legal order.

1. INTRODUCTION

Unitization is the most effective method to avoid irrational, wasteful and environmentally unsustainable production of oil and natural gas. The institute recommends that, if an oil and natural gas

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field extends over more than one production unit (lease, concession, shared area, private property, etc), the respective holders of exploration and production (E&P) rights must produce the hydrocarbons from that deposit in a unified way, avoiding predatory competition and the consequent early depletion of the reservoir. According to Worthington,¹ unitization enhances project efficiency and effectiveness and also improves the aggregate economics relative to competitive development.

Therefore, it is important to notice that unitization is a complex practice. It is effective for the equitable production division of a deposit shared by different owners. However, compulsory membership can result in costly negotiation and make E&P projects less attractive.

In the pre-salt,² the most productive Brazilian oil province,³ unitization processes are common, due to the methodology adopted for block delimitation.

Unitization in the pre-salt region is even more complex due to the following factors: (i) there are three different tax regimes in the pre-salt polygon; (ii) when the reservoir is shared with an area not granted yet (referred to as an open area), the Brazilian regulation establishes that the unitization process must be carried out with the public company, Pré-sal Petróleo S.A. (PPSA), representing the Government; (iii) moreover, due to the high productivity of the pre-salt layer, the financial values involved in this process are substantial, even with a participation of less than 1 per cent in the shared reservoir.

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This article proposes that in this process of regulatory improvement, good international petroleum industry practices (good practices), contractual models drawn up by industry associations and codes of conduct shall be used as a reference. These non-state rules, which are the result of self-regulation by the upstream sector of the oil industry, will be considered in this article as transnational rules, following the approach of Halliday and Shaffer.⁴ These authors propose the existence of a transnational legal order (TLO), granting validity to non-state rules.⁵

Therefore, this article will detail the transnational rules related to unitization and will present examples of how these rules already influence the Brazilian regulatory system for unitization. Section 2 presents a brief history of unitization practice. Section 3 focuses on the specificities and the complexities of unitization in the Brazilian pre-salt. Section 4 discusses the TLO approach to deal with regulatory aspects of unitization. Section 5 shows examples of TLO's influence on the Brazilian regulatory system for unitization. Finally, suggestions will be proposed for adopting transnational rules to address the shortcomings found in the unitization process in Section 6.

¹ Paul F Worthington, 'An Analysis of Protocols for the Calculation of Tract Participation' (2014) 32 *First Break*, 61.

² To better understand the pre-salt province, it is important to know about the conceptual difference between the geological pre-salt and the legal pre-salt. The first corresponds to a geological province located below a deposit of evaporitic sediments (generally called 'salt'), formed approximately 120 million years ago as a result of tectonic movements that culminated in the continental separation between the current continents of South America and Africa from Asia. The legal pre-salt is a vertical prism of undetermined depth, whose horizontal projection is a polygon with coordinates defined by Law No 12.351/2010 (Pre-salt Law), covering an area of approximately 150,000 km². Thus, not everything that is legal pre-salt is geological pre-salt. In other words, the legal pre-salt, as it is a prism of undetermined depth, contains reservoirs not only from the geological pre-salt, but also from the geological context of the post-salt. Conversely, not everything that is geological pre-salt is included in the legal pre-salt area (the polygon). In other words, there are geological pre-salt reservoirs located in areas whose horizontal projections are not in the legal pre-salt.

³ Brazil stands out in offshore production of oil and gas, representing a high level of expertise due to the technological trajectory of its national oil company, Petrobras, which has explored and exploited this environment since the 1970s (Piquet and Pinto Jr, 2018). This experience led to the discovery of pre-salt, the highly productive geological province, situated in ultra-deep water, which already accounts for more than 75 per cent of Brazilian production, according to the ANP's Dynamic Panel of petroleum and natural gas production—March 2023 (for more information, see: <<https://app.powerbi.com/view?r=eyJrIjoInzVmNmZlIIMzQtNTYlNC00ZGVhLTk5N2ItNzBkMDNhY2IzZTlxIiwidCI6IjQ0TmNGZmLTl0YTtNGl0MiIiN2VmLTEyNGFmY2FkYzcxMyJ9>> accessed 16 March 2021). As published by IEA's WEO (2019), considering the Stated Policies Scenario, the pre-salt province output in Brazil will be the third-largest source of production growth globally by 2030, after only the United States and Iraq. The newsletter *Petroleum Intelligence Week*, of 2 April 2021, reports that 'Goldman Sachs recently called the Santos pre-salt "the most profitable non-Opec basin with scale."'

⁴ Terence C Halliday and Gregory C Shaffer, *Transnational Legal Orders* (CUP 2015).

⁵ For more information about TLO, see Luciana Braga and Helder Pinto Jr, 'The Financial Aspects of Offshore Decommissioning and Brazilian Regulatory System in the Light of the Transnational Legal Order' (2022) 15(6) *Journal of World Energy Law and Business*, 423–448.

2. BRIEF HISTORY OF UNITIZATION PRACTICE

Mineral deposits do not respect artificial territorial demarcations, because, as a rule, they are in the subsurface. In the case of petroleum, whether in its liquid or gas phase, the situation is more complex due to its fluidity, which allows it to migrate from regions of high to low hydrodynamic pressure.

According to Pinto Jr,⁶ ‘geology does not obey geography, nor the geometry of blocks’. The edges of mineral deposits extend across different properties, extrapolate municipal or state boundaries, and, not infrequently, cross the border between sovereign states.

This physical peculiarity allows that, if no legal restrictions are imposed, a certain holder of E&P rights, in an effort to obtain greater volumes of oil for their entity, could drill an unlimited number of wells, artificially reducing the pressure of the reservoir located under his concession area and imposing the tendency for fluids to migrate from neighbouring areas towards the region in which he is the holder of the mining rights. As if it were not enough to constitute a notorious inequity, the procedure invariably causes damage to the oil reservoir itself, reducing the total volume of oil/hydrocarbons that could be extracted if appropriate techniques were used.

Rule of Capture

This procedure, called the Capture Rule, was defined by attorney Robert E Hardwicke as: ‘The owner of a tract of land acquires title to the oil and gas which he produces from wells drilled thereon, though it may be proved that part of such oil or gas migrated from adjoining lands’.⁷

The Rule of Capture was applied in the early days of the North American oil industry, inspired by the English Common Law. It was of crucial importance in the initial development of the petroleum industry in the USA and can be identified as the most relevant legal understanding in the context of the commencement of North American petroleum production. The Rule of Capture was, properly speaking, the structure of the industry in its beginning.⁸

Therefore, it was legally possible to drain disproportionately or reduce adjacent wells’ production located on neighbouring properties. This rule encouraged accelerated production by well owners in order to avoid draining their wells by other neighbours, causing two major interrelated problems: excessive drilling and a strong decrease in the reservoir’s natural energy.⁹

The unbridled competition stimulated by the Capture Rule ultimately means a general loss, as the aggregate profitability of the reservoir is significantly reduced. Furthermore, the waste induced by competitive production irreversibly affects the public interest consistent in the optimal use of the natural resources of the States.

The cost of indiscriminate application of the Capture Rule was severe. An article published in the *Oil Weekly* of April 1942 estimates that the recovery of associated gas reservoirs could have been increased from two to five times if procedures to mitigate their effects had been adopted earlier.

Gradually, some US courts began to impose limits on the Rule of Capture, a trend that evolved towards the doctrine of co-related rights,¹⁰ which asserts that the different holders of E&P rights over a common oil and natural gas reservoir hold co-related rights to participate proportionately in the obligations and rights, including the profits generated, as well as a public charge in not wasting oil and natural gas. According to the doctrine of co-related rights, each holder of E&P rights of a common source of hydrocarbons has prerogatives concerning the other holders of rights, so that it can produce the oil and natural gas located under its concession area. Such prerogatives, however,

⁶ Helder Queiroz Pinto Jr, ‘Unitization in Brazil’ Interview. 2021.

⁷ Bruce M Kramer and Owen L Anderson, ‘The Rule of Capture—An Oil and Gas Perspective’ (2005) 35 *Environmental Law*, 899.

⁸ Daniel Yergin, *O petróleo: Uma história mundial de conquistas, poder e dinheiro* (Paz & Terra 1992).

⁹ *ibid*; Kramer and Anderson (n 7).

¹⁰ The doctrine of co-related rights is not an express guarantee to the E&P rights holder that he will be allowed to appropriate a fair and equitable share of the production of the shared deposit. It only ensures that the owner will have the opportunity to receive such a share. For this reason, in addition to legal norms, contractual relationships must be established that guarantee equity in sharing. In this context, the unitization institute stands and grows in importance.

are limited by duties vis-à-vis other holders of E&P rights and society, duties that prevent them from harming the productivity of the deposit and repel unjust enrichment arising from the appropriation of an undue proportion of the production of a reservoir.

In this sense, especially from the 1920s onwards, the Rule of Capture has faced campaigns against its adoption, due to the effect it causes in the reservoir pressure and, as a corollary, the waste of the hydrocarbons that can no longer be produced due to the lack of pressure.¹¹

Unitization against Rule of Capture

One of the main oil men to be concerned with the social costs created by continued adherence to the Rule of Capture was the petroleum engineer, Henry Doherty, who was the leading proponent for a statute for unitization.¹² Henry Doherty maintained, in the movement to adopt compulsory unitization in the USA, that the Rule of Capture encouraged predatory production, causing a waste of capital and labour force. Besides, at the beginning, the Rule of Capture leads to an excess of oil supply, causing the fall of petroleum prices¹³ and even the overvaluation of rural properties located around the producing areas. As Yergin¹⁴ pointed out:

Real estate speculation had no limits. A farm that a few months before was almost worthless was being sold for two million dollars [...]. A few months later, production quickly sold out – almost as quickly as it had started. The city returned to silence and solitude. A plot of land in Pithole that in 1865 had sold for two million dollars was auctioned for \$4.37 in 1878.

It is important to remember that Henry Doherty was director of the American Petroleum Institute (API), an association that, according to Weaver,¹⁵ was ‘driven by an ideology of private property rights and anti-regulation fervor’. Because the API has treated him as a pariah, Henry Doherty was free to write a letter directly to President Coolidge in 1924 in the following terms:

If the public [some day] awakens to the fact that we have become a bankrupt nation as far as oil is concerned, and that it is too late to [practice conservation], I am sure they will blame both the men of the oil industry and the men in public office at the time conservation measures should have been adopted.¹⁶

Another character that stands out in the movement to promote unitization, according to Weaver,¹⁷ is the petroleum engineer, William Murray, the regulator of the Texas Railroad Commission. After World War II, Murray issued a series of orders that lead to the unitization of some of the most significant fields in Texas, even in a context that Weaver describes as ‘antipathy for compulsory unitization’. In order to avoid waste, Murray developed the ‘Doctrine of Co-equal Coercion’. By threatening to close wells that were flaring or wasting gas, he led small and large operators to think of solutions to prevent waste, resulting in voluntary unitization agreements to enable the unified development of the fields. Weaver reports that she ‘tracted each no-flare and no-waste order and linked it to an RRC order approving a voluntary unitization agreement in that field shortly thereafter’.

Unitization was regulated in the USA for federally owned lands by amending the leasing Act. This diploma foresaw the requirement for unitization whenever the Secretary of the Interior judged that this process was the best way to attend the public interest. This rule later evolved into

¹¹ Terence Daintith, *Finders Keepers?: How the Law of Capture Shaped the World Oil Industry* (RFF Press 2010).

¹² Kramer and Anderson (n 7).

¹³ *ibid.*

¹⁴ Yergin (n 8).

¹⁵ Jacqueline L Weaver, *The Role of the Regulator: Reflections on Forty Years of Research and Learning about Energy, Economics & the Environment* (Institute for Energy Law 2017).

¹⁶ Jacqueline L Weaver, *Unitization of Oil and Gas Fields in Texas: A Study of Legislative, Administrative, and Judicial Policies* (RFF Press 2011).

¹⁷ Weaver (n 15).

compulsory unitization. However, the Rule of Capture continued to be adopted for primary recovery by artesian or pumped flow from wells.

Currently, in the USA, all producing states have compulsory unitization statutes, except for Texas. This practice spread to other oil-producing countries. In his research, Worthington analysed the unitization regulation of 90 countries, including the Brazilian regulation.

3. SPECIFICITIES OF UNITIZATION IN THE PRE-SALT

As detailed in the paper 'Why the unitization process is an important issue when dealing with the Brazilian Pre-salt Polygon', by Braga and David,¹⁸ unitization in pre-salt is common and even more complex due to the following four reasons:

- i) First, the coexistence of three types of E&P agreements in the pre-salt polygon¹⁹: production sharing agreement (PSA), concession agreement, and transfer of rights agreement (TOR).²⁰ As the blocks and fields that make up the pre-salt polygon are subject to different types of E&P contracts, it is very likely that the negotiation of the unitization involves at least two different types of contracts or even all three of them, which is the case, for instance, of Lula/Tupi, Búzios, Atapu and Sépia, four of the most prolific fields in Brazilian pre-salt (and in the country as a whole). The need to harmonize different fiscal regimes for joint production makes negotiations quite complicated.
- ii) Secondly, the requirement of a Unitization Agreement (UA) when a deposit extends to an open area, which means areas for E&P rights have not yet been granted or areas previously relinquished by the former E&P rights owner. In addition to the companies holding E&P rights over the shared deposit, the UA must be negotiated and signed by the public company Pré-sal Petróleo S.A. (PPSA) before its submission to the National Agency of Petroleum, Natural Gas and Biofuels (ANP) for analysis and contingent approval. PPSA is the representative of the Brazilian Government in negotiating agreements and managing oil resources found in the open area placed within the pre-salt polygon (legal pre-salt);
- iii) Thirdly, the high productivity of the fields situated in the pre-salt polygon. Thus, the financial values involved in the pre-salt unitization processes are substantial, even when dealing with a tract participation (TP) of less than 1 per cent in the shared reservoir, as in the case of the Lula field, for example. Despite the predictions of redeterminations, mistakes concerning tract participation's definition can represent a high financial unbalance.
- iv) Finally, the fourth reason is the fact that some fields, are composed of two or more reservoirs, and only one of them is unitized, which usually generates the necessity of sharing facilities that belong to different contractors. Albacora field, for example, is a Post-salt field in the Campos basin, located inside the pre-salt polygon. Nonetheless, a new reservoir was discovered in the pre-salt geological context, and this reservoir (and only this one) unitizes with an open area.

¹⁸ Luciana P Braga and Olavo B David, 'Why the Unitization Process is an Important Issue When Dealing with the Brazilian Pre-Salt Polygon' (2018) 11(1) *Journal of World Energy Law & Business*, 17–33.

¹⁹ For more information about the Brazilian fiscal regimes, see: 'Oil in Brazil: Organization and Fiscal Regimes' Luciana Braga. *Encyclopedie de l'Energie* <<https://www.encyclopedie-energie.org/en/oil-in-brazil-organization-and-fiscal-regimes/>> accessed 11 January 2023.

²⁰ This agreement awarded to Petrobras the right to explore and produce up to 5 billion barrels of oil but the fields discovered by Petrobras—linked to this agreement—have estimated reserves much higher than 5 billion barrels. The excess volume was granted through production-sharing contracts. In order to have two contracts governing the same area, co-participation was the solution found so that the production resulting from two contracts could be shared fairly among all parties.

Thus, in the same vein as unitization, co-participation obliges interested parties (assignee on one hand, contractors in production sharing contract regime—PSC—and the PPSA on the other) to unify development and production activities, electing a single operator to carry out operations in both contracts. Co-participation, like unitization, is a kind of unification of the operations. According to David and others, 2021, co-participation may be understood as a 'unitization in time', since, through it, 'volumes that would be produced later to those extracted under TOR regime can be extracted concurrently'.

The pre-salt geological configuration and the methodology chosen to define the limits of the blocks in this area, led to several processes of unitization.²¹ Regardless of these complexities, ten UAs were signed and effective (ie, approved by the ANP) and eight are under negotiation, according to PPSA,²² within the last 9 years.

In Brazil, the construction of an appropriate regulatory system took place after successive steps. The first unitization legal provision came with the poorly elaborated (and currently revoked) Article 27 of Petroleum Law, in 1997. In the absence of any regulation, the concession contracts, used since the so-called round zero E&P contract (from 1998 onwards), established some guidelines to be used in a possible unitization. The first regulation regarding unitization was published only in 2013 (ANP Resolution no 25/2013, currently ANP Resolution no 867/2022). The National Energy Policy Council (CNPE) later published its Resolution no 08/2016, focusing specifically on unitization involving open areas. Then, the resolution established by the ANP underwent two changes, one in 2017, focusing on provisions that dealt with open areas, and in 2020, making simpler changes related to the form.

In view of the complexity of unitization in pre-salt for the reasons presented, it is important to keep the Brazilian regulatory system adequate to attract investments and protect the public interest. Thus, seeking constant regulatory improvement, this article proposes to consider the good practices, the contractual models developed by industry associations and the codes of conduct, already used as a reference by Brazilian regulators in an incipient way. These non-state rules, the result of self-regulation by the upstream sector of the oil industry, will be considered in this article as transnational rules, following Halliday and Shaffer's²³ approach on transnational legal order, which will be presented in the next section.

4. A NEW APPROACH TO UNDERSTANDING THE REGULATORY SYSTEM OF UNITIZATION: THE TLO

Introducing the TLO

This article presents a comprehension of the regulatory system for unitization beyond the still predominant positivist doctrine, and beyond the duality between national and international orders, also supported by Ost and Kerchove.²⁴

Halliday and Shaffer²⁵ propose the existence of a new legal order, which they call the TLO. The TLO comprises the rules that make up the national legal order, the international legal order and the transnational rules.

Transnational rules

The transnational rules are non-state rules that cannot be classified as national or international rules. They cannot be considered national because they are not created within a national legal order, by state agents. Within the logic of the positivist doctrine, a rule is deemed to be national if a competent State actor creates it, providing that it follows the procedures established in the country's Constitution and the other norms subordinated to it.

²¹ The post-salt blocks were delimited in order to encompass the geological structures and reservoirs then known (and in a mature stage of exploration and production) within the geological context of the post-salt. However, despite the discoveries of the even more prolific pre-salt geological formations, which took place in the mid-2000s, the existing (concession) contracts were fully preserved, including with regard to their contractual areas, which corresponded to blocks designed, as seen, based on the geological context of the Post-salt. Thus, in several development and production areas of oil and natural gas (eg, Lula/Tupi, Jubarte, Albacora, Tartaruga Verde, Sapinhoá, among others), and even in areas under exploration (such as Carcará, Sagitário and Uirapuru), it was found that the pre-salt reservoirs extrapolated the blocks designed for the post-salt, which extend, especially, to open areas. This fact not only led to the occurrence of numerous unitizations, but also increased the complexity of each process.

²² PPSA, 'Acordos Assinados' <<https://www.presalpetroleo.gov.br/acordos-de-individualizacao-de-producao/acordos-assinados/>> accessed 11 April 2023.

²³ Halliday and Shaffer (n 4).

²⁴ François Ost and Michel Van de Kerchove, *De la pyramide au réseau?: Pour une théorie dialectique du droit* (Publications des Facultés universitaires Saint-Louis 2002).

²⁵ Halliday and Shaffer (n 4).

Transnational rules also cannot be considered international rules, as they are not created by actors who have a personality under international law. According to Resek,²⁶ individuals, companies, and non-governmental organizations do not have legal personalities under international law. Therefore, they cannot formally create international rules. Pursuant to Public International Law theory, only the norms issued by sovereign countries and intergovernmental organizations (IGOs) can be considered part of the international legal order.

Within the regulatory system for the unitization, the pertinent transnational rules are model contracts, industry practices and foreign regulations.²⁷ Despite being created by sovereign countries, foreign regulations cannot be considered international rules. This is because foreign regulations are prepared within the national legal order of a given producing country, without the sovereign participation of the state that uses them as a reference to create its own rules.

Beyond the positivist doctrine

Verifying how the transnational rules interact with the regulatory system for unitization, it is observed that the positivist logic is insufficient to understand this system. The positivist logic only recognizes as valid the rules created by the State, following the procedures established in the country's Constitution. According to this logic, the national legal order would be a closed system, hierarchically structured based on the country's Constitution.

From a positivist perspective, a national regulatory system would be composed only of specific constitutional based rules for the petroleum industry. These rules are the law that organizes this sector (Petroleum Law), the resolutions that establish the industry operation rules within the producing country, the E&P contracts and the unitization agreements negotiated by the interested parties and submitted for Government contingent approval. International conventions created by IGOs would also integrate this system after being ratified. Transnational rules are simply disregarded by positivist doctrine.

Lex Petrolea

In the effort to understand the presence of transnational rules in the regulatory system for the upstream sector of the petroleum industry, some scholars defend the existence of the *lex petrolea*, a group of rules completely autonomous from national and international legal orders.²⁸ De Jesus²⁹ argues that companies operating in the upstream sector have developed their own rules for governing transnational petroleum contracts. He also rejects the adoption of national law to resolve disputes arising from such contracts.

However, this article does not adopt this interpretation, since there are hardly any rules completely independent from the State³⁰ and the transnational rules enforcement system, primarily arbitration, depends on the acceptance of the State.³¹

Transnational legal order

Therefore, TLO was chosen as the better approach to understanding the regulatory system for unitization in an integrated way as a system formed by national, international, and transnational rules.³²

²⁶ Francisco Rezek, *Direito internacional público: Curso elementar*– (17a edição Saraiva 2018).

²⁷ Another type of transnational standard relevant to regulatory systems are codes of conduct, which are compilations of good practices on a given subject. In the research on which this article is based, no codes of conduct on unitization were found.

²⁸ R Doak Bishop, 'International Arbitration of Petroleum Disputes: The Development of a Lex Petrolea' (1998) Yearbook of Commercial Arbitration 1131. A Timothy Martin, 'Decommissioning of International Petroleum Facilities evolving Standards and Key Issues' (2003) 1(5) Oil, Gas & Energy Law; John Bowman, *Lex Petrolea: Sources and Successes of International Petroleum Law* (KSLaw 2015); Alfredo De Jesus, 'The Prodigious Story of the Lex Petrolea and the Rhinoceros Philosophical Aspects of the Transnational Legal Order of the Petroleum Society' (TPLI Series on Transnational Petroleum Law, 2012); Julian Cardenas Garcia, 'Best Industry Practices and Environmental Regulation for Offshore Petroleum Operations. A Contribution to the Study of the Lex Petrolea' (Transnational Petroleum Law Institute Series on Transnational Petroleum Law, 2012).

²⁹ De Jesus *ibid*.

³⁰ Ralf Michaels, 'State Law as a Transnational Legal Order' (2016) IC Irvine Journal of International, Transnational, and Comparative Law, 141.

³¹ Terence Daintith, 'Against "Lex Petrolea"' (2017) 10(1) Journal of World Energy Law & Business, 1–13.

³² For more information about the adoption of TLO approach to understanding the regulatory system for unitization, see: Luciana Palmeira Braga, 'The Brazilian Regulatory Systems for Unitization and Offshore Decommissioning: An Analysis of the Transnational

Halliday and Shaffer³³ characterized the TLO, differentiating it from the national legal order and international legal order. For these authors, TLO would be 'less an overcoming than a transcending of the state', a new order that does not suppress the State concept but extends beyond its powers and requires looking beyond the national lens.

According to Halliday and Shaffer,³⁴ the TLO's objective is to, directly or indirectly, influence legal institutions within nation-states. Thus, the transnational rules orbit around the national and international order and are valid because they interact, influence, and affect these orders.

Halliday and Shaffer³⁵ characterized this third order, differentiating the TLO from the then consolidated national legal order and international legal order. For the authors, TLO would be 'less an overcoming than a transcending of the state', a new order that does not suppress the State concept but extends beyond its powers and requires looking beyond the national lens.

To understand the regulatory system for unitization in an integrated way as a system formed by national, international and transnational rules, this article adopts the methodological approach of Halliday and Shaffer³⁶ that proposes the existence of a new legal order, which they call the TLO.

The unitization regulatory system under the approach of TLO

Based on the structure offered by TLO, the national, international and transnational rules that make up the regulatory system for unitization will be presented below.

National rules

According to Worthington,³⁷ the national rules related to unitization are petroleum laws, unitization regulations, and E&P contracts.

Within the positivist logic, petroleum law is the highest norm in the hierarchy of this tripartite legislative framework, just below the Constitution. The petroleum law establishes the policy and objectives that must be observed to elaborate specific regulations on unitization. According to Worthington,³⁸ the petroleum law must cover the following subjects:

Reasons for Unitization; Confirmation of Straddle; Notification to Regulator; Subsurface Appraisal; Requirement of Commerciality; Unitization Trigger; Negotiating the UUOA; Referral to Expert; Uncooperative Coventurers; Unallocated Tracts; Regulatory Enforcement of Petroleum Statutes.

Unitization regulations generally detail the specific rules for the unitization process provided for in petroleum law. However, as Worthington³⁹ reported, some oil-producing countries have unitization regulations without the petroleum law giving specific rules for this matter.

These regulations represent the main legislative governance of petroleum unitization, providing practical issues to reach the unitization agreement. They regulate onshore and offshore; domestic or cross-border unitization, jointly or separately.

E&P contracts, in their three conventional forms—concession, production sharing and risk service agreements⁴⁰—generally bring specific rules for unitization that deal with operational and fiscal issues. For Weaver and Asmus,⁴¹ oil-producing countries prefer to use E&P contracts to regulate unitization, rather than establishing rules in laws or regulations. This preference is

Legal Order' GAEL – Laboratoire d'Economie Appliquée de Grenoble <<https://theses.hal.science/tel-03578881>> accessed 5 April 2023.

³³ Halliday and Shaffer (n 4).

³⁴ *ibid.*

³⁵ *ibid.*

³⁶ *ibid.*

³⁷ Worthington (n 1).

³⁸ *ibid.*

³⁹ *ibid.*

⁴⁰ Claude Duval and others, *International Petroleum Exploration and Exploitation Agreements: Legal, Economic and Policy Aspects* (2nd edn, Barrows Company 2009).

⁴¹ Jacqueline L Weaver and David Asmus, *Unitizing Oil and Gas Fields Around the World: A Comparative Analysis of National Laws and Private Contracts*, SSRN Scholarly Paper (Social Science Research Network 2006).

explained by the fact that E&P contracts are prepared by administrative regulation of the licensing authority. Most of the time, there is no need for legislative approval, which simplifies the regulation process through these contracts.

International rules

The international rules for unitization are related to cross-border unitization. This type of unitization deals with a typical international petroleum deposit. In the words of Onorato,⁴² ‘an international common petroleum deposit is a single petroleum structure or field which underlies in part the territory of two or more States. Such a deposit may be situated on land or offshore’. In this case, international treaties are drawn up to establish a specific regime for the joint exploitation of petroleum resources, harmonizing the regulations particular to each oil-producing country. Worthington⁴³ reports that these agreements were recurrent in the North Sea, where international treaties were signed to regulate cross-border unitization. Among the fields that were submitted to these treaties, he points out: Frigg, Murchison, Statfjord and Markham.

Another international rule on unitization that stands out is the United Nations Law of the Sea Convention (UNCLOS). Cameron and Stanley⁴⁴ highlight the relevance of this convention for cross-border unitization in maritime waters.

Some principles of international law apply to cross-border unitization, such as the principles of cooperation, prevention of waste, and protection of correlative rights. Lima and Ribeiro⁴⁵ highlight the rule of customary law. According to this rule, each State has, in principle, concerning its neighbouring State, the duty of notification, negotiation, and cooperation, regarding the exploitation of ‘deposits’ that go beyond an agreed or potential boundary.

Transnational rules

There are three types of transnational rules that are relevant to unitization: (i) good international industry practices, (ii) model contracts and (iii) foreign regulation. Despite the fact that there is no code of conduct related to unitization, the research by Weaver and Asmus⁴⁶ and Worthington⁴⁷ point out a set of good international industry practices for unitization that could support specific codes of conduct for this area. The subsequent information will detail these transnational rules related to unitization.

Industry practices

Good international petroleum industry practices, or simply industry practices, can be defined as practices and procedures generally accepted, adopted by petroleum companies worldwide, under similar conditions and circumstances.⁴⁸

The unitization practice emerged as an industry practice in a context of campaigns against the Rule of Capture adoption, led by Henry Doherty, the mentioned director of the API, that proposed a statute for unitization.⁴⁹

Nearly all domestic unitization rules require industry practices to be followed. These should be considered when drafting the national unitization rules, the UA, and the Unit Operating Agreement (UOA).

⁴² William T Onorato, *Legislative Frameworks Used to Foster Petroleum Development*. Policy Research Working Papers (The World Bank 1999).

⁴³ Worthington (n 1).

⁴⁴ Peter D Cameron and Michael C Stanley, *Oil, Gas, and Mining: A Sourcebook for Understanding the Extractive Industries* (World Bank Publications 2017).

⁴⁵ Juliana Cardoso Lima and Marilda Rosado de Sá Ribeiro, *Unitização e desafios* (Revista Brasileira de Direito do Petróleo, Gás e Energia 2012).

⁴⁶ Weaver and Asmus (n 41).

⁴⁷ Worthington (n 1).

⁴⁸ Julian Cardenas Garcia, *Reflexiones sobre la Educación y la Práctica del Derecho Transnacional Petrolero* (Transnational Petroleum Law Institute 2015).

⁴⁹ Kramer and Anderson (n 7).

Worthington⁵⁰ emphasizes that the first concern must be regarding the correct terminology used to describe the operations related to unitization. The very use of the term ‘unitization’ can be considered as an industry practice. This author reports that other words are misused to describe this process, such as unification, individualization of deposits, unitary work programme. There are also incorrect uses of terms to refer to the UA, such as cooperative agreement or to refer to the unitization as field consolidation, coordinated petroleum activities, or joint development.

Worthington⁵¹ also reports the inconsistency in the use of terminology in the rules on unitization that make up the regulatory structure of a host country (HC). This inconsistency occurs, for example, when, to refer to the unitization process, the Petroleum Law uses one term; the regulation uses another, and E&P contracts use a different word.

Another issue related to international practices comes when considering that unitization’s main objective is to define the track participations (TPs) to get closer to the Pareto Optimum. In this case, the industry practices used for calculating and evaluating the reservoir volume, related to sub-surface operations, assume great importance in the process of unitization.

The calculation of TPs is carried out from technical studies driven by fluid and reservoir character. According to Worthington,⁵² ‘(t)he most commonly utilized bases can be grouped into static, dynamic and hybrid bases, where the last category encompasses some combination of the first two’.

Concerning static bases, Worthington⁵³ cites the following methods as examples: Initial Hydrocarbon Pore Volume (IHPV) and Hydrocarbon Initially in Place (HIIP), considered as high-level bases, and Net Acre Feet (NAF) and Surface Acres (SA) as lower-level bases. On the dynamic bases, this author cites the following examples: Movable Hydrocarbons Initially in Place (MHIP), Estimated Ultimate Recovery (EUR) and Estimated Economic Recovery (EER), considered by this author as high-level bases, and Total Recoverable Volumes (TRV) and Total Estimated Recovery (TER) as lower-level bases. There are also hybrid bases, which combine factors of the static and dynamic bases. As examples, Worthington⁵⁴ cites the following arrangements: Gas initially in place (GIIP) and Transmissibility (T); Net acre-feet (NAF) and Production over a specified period time (Pt); Stock tank oil initially in place (STOIP) Production over a specified period time (Pt).

Worthington⁵⁵ points out that it is necessary to choose the bases that result in a ‘single numerical outcome’ with a deterministic ethos, and to avoid the geo-mathematical approach, which ‘assumes a range of uncertainty associated with each parametric input and uses inferred probability distributions to generate a range of outcomes’. Thus, it will be easier to audit and replicate the results from calculating the reservoir volumes, a task that must be performed by each party involved and by the HC body responsible for the UA approval.

However, Anderson⁵⁶ highlights that there are two ‘fundamental’ ways to analyse the TP:

Under the historical idea that the concessionaire owns the oil in the ground (ownership in place rule, eg, Texas), all other things being equal (which they seldom are), the tract participation should be determined based upon the oil in place beneath each tract. But based on the modern idea that the concessionaire only owns the oil after production (non-ownership in place rule, e.g., Oklahoma), all other things being equal (which they seldom are), the tract participation should be determined based on the oil that each block could produce. Due to geology and reservoir mechanics, one block might naturally produce more of the reservoir’s oil (e.g., because it is higher on the geologic structure such as at the top of an anticline) than the other block—especially if the reservoir was a water drive reservoir.

⁵⁰ Worthington (n 1).

⁵¹ *ibid.*

⁵² *ibid.*

⁵³ *ibid.*

⁵⁴ *ibid.*

⁵⁵ *ibid.*

⁵⁶ Owen L Anderson, ‘Why Unitizations are so Difficult?’ Interview. 2020.

According to Worthington,⁵⁷ '(t)here are several different algorithms available for calculating tract participation, and these are governed by the technical basis that is selected'. Therefore, these algorithms are the 'good international subsurface practices that are used to define tract participation'. These industry practices will be debated and disseminated by the industry, in a general way, within the scope of professional organizations that bring together petroleum geologists, geophysicists, and petroleum engineers.

Worthington⁵⁸ lists five professional associations most relevant for unitization, whose standards aim to define Industry practices from the point of view of the subsurface:

These are the American Association of Petroleum Geologists (AAPG); the European Association of Geoscientists and Engineers (EAGE); the Society of Exploration Geophysicists (SEG); the Society of Petroleum Engineers (SPE) and the Society of Petrophysicists and Well Log Analysts (SPWLA).

Simões Filho⁵⁹ emphasizes the considerable differences in the calculation formulas adopted by each of these professional organizations. There are also differences in the adopted nomenclature and rigour concerning the required data. He uses the example of measuring the oil depth variable to illustrate these differences. The SEC is more restrictive in obtaining these data, accepting only the values for as far as it was able to measure. This organization only works with proven, developed or undeveloped reserves. The SPE is even more flexible, allowing more freedom of interpretation. This organization admits other classifications in addition to the proven reserves, such as probable and possible reserves.

Simões Filho⁶⁰ informs that the details of these calculations are confidential. However, during the negotiation of the UA, the formulas must be presented to the parties. Thus, the parties can audit the percentages obtained for the definition of each participation. A confidentiality agreement is usually required to ensure data non-disclosure.

After analysing 90 regulatory frameworks about unitization, Worthington⁶¹ states that there is little material to guide regulators for the application of industry practices in the regulatory context of each HC. This author cites the experience of India, which has developed a guideline, compiling the industry practices to be adopted in the Indian oil industry. However, Worthington⁶² points out that among the practices listed in this guideline, few apply to the unitization process, and they are insufficient to guide the regulator. Thus, there is a gap to be filled, the elaboration of specific codes of conduct for unitization, which could be published by IGOs, industry associations or informal networks among actors in the upstream sector interested in unitization.

Model contracts

Model contracts are adopted by the petroleum industry to assure the benefits of standardization, reducing costs and increasing efficiency. Upstream contracts are complex because they often involve long-term, large investments, sophisticated technology, increased exposure to risks, compliance issues and other difficulties. By trying to use their specific contractual versions in the negotiations, the parties will spend more time and hence more resources to come up with similar solutions. Therefore, the negotiation time of these contracts may extend for months or years. Thus, it is more efficient for such parties to hold discussions in industry associations, represented by their specialized professionals, to negotiate such contractual models, and to commit themselves to constant updates. According to Martin and Park,⁶³ standardization 'can save months of management time in each and every negotiation' since it reserves only a small part for the parties to

⁵⁷ Worthington (n 1).

⁵⁸ *ibid.*

⁵⁹ Interview granted by Ivan de Araújo Simões Filho, a SEG's regional coordinator for Latin America from 2005 to 2009, on 29 September 2020.

⁶⁰ *ibid.*

⁶¹ Worthington (n 1).

⁶² *ibid.*

⁶³ A Timothy Martin and J Jay Park, 'Global Petroleum Industry Model Contracts Revisited: Higher, Faster, Stronger' (2010) 3(1) *Journal of World Energy Law & Business*, 4–43.

negotiate and draft. For Ost and Kerchove,⁶⁴ this contract standardization generates stability in contractual relationships and networks of economic partnerships.

UA negotiation involves complex issues, requiring multidisciplinary specialists (economists, lawyers, accountants, engineers and geologists) to participate in discussions. This technical complexity and the diversity of opinions in finding the ‘perfect’ participation formula⁶⁵ can make negotiations long and complicated. For Worthington,⁶⁶ contractual models, together with clear and understandable regulations, can help make negotiation more efficient and less costly.

Specifically, regarding unitization, the contractual models that apply are the Unitization Agreement and the Unit Operation Agreement. Cameron and Stanley⁶⁷ highlight the role of the ‘Association of International Energy Negotiators’ (AIEN), the ‘Petroleum Joint Venture Association of Canada’ (PJVA), the ‘API’, and the ‘Foundation for Natural Resources and Energy Law’ in drafting these agreements.

However, during negotiation, other more general contractual models can also be adopted. As already mentioned, during the preliminary negotiation phase, the Confidentiality Agreement, the Joint Well Agreement, and the Joint Studies Agreement (David, 1996) are often signed.

Foreign regulation

Foreign regulations from oil- and gas-producing countries with more experience in petroleum operations are generally adopted as a reference in drafting a regulatory system for unitization. As stated earlier, compulsory unitization was adopted in US-producing states regulation and later this practice was replicated in other oil and gas-producing countries.

This next section will analyse how the transnational rules cited influence the Brazilian regulatory system for unitization on its rulemaking and interpretation process.

5. EVIDENCE OF TLO’S INFLUENCE ON THE BRAZILIAN REGULATORY SYSTEM FOR UNITIZATION

The influence of TLO on the Brazilian regulatory system for unitization was verified in the rule-making process of the national rules and the interpretation of these rules.

Rule-making process

In the case of the Brazilian regulatory system for unitization, foreign regulation from other producing countries was primarily brought into the national regulation rule-making process indirectly. In the first phase of the regulatory framework, in which the Petroleum Law and the concession contract were drawn up, foreign regulatory references were brought in by the consulting companies Expetro⁶⁸ and Gaffney Cline. During the review of the regulatory framework, in which the Pre-salt Law, PPSA Law, TOR Law, and the Libra PSA were drawn up, the foreign regulation references were mainly brought in by ANP, Brazilian Development Bank (BNDES), and Energy Research Office (EPE) technicians. A few missions took place to learn about regulation at that time. Specifically, the visits to Angola and Russia Governments stand out. For the construction of the ANP and CNPE Resolutions for unitization, the reference to foreign regulations was added by ANP technicians, representatives of the private foundation Brazilian Petroleum and Gas Institute (IBP) and interested petroleum companies.

⁶⁴ Ost and Van de Kerchove (n 24).

⁶⁵ Weaver and Asmus (n 41).

⁶⁶ Worthington (n 1).

⁶⁷ Cameron and Stanley (n 44).

⁶⁸ Expetro was a consultancy company made up of retired Petrobras technicians with considerable international experience, as they worked at Braspetro. Braspetro was created to carry out Petrobras campaigns in Iraq, in North Africa. Braspetro discovered the Majnoon field in Iraq in 1975, among the largest fields in the world. But soon after, the contract was terminated and compensated by Saddam Hussein. And the indemnity money was used to expand Braspetro in other areas. Braspetro operated in the Arab countries, the countries of North and West Africa, Latin America, the Gulf of Mexico and the English and Norwegian North Sea.

The first concession agreement

As previously reported, the Petroleum Law contained only one provision for unitization. The regulation of this practice was established in the concession contracts.

According to Bill Cline,⁶⁹ the first concession agreement was drafted based on Gaffney Cline's experience in developing and fitting petroleum contracts into the underlying technical (resources and costs) and legal realities. Among the regulations that this consultancy company managed, those that stand out are the contracts of Venezuela (the 1995 Association Agreement and the 1997 3rd Round), Australia, Indonesia, the UK and the Norwegian North Sea.

During the elaboration process of the first concession contract, debates were held at IBP with the objective of obtaining contributions for this process. Ribeiro⁷⁰ (2020) recalls that Thomas Walde took part in these discussions, presenting the United Nations guidelines for upstream sector regulation. Simões Filho also recalls that Daniel Yergin, head of IHS consultancy, was hired by IBP to discuss some requests from companies interested in participating in the first bidding round and to present some associated good practices.

Regarding the construction of the unitization clause of the first round concession contract, Cline reports that Gaffney Cline's view had been considerably influenced by the unitization experience in the North Sea in the early-mid 1990s. Specifically, the consultant recalls that from 1989 to 1990 Gaffney Cline was commissioned by 13 large IOCs (all of the majors plus some large independents) to develop standards, principles and procedures to expedite and standardize what at that time was a very inefficient, acrimonious and lengthy process.

Pre-salt Law

Foreign regulations also influenced the rulemaking process of the Pre-salt Law. To support the construction of this Law, ANP, EPE and BNDDES researched the regulation of other producing countries.⁷¹

It is reasonable to state, from the study of this research, that the unitization regulations of the Pre-salt Law are comparable to those of Norway and Indonesia in some respects. Concerning Norway, similarities occur in the requirement for the submission of the UA, the need for UA approval by the regulatory agency, and the definition, by the regulatory agency, of each party's rights and obligations in cases where there is no agreement. Regarding Indonesia, Brazilian regulation is similar concerning the need for companies to notify the regulatory agency after verifying the existence of a shared deposit.

ANP Resolution

The drafting of the ANP Unitization Resolution of 2013 was based on some transnational rules. In the ANP Technical Report no 116/2012,⁷² which discusses the ANP Unitization Resolution

⁶⁹ Interview granted by Bill Cline, consultant of Gaffney Cline, on 13 October 2020.

⁷⁰ Marilda Rosado de Sá Ribeiro, 'The Beginnings of Brazilian Upstream Regulation' Interview. 2020.

⁷¹ In 2007, ANP prepared a comparative analysis of Brazilian E&P contracts and those adopted by the following countries: Saudi Arabia, the USA, Russia and Venezuela. The result of this analysis was entitled: Models of contracts for oil and natural gas exploration and production: a critical analysis of the Brazilian experience and selected countries. ANP also carried out missions to Angola and Russia to learn about the experience of these countries in adopting PSCs.

EPE prepared several studies in 2008. Among them, the study 'Aspectos conceituais dos sistemas regulatórios de exploração e produção de petróleo e gás natural e a experiência internacional - Relatório A do Grupo de Trabalho MME-EPE' (Conceptual aspects of regulatory systems for exploration and production of oil and natural gas and the international experience—Report A of the MME-EPE Working Group) stands out in the context of this article. This study analysed the E&P regulatory systems of 10 HCs (Algeria, Angola, Azerbaijan, Kazakhstan, Colombia, Indonesia, Iran, Libya, Venezuela, Norway), focusing on analysing the tax regimes of each HC.

BNDDES also prepared studies to support the rulemaking process of the Pre-salt Law. The first was launched in December 2008, under the name 'Estudos sobre o Pré-sal' (Studies about Pre-salt). It analysed the international experiences of the Middle East and North Africa (MENA), Norway, the USA (Alaska) and Canada (Alberta) HCs, with a focus on managing revenues from petroleum exploitation.

The second study published by BNDDES in June 2009, was named 'Estudos de alternativas regulatórias, institucionais e financeiras para a exploração e produção de petróleo e gás natural e para o desenvolvimento industrial da cadeia produtiva de petróleo e gás natural no Brasil' (Studies of regulatory, institutional and financial alternatives for the exploration and production of oil and natural gas and for the industrial development of the oil and natural gas production chain in Brazil). This study made a brief presentation on the various rules that make up E&P regulation, including the unitization issue. The regulations of the following HCs were analysed: USA, United Arab Emirates, Norway, Angola, Indonesia, Mexico, Saudi Arabia, Venezuela, Russia and Nigeria.

⁷² 'ANP—Consulta e Audiência Públicas no 5/2013' <<https://www.gov.br/anp/pt-br/assuntos/consultas-e-audiencias-publicas/indice/2013>> accessed 28 April 2013.

rulemaking process, there are references to the UOIA model contract from AIPN (current AIEN) from 2006, the UK regulation on transboundary unitization, and the doctrine of HCs with more experience on this subject (USA and UK in this case). This statement can be seen from the excerpt of the cited report below:

It was adopted as bibliographic references the following resources: “Petroleum, Industry and Governments: An Introduction to Petroleum Regulation, Economics and Government Policies” by Bernard Tavene; “International Petroleum Exploration and Exploitation Agreements: Legal, Economic & Policy Aspects” de Claude Duval e outros; the article of AIPN, “Unitizing Oil and Gas Fields Around the World: A Comparative Analysis of National Laws and Private Contracts”, by Jacqueline Lang Weaver and David F. Asmus, and also the guidelines of Department of Energy and Climate Change (DEEC), of UK: “UK-Norway. Trans-Boundary Oil & Gas Fields: Guidelines for Development of Trans-Boundary Oil & Gas Fields”.

The criterion for defining the initial TPs (Original Volume of Equivalent Oil), an industry practice, was expressly mentioned in the ANP Resolution for Unitization to be adopted preferentially in the negotiations of the UA signed in Brazil.

Furthermore, during the preparation of the initial version of this Resolution, IBP and the companies involved in potential unitization processes provided their suggestions for the public consultation process. These suggestions reflected industry practices and international regulations.

The ANP Unitization Resolution no 25/2013 first amendment considered the suggestions of IBP and the companies involved in unitization processes, especially those involving open areas. In its presentation during the public hearing, IBP stated that its proposal was based on the best practices in the petroleum industry, as can be seen in the transcript: ‘IBP’s proposals for improving Resolution ANP 25/2013 are based on the best practices of the petroleum industry’.⁷³ The second amendment of the ANP Unitization Resolution included the requirement for information on track participation, as provided for in the UA models contracts.

Interpretation

Regarding the TLO for the upstream sector’s influence on the interpretation of the Petroleum Law unitization provisions, the clearest example is related to the sole paragraph of Article 27. This provision, currently revoked, dictated that when the parties did not reach an agreement, ANP would determine, based on the arbitration report, how the rights and obligations would be equitably appropriate. The term ‘arbitration report’ caused ambiguity and may be interpreted as an arbitration award or as an administrative decision.⁷⁴ Many different interpretations have ensued, as Bucheb⁷⁵ reported in his work, based on industry practices.

It is possible to affirm the influence of TLO on the interpretation of the Brazilian unitization regulation for the first UAs that involved open areas located in the pre-salt polygon, notably those of the Tupi (former Lula) and Sapinhoá fields. In the Tupi’s UA, ANP informs the parties that the criteria for redetermination should be dealt with in a UOIA, not in the UA. Additionally, the

⁷³ IBP, ‘IBP Presentation for the ANP Public Hearing about ANP Unitization Resolution’ 2017.

⁷⁴ It is worth to note that the dubiousness reflected in the aforementioned legal provision was fully clarified with the new rules on unitization brought by the Pre-salt Law in its arts 33–41. In art 34, the Law prescribes essential clauses for unit agreements, stipulating, among them, ‘dispute settlement mechanisms’. However, art 40, when prescribing the administrative solution in the event of an impasse in the voluntary unitization, establishes that ANP, based on a technical report, will determine how the rights and obligations over the shared deposit will be appropriated, notifying the interested parties to sign the respective agreement in the form administratively indicated by the ANP, under penalty of termination of the E&P contracts (art 41). In short, the parties have the power to submit an agreement for voluntary unitization production to the ANP for deliberation. If they are not successful in adjusting the agreement, the ANP administratively determines the way in which the rights will be appropriated, and the obligations shared between the interested parties. From the effective date of the unitization agreement, however, the dispute resolution body is no longer administrative, becoming the one defined (and approved by the ANP) in the UA itself, which, in Brazilian practice, in line with the model contracts, legislation and industry best practices, has been the submission of the dispute to international arbitration.

⁷⁵ Jose Alberto Bucheb, *Direito do Petróleo: A Regulação das Atividades de Exploração e Produção de Petróleo e Gas Natural no Brasil* (1aEd, Lumen Juris 2007).

industry practices related to the equalization of past costs and production (balance correlative rights) are mentioned by BG, one of the parties to negotiate Tupi's UA.

Another example that demonstrates the influence of transnational rules in the interpretation of Brazilian regulation on unitization is the adoption, in the UAs submitted to the ANP, of the clause dealing with TP. This information is not required by the ANP Unitization Resolution, but it appears in the model contracts related to unitization. All UAs, submitted to ANP after the publication of this Resolution, contained this information, emphasizing the importance of model contracts in the interpretation of the unitization regulation.

It is worth noting that, when Article 27 of the Petroleum Law was in effect, private agreements followed the contractual model of the AIPN UUAO of 2006, as reported by Araujo.⁷⁶ Following the implementation of the Pre-salt Law, David⁷⁷ reports the adoption of the AIPN's Accounting Procedures model's private unitization covenants; some clauses from the AIPN's UUAO model; and the Expenses and Volumes Equalization Agreement, primarily developed by Petrobras and PPSA for UA involving open areas placed in the pre-salt polygon. However, the version of the signed UAs submitted to ANP for approval is very brief. In the public version of the UAs, only the information required by ANP is provided.⁷⁸

6. HOW TRANSNATIONAL RULES CAN CONTRIBUTE TO MINIMIZING UNITIZATION SHORTCOMINGS

Although unitization is considered the best method for producing a shared reservoir efficiently and fairly as affirmed by Weaver and Asmus,⁷⁹ the unitization process represents some risks and has some flaws. The risks may arise from the asymmetry of information resulting from unequal data collection, absence of effective regulation and suspicions/mistrust in negotiation. According to Anderson⁸⁰ unitization allocation is challenging since reservoirs are generally heterogeneous, parties have unequal geological knowledge of the reservoir and geological context of the area and the E&P contracts involved are not always identical.

According to Libecap and Smith,⁸¹ in certain circumstances, the unitization procedure might not result in the pareto optimal outcome, penalizing some of the participants. After analysing the regulation on the unitization of ninety HCs, in an update of the study by these authors, Worthington⁸² describes some shortcomings that prevent the pareto optimum from unitization.

Knowing how transnational rules can influence the regulatory system of unitization, allows us to analyse these failures by considering how transnational rules can assist us in dealing with them. Public and private actors, adding expertise and jointly thinking about solutions, can build a more efficient regulation concerning these shortcomings.

Shortcomings related to information asymmetry

Shortcomings related to information asymmetry occur when agreements do not have good data sharing mechanisms. When the company that has collected the most data feels hampered by disclosing them to the other party, the tendency is to hide such data. According to Worthington,⁸³ it is easy to omit the data, given that many companies do not have centralized management for data acquisition, continuity, storage and management. This problem is aggravated when the parties' conflicts are submitted to arbitration, resulting in a slower process. Another example is the non-

⁷⁶ Gregório Da Cruz Araújo, *Coordenação, Contratos e Regulação: Um Estudo Teórico e Empírico Acerca dos Acordos de Unitização* (Universidade Federal do Rio de Janeiro 2009).

⁷⁷ Olavo B David, 'PPSA's Experience in Negotiating UA involving Brazilian Pre-salt Areas' Interview. 2020.

⁷⁸ Luciana Palmeira Braga, 'Pre-sal: Individualização da Produção e os Contratos Internacionais de Petróleo' Série EDB (Edição: 1a, Saraiva 2014).

⁷⁹ Weaver and Asmus (n 41).

⁸⁰ Anderson (n 56).

⁸¹ Gary Libecap and James Smith, 'Regulatory Remedies to the Common Pool: The Limits to Oil Field Unitization' (2001) 22(1) *Energy Journal*, 1–26.

⁸² Worthington (n 1).

⁸³ *ibid.*

uniformity of available information, leading to information asymmetry, primarily related to technical data, distorting the fairness, equitability and Pareto-optimization of the unitization process.

In Brazil, this problem can be seen in the UA negotiation between the Polvo and Tubarão Martelo fields. Even though there is a legal requirement for this directive, the concessionaires' disagreement over data sharing prevented them from signing the UA and, as a result, to put on production the shared deposit.

Another example is related to UA negotiations involving Petrobras. This company operates 94.5 per cent of the fields that produce oil and 95.6 per cent of the fields that produce gas. This situation provides Petrobras with a knowledge of Brazilian geology that no other company could possibly have, which gives it an advantage in UA negotiating.

Perhaps, a model confidentiality agreement established expressly for this situation, jointly by regulators and company associations, could aid in the sharing of information and lessen the imbalance in this situation.

Shortcomings related to inefficient regulation

Shortcomings related to inefficient regulation occur when regulation on the ownership of petroleum subsurface resources establishes that underground resource property is private. Remedies like well spacing regulations and pooling will not wholly prevent the Rule of Capture.⁸⁴

Another example occurs when there is no effective regulatory prescription and no rules imposing the unitization process when a shared reservoir is identified. Even if a voluntary unitization tries to be negotiated, the absence of regulations can lead to contractual failures.

Failure to enforce regulation is also another example of shortcomings. The lack of due diligence on the regulator's part to enforce the unitization can lead to failure to assure compliance with unitization statutes and implementing petroleum regulations.

When legislation is over-prescriptive and imposes an unnecessary cost, the unitization process result can be harmed, leading to another shortcoming. According to Worthington, 'a unitization legislator should leave detailed subsurface prescription to be formulated by the coventurers in a UUA', avoiding over-prescription. However, the ANP Resolution for unitization details the procedures that must be adopted to define the TP. It also determines that the Original Volume of Equivalent Oil criterion should be adopted preferentially. During the public hearing to discuss this resolution's revision, IBP⁸⁵ expressly requested excluding the prescription from the preferential criteria, indicating that the details were not adequate.

To address this shortcoming, codes of conduct that bring together the best practices related to unitization, created by a collaborative process between regulators and company associations could be efficient mechanisms to guide petroleum companies and regulators in the performance and monitoring of operations.

Shortcomings related to trading

Disparate TPs can make negotiation difficult, especially when they are highly disproportionate, such as when one party has 99 per cent, or more, and the other party has 1 per cent or less. This disproportion can lead the party with more participation to impose conditions or even to carry out the capture if allowed. This problem occurs in Brazil, especially concerning Petrobras, which, due to its monopoly history, tends to have greater participation in E&P projects.

⁸⁴ According to Worthington, the practice of onshore well spacing is adopted in the USA, Canada and other producing countries. It is a practice applied, especially in neighbouring producing properties, where there is a risk of capture. This practice requires a minimum spacing between the wells to be drilled. However, small landowners may have their requests for drilling permits hampered by not having enough space as required by regulation, which can lead to the drainage of production by others. Pooling is a practice that complements the regulation that establishes well spacing. As Weaver and Asmus (2006) explained, to achieve the required size in the regulation that sets the minimum spacing for drilling wells, small tracts of land are grouped into drilling units or spacing units. This author argues that, like unitization, pooling prevents unnecessary well drilling but is more suitable for the primary recovery phase of production. And a fair share of the unit well's production is granted to each owner of land pooled. However, according to Worthington (2020), the effectiveness of pooling is limited in eradicating the effects of the Rule of Capture, although they help preserve equity, especially for the minority shareholders in a given onshore accumulation. Only unitization, according to this author, imposes project efficiency and effectiveness and also improves the aggregate economics relative to competitive development.

⁸⁵ IBP, 'IBP Presentation for the ANP Public Hearing about ANP Unitization Resolution' 2017.

Unaligned commercial priorities, related to the difference in the priority level that each party will give to the shared reservoir development also make negotiation. The parties with greater participation will be more interested in developing the reservoir quickly. Those with less participation may prefer to postpone this asset's development, generating a conflict of interest. This disparity can also occur due to the corporate behaviour of the companies. Majors may have different strategies to deal with unitization processes than those of independent companies.

Analysing the unitization negotiations performed in Brazil, an example that can be cited is Lorena and Pardal fields in a UA negotiation between Petrobras and Potiôleo, an independent Brazilian company. As Araújo⁸⁶ described, it was a unitization process that involved companies of quite different sizes. Petrobras, a leading company in the Brazilian market with international operations, and Potiôleo, a company with local-level operations. Production in a mature onshore field was necessary for Potiôleo, but it was not a priority for Petrobras. Consequently, the negotiations lasted for seven years which was the most extended negotiation period for a Brazilian UA negotiation reported by Bonolo and Almeida.⁸⁷

Another example of shortcomings related to trading occurs when there are multiphase reservoirs. When a reservoir has oil and gas it is a challenge to convert gas volumes to barrels of oil equivalent to determine TPs. Almost all of the production fields in the pre-salt polygon produce oil and gas, which includes the Sapinhoá field, according to the ANP Monthly Production Bulletin of February 2023.⁸⁸

Post-production unitization also creates difficulties in negotiation.⁸⁹ When the production has already started in one field (brown–green fields) or both fields (brown–brown fields), it is challenging to balance correlative rights and fairness with maximizing economic returns, especially through enhanced-recovery scenarios. The Lula/Tupi field UA illustrates this problem; one of the obstacles in this field's UA negotiation was the definition of the methodology to be adopted to reimburse the Brazilian Government. As the holder of the open area rights, where the shared deposit was extended, the Brazilian Government must receive its share in the volume produced since 2010 until the UA signature, in an agreement known as the Equalization of Expenditures and Volumes Agreement.

Anderson⁹⁰ highlights the delay that arises in reaching an agreement as a serious risk to unitization. He points out the Talos Zama discovery as an egregious example. The Zama Field overlaps Talos's Block 7 and a Pemex area, all of which are situated offshore in Mexico. The discovery was made in 2017 and no final investment decision is forthcoming because Pemex refuses to negotiate the TPs and a UA. In order to avoid problems like that, Anderson suggests that fairly strict deadlines must be set in advance. Another illustration of this weakness is the 7-year-long UA negotiations between Petrobras and Petróleo for the Lorena and Pardal fields. Regarding varying tract participation, unaligned commercial priorities and the delay in reaching a UA, an efficient regulation can help to solve these shortcomings. Brazil can do research to find good references of foreign regulation in experienced producing countries. Aside from that, Brazil now has more than adequate experience with unitization processes and may be a good reference for foreign oil and gas producing countries dealing with unitization. Concerning the multiphase reservoir shortcoming, it is important to consider good industry practices to establish the criterion for defining the initial TP. Regulators need to distinguish these practices in order to guide companies. Codes of conduct that guide the criteria for defining the TP according to each situation, drafted by the actors involved in the unitization process, are also recommended.

⁸⁶ Araújo (n 76).

⁸⁷ Daniel D Bonolo and Mateus Passeri de Almeida, 'Ten Years of Unitization in Brazil' Rio O&G 2012, Rio de Janeiro, Brazil.

⁸⁸ Boletim da Produção de Petróleo e Gás Natural. ANP (2023) <<https://app.powerbi.com/view?r=eyJrjoiZjZhZDliMTYtOWIyZi00OGYSLWJkYzItOTQ1MzFjZGMzMDNkIiwidCl6lGjQOTmNGZmLT10YTYtNGI0Mi1iN2VmLEtEYNGFmY2FkYzIxMy99>> accessed 6 April 2023.

⁸⁹ According to Anderson (n 56), this is one reason why US unitization practices are not a model for use elsewhere. Except where federal lands are involved (and even in this case, the practice is not universal), nearly all field-wide unitization negotiations begin after production has started in the USA. Instead, the US states rely on 'spacing and drilling/production units' that typically are designed for only one well or perhaps several horizontal wellbores, but not for the entire field.

⁹⁰ Anderson (n 56).

Model contracts designed to balance correlative rights can help address the post-production unitization shortcomings.

For Worthington,⁹¹ industry practices coupled with effective regulatory governance and diligent unit management can curb the shortcomings listed above, as well as the risks related to regulatory changes.

7. CONCLUSION

This article aimed to present a new approach to understanding the regulatory system for unitization. By adopting Halliday and Shaffer's theory on transnational legal order, it was sought to confer validity to non-state rules related to unitization and thus understand the regulatory system for unitization in an integrated way. In this sense, it was possible to understand this system composed of national, international, and non-state rules referred to as transnational rules in this article.

In the context of the regulatory system for unitization, transnational rules assume great importance. As reported in Section 2, unitization emerged as an industry practice, and later, when incorporated into the regulations of several American countries, it began to be replicated in other oil-producing countries. Industry practices related to the methodology for defining these interests are critical for the main purpose of unitization, which is the determination of interests among holders of exploration and production rights.

By analysing the Brazilian case, this article showed how transnational rules are already entangled in the regulatory system for unitization in this country. Transnational rules assumed an important role during the rulemaking process of the main norms on unitization and also in the process of interpretation of these rules.

As supported by Worthington,⁹² unitization will not always lead to the best result. This author lists the main shortcomings, which were exposed in this article, and argues that transnational rules can contribute to minimizing them. In Brazil, where this process is common and complex, as reported in Section 3, it was possible to identify examples of all the shortcomings identified by Worthington.

Thus, it is important that all those who deal with this practice, especially those who deal with unitization in Brazil, become increasingly aware of the transnational rules related to unitization.

⁹¹ Weaver and Asmus (n 41).

⁹² Worthington (n 1).