

Oil and Gas Service Contracts around the World: A Review¹

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Abstract

This paper reviews the energy strategy and oil and natural gas fiscal systems of eight major oil or natural gas producing countries which have either adopted a variation of a service contract or have shown interest in this framework as an alternative to production sharing contracts over the period 1990 to 2014. In particular, we look at each country's variation of service contract, and examine how these variations of service contracts are different from each other. A service contract is a long-term contractual framework that is used by some host governments to acquire the international oil companies' expertise and capital without having to hand over the field and production ownership rights to them. Our review suggests that the new interest in service contracts might be explained partially by heightened sovereignty concerns and the political environment on one hand, and the need for international oil companies' capital and know-how in developing oil and natural gas fields in the host countries on the other. In our review, we also explore some of the drawbacks of service contracts including the potential for economically inefficient outcomes. In addition, we look at some possible solutions for improving the economic efficiency of service contracts.

Keywords: oil service contracts, energy strategy review, oil and natural gas producing countries

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1. Introduction

In recent years, some oil and natural gas producing countries have shown an increasing interest in adopting variations of service-type contracts rather than production sharing contracts or concessions in their oil and natural gas development and exploration projects. A service contract² is a long-term contractual framework that governs the relation between a host government and international oil companies (IOCs) in which the IOCs develop or explore oil or natural gas fields on behalf of the host government in return for pre-determined fees and in which in most cases the host government does not hand over the control of the extracted or subsoil or sub-surface resources to the IOCs.³

The move towards service contracts is reminiscent of a similar transition towards production sharing contracts away from concessionary systems starting in 1966 in Indonesia.⁴ While opposition against international oil companies' control over the world oil prices and sovereignty issues over natural resources might have been the main driving factors behind the adoption of production sharing contracts in the 1960s (Machmud, 2000), it seems that the new interest in service contracts might be explained partially by heightened sovereignty concerns on one hand, and the need for international oil companies' capital⁵ and know-how⁶ in developing oil

² The term service contract can also refer to oilfield service contracts. There are oilfield service firms, such as Halliburton, Schlumberger and Baker Hughes, that provide oilfield services and that may specialize in services such as drilling. These firms are awarded oilfield service contracts to fulfill particular jobs as part of broader development or exploration plans. Sund and Hausken (2012) analyze when an operator and a service provider prefer a fixed price oilfield service contract, common in the oil and gas industry, versus the uncommon incentive-based oilfield service contract. In this paper, we focus on service contracts between host governments and international oil companies, not on oilfield service contracts between an operator and a service provider.

³ In some variations of service contracts such as Venezuela's third round operational service agreements, the IOCs may enjoy more benefit than usual service contracts in terms of sharing the profit oil, and therefore have some degree of control over the produced crude. However, in general, service contracts do not have a profit sharing mechanism.

⁴ In August 1966, the first version of a production sharing contract was signed between Indonesia's state owned company, PERTAMINA, and Independent Indonesian American Petroleum (IIPCO) group (Machmud, 2000).

⁵ The degree of need for the IOCs' capital varies in each country and for different projects inside a country. In some cases, a country's bad credit rating may leave the country no other option than to fund the projects through the IOCs' capital and pay back them later. This could be the case in production sharing as well. In addition, the IOCs might have access to cheaper capital compared to what is available for the host governments. In other words, it might be cheaper for the countries to borrow from the IOCs than to finance their development projects through other sources. In the case of Iraq, due to the fast cost recovery mechanism embedded in the technical service contracts, it may look that the country did not need the IOCs' capital. However, the total cost of development of all the awarded fields in the first two <Footnote continues next page.>

and natural gas fields⁷ in the host countries on the other. As argued by Ghandi and Lin (2012) for the case of Iran, several major OPEC and non-OPEC oil producing countries have found service-type contracts a means to address both sovereignty concerns, which mostly are reflected in these countries' constitutions and petroleum laws and regulations, and the need for IOCs' capital and expertise capabilities. As we describe for each of the eight countries we examine in this paper, the political environment is a contributing factor for the heightened sovereignty concerns and the move toward service-type contracts as well.

In the late 1980s and early 1990s, service-type contractual frameworks started to appear in the political economy of several major oil or natural gas producing countries. Venezuela, Kuwait and Iran signed their first of such contracts in 1991, 1992 and 1995, respectively. More recently Iraq, Mexico, Bolivia, Ecuador and Turkmenistan have signed new service contracts, or have shown more interest in adopting variations of service-type contracts rather than production sharing contracts in order to explore and develop their oil and natural gas fields.

This paper presents a short review of service contracts in the above eight countries. First, we compare service contracts and production sharing contracts and provide some reasons for the move towards service contracts. We then discuss some potential drawbacks of service contracts, mostly due to the loss of profit through time, which is interpreted as economic inefficiency. In addition, we look at some possible solutions for improving economic efficiency of service contracts. Then we discuss thoroughly the oil and natural gas fiscal system in each of the eight countries mentioned above. In particular, we study each country's variation of service contract, and how these variations of service contracts are different from each other. We also examine the political environment and other sources of heightened sovereignty concerns in each country. Finally, we conclude with an emphasis on the sovereignty concerns as an explanatory factor for the move towards the service contracts and the consequence of such decisions in terms of economically inefficient outcomes.

rounds may suggest that financing through government annual budget was really hard and may be impossible (personal communication with industry experts).

⁶ In addition to the need to IOCs capital, the participation of the IOCs allows the government to benefit from their know-how. The know-how is sometimes bigger than just the technology. It also includes project management in terms of how the capital is invested since IOCs have better advantage on the process and structural system of managing large scale investment (personal communication with industry experts).

⁷ This is particularly the case for mature fields that require enhanced oil recoveries or fields in more challenging locations.

2. Service versus Production Sharing Contracts

Table 1 summarizes some of the differences between four petroleum fiscal regimes: concessions, production sharing contracts, and service contracts. In this section we focus on comparing service contracts with production sharing contracts.

In a service contract, similar to a production sharing agreement, the closest legal framework, the international oil company brings the technology and makes the upfront capital investment. However, in contrast to production sharing contracts, in a service contract the IOCs agree to a pre-determined return in lieu for sharing profit oil. In addition to the IOC's method of compensation, service contracts and production sharing contracts could also differ in four other major categories: field ownership rights, produced crude ownership rights, field's operatorship, and the degree of risk that each side bears. These differences are summarized in Table 1.

One main driving factor why many countries are adopting a variation of service contracts is their concern for maintaining their sovereignty over their natural resources. Under a service contract, countries maintain field ownership and in most cases produced crude ownership rights as well, and do not have to allocate them to the foreign company. Countries are interested in adopting service contracts because service contracts enable them to give up less control over the fields and over the produced crude to foreign oil companies while still using the expertise of these companies.

With production sharing contracts, sovereignty concerns arise in part because these contracts give decision-making power to the international oil companies in handling the development/exploration and operation. Under a production sharing contract, countries share produced crude ownership rights with the foreign company.

When countries relinquish their sovereignty over their natural resources, there is a lower potential for proper oversight from the host government over the international oil companies' operation, which is in part due to the many different regulatory, supervisory and operatorship roles that the state-owned oil companies usually have to play at the same time in these countries.

Another source of sovereignty concerns that arise from production sharing contracts is the tax code or some institutional deficiencies that could prevent the host governments from efficiently collecting rent from the international oil companies. As a result, while there have been efforts in some oil producing countries that have demonstrated interests in service contracts to reform the tax code in order to attenuate some of the sovereignty concerns arising from production sharing, the lack of political will and public support, due in part to institutional problems, have made the implementation of production sharing very difficult.

While a service contract may better address sovereignty concerns, the framework is prone to huge potential losses in profit, as shown by Ghandi and Lin (2012) and Ghandi and Lin (2014a) for Iran's buy-back service contract and Iraq's producing field technical service contract,

respectively.⁸ In both studies, the state-owned oil companies' objectives diverge from dynamic profit maximization, which is one of the factors causing service contracts to be economically inefficient. In fact, adopting a dynamic profit maximization policy as a means to increase the economic efficiency of the service-type contract is a common recommendation suggested by both studies for both cases of service contracts in Iran and Iraq.

The service contract framework is prone to huge potential losses in profit even if the host government adopts a dynamic profit maximization policy. Even though both Ghandi and Lin (2012) and Ghandi and Lin (2014a) show that adopting dynamic profit maximization objectives, as opposed to objectives of maximizing undiscounted revenue or of maximizing cumulative production through time, could yield more economically efficient outcomes, the adoption of such a policy might not be enough to make the outcomes under a service contract efficient. The uncertainty is due to the fact that the dynamic profit maximization concept requires making incessant optimal decisions through time. In particular, such a policy requires that in each period, the operator updates its decision on the optimal production quantity and also its optimal new well drilling plan⁹ based on updated oil market price forecasts, reserves estimates, required capital and operation cost and other determinant factors.

However, since the IOCs' remuneration are pre-determined in association to the production profile through the lifetime of the contract, the current service contracts lack the necessary tools for adopting the dynamic profit maximization objectives by the state-owned oil companies. Specifically, in terms of Iran's buy back service contracts, the IOCs' remuneration entitlement is contingent upon following pre-determined contractual profile for specified amount of time. Under such requirements, deviation from the contractual production levels might be hard even though the operator finds it optimal (Ghandi & Lin, 2012). In the case of Iraq, the IOCs' per barrel remuneration is in close association to reaching and staying at the production plateau target in the production plateau period (Ghandi & Lin, 2014a) without any mechanism in place to decide on the production level optimally in each period.

Under production sharing on the other hand, it is more likely that the IOCs, in partnership with the state-owned oil companies, follow dynamic profit maximization objectives. This is because under production sharing the IOCs are given decision making power and ownership rights over the produced crude, and decisions are made over the whole field in conjunction with their state-owned oil company partner. Therefore, IOCs and their state-owned oil company partner are more likely to achieve higher economic efficiency under production sharing framework than the service contract.

⁸ These two papers discuss in detail evidence for the existence of such economic inefficiency in the case of Iran's Soroosh and Nowrooz buy back service contract and Iraq's Rumaila producing field technical service contract, respectively.

⁹ The choice of well drilling plan in addition to production is modelled by Ghandi and Lin (2014a) for the case of Iraq.

Despite the drawbacks to service contracts, these contracts have the potential to be improved within the service contract framework.¹⁰ As Ghandi and Lin (2014a) show for the case of the Rumaila producing field technical service contract, in comparing the most likely scenario to be realized with the optimal outcome under the conditions of the contract (their “TSC optimal” scenario), there is a potential for a profit gain as high as 56 to 83 billion dollars for the varying and high well productivity cases, respectively. It is therefore still possible to improve the efficiency of outcomes under a service framework.

Now that we have established the differences among service-type and production sharing contracts, and the reasons for countries to move towards service contracts, we describe the current state of service-type contracts in each of the eight above mentioned countries.

¹⁰ The adoption of service contracts may also affect the ability of host governments to attract investment by international oil companies. Ghandi and Lin (2014b) analyze risk factors specific to Iran’s buy-back service contracts that can contribute to a reduction in the rate of return for the international oil company. They show that there is a potential for modifying the contracts in order to make them more attractive to the international oil company, enabling the international oil company to face an actual rate of return closer to the contractual rate of return even if the contract faces cost overrun or delay, without exceeding the maximum contractual return that the National Iranian Oil Company is willing to give.

Table 1: Petroleum Fiscal Arrangements

	<i>Concessionary System</i>	<i>Contractual System</i>	
	Concession	Production Sharing Contracts	Service Contracts
Oil Field Ownership	IOC	NOC	NOC
Crude Production Ownership	IOC	IOC/NOC	NOC
Oil Field Operator	IOC	IOC	IOC/NOC
How the IOC is Compensated	N/A	A share of production	Flat fee
Who Bears the Risk	IOC	IOC/NOC	IOC/NOC

Notes: IOC denotes “international oil company”. NOC denotes “national oil company”.

3. Summary of Service Contracts around the World

As shown in Table 2, there are at least eight countries around the world that have pursued or shown interests in service contracts. Each country, however, has pursued its own variation of service-type contracts, and often more than one variation. The fact that each country uses its own unique name for its contracts reinforces that the contracts are not the same.

Table 2: Summary of Countries and their Variations of Service Contracts

Iran	Buy-Back Service Contract First Generation (First Signed in 1995)	Buy-Back Service Contract Second Generation (First Announced in 2004)	Buy-Back Service Contract Third Generation (First Signed in 2009)	Iran's New Plans for More Attractive Contracts Including Variations of Iraq's Technical Service Contracts or Potentially Production Service Contracts (2014)
Kuwait	Service Contract (First Signed in 1992)	Operating Service Contract (First Announced in 1999)	Enhanced Technical Service Agreement (First Signed in 2010)	Oil Field Service Contract (2013)
Venezuela	Operational Service Agreements (First Round Auctioning in 1991)	Operational Service Agreements (Second Round Auctioning)	Operational Service Agreements (Third Round Auctioning in 1997)	Service Agreements were Converted into "mixed enterprise" Frameworks with Majority Stakes for PDVSA (2006-7)
Mexico	Multiple Service Contract (First Announced in 2001)	Incentive-Based Multiple Service Contract (First Announced in 2009)	Incentive-Based Multiple Service Contract (Second Round Licensing in July 2012)	Integrated Exploration and Production Service Contract (Third Round Licensing in July 2013)
Bolivia	Operations Contract (First Announced in 2006)	Operations Contract (First Bidding Round in 2012)	Additional Incentives Introduced to the Operations Contract (April 2012)	Additional Incentives Introduced for Exploration Operations Contract (May 2013)
Ecuador	Service Contract (First Announced in 2007)	Incremental Production Contract (First Signed in February 2012)	New Licensing Round on 13 Exploration Blocks (December 2013)	Integrated Specific Service Contracts over 16 Mature Fields for Enhanced Oil Recovery (Jan 2014)
Iraq	Producing Field Technical Service Contract (2009)	Development and Production Technical Service Contract (2009)	Technical Service Contract (Third Round Auctioning in 2010)	Technical Service Contract (Fourth Round Auctioning in 2012)
Turkmenistan	Risk Service Contract (First Announced in 2008)			

4. Service Contracts' Major Differences

Table 3 presents five major categories in which the service contracts in Iran, Iraq, and in Venezuela's three auctioning rounds differ from each other: the capital cost decision interaction between the IOC and the national oil company (NOC); the allocation of ownership rights of the produced crude; the allocation of the developed field's operatorship rights; remuneration; and how risk is shared between the IOC and the NOC.

With regards to the IOC/NOC capital cost decision interaction, Iran is different from the other two countries' service-type contracts due to the IOCs' limited options regarding the capital cost ceiling once the contract is signed. That is because in most Iran's buy back service contracts, IOCs do not have the option to change the capital cost level after they sign the contracts, and such limitation could increase the IOCs risk in these contracts. (Ghandi & Lin, 2014b)

For the case of Iraq, the capital cost decision interaction could be an issue since the Iraqi government might find it too costly to achieve the production plateau target. As a result, they may limit the IOCs' capital expenditures. In doing that, the Iraqi government might increase the economic inefficiency in the contracts. (Ghandi & Lin, 2014a)

In Venezuela's third round service contract, the IOCs are entitled to a portion of the produced crude. That is one unique feature of the Venezuela's third round contracts, since in the other service contracts the state-owned oil company retains ownership of the produced crude.

For the operatorship rights of the developed fields, while Iran holds the right for its own state-owned subsidiaries, it is usually the IOCs who operate the fields under service contracts. The operatorship could also be a source of economic inefficiency as shown by Ghandi and Lin (2012) in Iran's Soroosh and Nowrooz buy-back service contract.

Since IOCs usually do not share the profit oil in a service-type contract, the remuneration is the only source of the profit for their investment. In Iran's buy-back service contracts, the remuneration is calculated in association to a fixed rate of return for the IOCs in the project. However, in Iraq and Venezuela's first two rounds service contracts, the remuneration is based on per barrel production. In the third round, Venezuela has also experienced a sliding mechanism for the IOCs remuneration based on the project rate of return.

Finally, not all service-type contracts are similar with regards to the IOCs' risk exposure. Service contracts differ in how risk is shared between the IOC and the NOC. In addition, while capital cost overrun could be the main source of the risk for the IOC in Iran's buy-back service contracts (Ghandi & Lin, 2014b), it might not be the case in other types of service contracts.

Table 3: Main categories in which the service contracts in Iran, Iraq, and in Venezuela's three rounds are different

	Iran BBSC	Iraq TSC	Venezuela OSA (1st & 2nd)	Venezuela OSA (3rd)
Capital Cost Decision Interaction	No leverage for the IOC	IOC/NOC	IOC/NOC	IOC/NOC
Produced Crude Ownership	Iran	Iraq	Venezuela	IOC/Venezuela
Oil Field Operator	Iran	Joint Company	IOC	IOC
Remuneration	Fixed in accordance to the IOC Rate of Return in the Project	Per Barrel Production	Per Barrel Production	Based on the Project Rate of Return
Who Bears the Risk	IOC	IOC/NOC	IOC/NOC	IOC/NOC

5. Venezuela's Service Contracts

Venezuela tried an interesting and complicated service-type contractual approach between 1991 and 1997 with three rounds of auctions of operational service agreements on 34 fields. During this same time period, Venezuela also pursued two other contractual frameworks: joint ventures¹¹ and risk exploration agreements.¹²

In the first two rounds of the operational service agreements, the IOCs' recovery included the initial investment plus interest (capital fee) and additional per barrel production operation fee to cover the IOCs' operation cost and profit without sharing the profit oil. The payments to the IOCs were in U.S. Dollars to guard against any exchange rate risk and were adjusted to the U.S. Energy CPI.

The third round operational service agreements were different since the IOCs were entitled to a portion of the produced crude through a sliding mechanism based on the projects' internal rate of return in each year and an incremental value of the production, which is the market value of the produced crude of the same year minus that year's capital cost, royalties and administration fees. In fact due to the internal rate of return sliding mechanism and the allocation of crude to the IOCs based on the market value, the third round operational service agreements are considered close to production sharing contracts (Manzano & Monaldi, 2010). Russia's 1994 Sakhalin II contract, which was the country's first of three production sharing contracts with a consortium of IOCs lead by Shell, is a good example of a contract with a rate of return sliding mechanism. The Russian government is entitled to the 10% (50% after two years) and 70% of the produced crude once the operator's¹³ rate of return reaches 17.5% and 24% respectively (Rutledge, 2004).

In 2006-2007, the new Venezuelan administration forced the IOCs to accept the conversion of their operational service agreements into "mixed enterprise" frameworks with majority stakes for the Venezuela's state-owned oil company *Petróleos de Venezuela, SA* (PDVSA). The contractual changes along with the implementation of the new windfall tax code in 2008 were implemented in order to increase the government overall take mostly on round three operational service agreements due to the greater size of the proven reserves and the higher

¹¹ Four joint ventures, known as extra heavy oil association agreements, were formed between the state-owned PDVSA, as the minority stakeholder, and four consortia of IOCs with majority of stakes, to develop the world's largest extra heavy crude reservoir of Orinoco Oil Belt (Manzano & Monaldi, 2010).

¹² Eight areas were auctioned in 1996 through risk exploration agreements, which led to three commercially viable discoveries without any further deals (Manzano & Monaldi, 2010).

¹³ Sakhalin Energy Investment Company is the contractor and operator of Sakhalin II contract. The initial stakeholders include Marathon Oil (30%), McDermott (20%), Royal Dutch Shell (20%), Mitsui & Co. (20%) and Mitsubishi Corporation (20%). Later, in 2000, the company structure changed to Shell (55%), Mitsui & Co. (25%) and Mitsubishi Corporation (20%) (Rutledge, 2004). In 2007, Russia's state-owned Gazprom bought 50% plus one share of SEIC from Shell for \$7.45 billion (RIA Novosti, 2007).

number and productivity of the fields under this type of contract (Manzano & Monaldi, 2010).¹⁴ Overall, the peak production of operational service agreements in 2006 reached 600,000 barrels per day, which was beyond the targeted goals of the Venezuelan government.

Even though the round three operational service agreements had included an internal rate of return-based sliding mechanism, the previous tax code, before modification in 2008, did not have such a mechanism to adjust for the higher royalties and income taxes that the PDVSA and IOCs had to pay as a result of the oil price hikes. The lack of such a mechanism in the tax code was one justification behind the 2006-2007 expropriation of all contracts in Venezuela, including the operational service agreements (Manzano & Monaldi, 2010).¹⁵ In addition to the tax code, another reason behind the 2006-2007 expropriation of all contracts in Venezuela might also have been the broader objectives of the Venezuelan administration, who wished to transform autonomous institutes such as PDVSA into agents of the government, to gain more control over the crude production (Ramón, 2010).

Overall, 25 international oil companies are in partnership with the PDVSA through the “mixed enterprise” or mixed venture framework. These mixed enterprises produce about 800,000 conventional, heavy and extra heavy crude oil. Recently, due to Venezuela’s economic problems including high inflation rates (56%) and shortages of construction raw materials such as steel and cement, mixed ventures operations have faced high costs. As a result, the IOCs in the mixed ventures have raised their objections to the current mixed enterprise business models. The IOCs would like three significant changes in the mixed ventures. First, they prefer their capital expenditures, in the form of direct loans, to be transferred directly to their mixed enterprises as oppose to the PDVSA. Second, the IOCs try to reduce their tax burden. Finally, the IOCs would like to have the mixed enterprises to be operated and managed more independently with less interference of the PDVSA (Mogollon, 2014).

6. Kuwait’s Service Contracts

Since the early 1990s, Kuwait has pursued or shown interest in three variations of service-type contracts. The term service contract was used for the earlier version, which includes

¹⁴ While the first two rounds covered 16 fields with 1,725 million barrels of proven oil reserves, the third round covered 18 fields with 20,510 million barrels. Also, while the initial idea of operational service contracts was to allocate fields that require secondary operations, the third round included less mature fields with higher production potentials (Manzano & Monaldi, 2010).

¹⁵ Since Venezuela state-owned company signed the operational service agreements with IOCs and due to the country’s tax code at the time, PDVSA was responsible for paying the 16.67% royalties as well as the 67% oil income tax while the IOCs (operators) were to pay only the 34% non-oil income tax in all three rounds of the operational service agreements. This was also a major incentive for the IOCs (Manzano & Monaldi, 2010).

5 contracts with BP,¹⁶ Chevron, Shell, Exxon, and Total from 1992 until 1997. At the same time, the Kuwait Ministry of Energy and Kuwait Petroleum Company attempted another initiative, known as Project Kuwait, in order to open Kuwait's upstream to the IOCs even more. However, the attempt has faced long lasting opposition by the Kuwait Supreme Petroleum Council and the National Assembly since 1995. The opposition was based on Kuwait's constitutional restriction on foreign control of Kuwait's natural resources including crude oil.

In 1999, the Kuwaiti government announced a new variation of service-type contract known as an "operating service contract" according to which the government could restrain the control over the ownership of the crude in accordance to constitutional provisions. The dispute over the terms of the new service-type contract, which was part of a broader quarrel over the jurisdictions of different branches of the government, prevented any new deals (Stevens, 2008).

In 2010, Shell signed a new version of Kuwait's service contract, called enhanced technical service agreement to develop a natural gas field (Business Monitor International, 2011). Other IOCs including Chevron, on Burgan field, and ExxonMobil, on Ratqa heavy oil field, have also been in negotiations with Kuwait over enhanced technical service agreement terms (Petroleum Intelligence Weekly, 2011).

Even though Shell's enhanced technical service agreement was considered as a model framework, a probe investigation conducted by Kuwait's parliament over this deal contributed to Kuwait's decision to halt awarding similar contracts to other international oil companies (Energy Compass, 2014). In addition, due to ExxonMobil opposition to enhanced technical service agreement's terms, negotiations over Ratqa heavy oil field were abandoned in June 2013 (Energy Compass, 2014). In October 2013, however, KOC announced its determination to hire service companies to fulfill the Ratqa heavy oil field first phase development plan which includes engineering, procurement and construction for a 60,000 barrels per day target production by 2017 (Strouse, 2013).

7. Iran's Buy-Back Service Contracts

Iran signed its first buy-back service contract on March 6, 1995¹⁷ with Conoco Oil Company¹⁸ (Alikhani, 2000), which was followed by several other service contracts. While

¹⁶ Kuwait had its first service contract with BP in 1992 (Middle East Economic Digest, 2010).

¹⁷ Conoco Oil Company backed of the deal on March 20, 1995 following President Clinton executive order on March 15, 1995, which prohibited any "contract for the financing of the development of petroleum resources located in Iran" (Alikhani, 2000, p. 183).

¹⁸ ConocoPhillips after the merger in 2002

Iran's service contracts are all called buy-back service contracts, their frameworks represent at least three generations of service-type contracts in the country. Shiravi & Ebrahimi (2006) discuss the framework that is used for development projects and a more recent one for exploration and development starting in 2004. In 2009, the National Iranian Oil Company (NIOC) signed a buy-back service contract with the Chinese Sinopec International Petroleum E&P Corporation in which Sinopec is allowed to make a final decision on the capital cost level up to two years after the start of the contract (Ghandi & Lin, 2014b). This accounts for the third type of buy-back service contracts in Iran. For more on Iran's buy-back service contracts, see Ghandi and Lin (2012); Ghandi and Lin (2014b); and van Groenendaal and Mazraati (2006).

Between 2005 and 2013, Iran's production potential declined significantly from 4.2 to 2.6 million barrels per day due to the US and EU oil and financial sanctions and embargos. However, along with recent and continuing efforts to ease the relations with the West in 2013 and 2014, Iran's new administration is also trying to bring back the international oil companies to the country by potentially introducing new contractual frameworks that are more attractive than its buy back service contracts (Energy Intelligence Finance, 2013).

8. Mexico's Multiple Service Contracts

Mexico announced the adoption of its first version of service contracts, known as multiple service contracts, in 2001. At the time, these contracts were for non-associated natural gas development projects only. Until then, the state-owned *Petróleos Mexicanos* (PEMEX) had relied heavily on oilfield service contracts with smaller work scopes in return for fixed service payments, as the only framework in utilizing foreign capital and expertise. However, in multiple service contracts, PEMEX awards multiple services combined in a single long-term framework to the international oil companies. In general, the decision to adopt the multiple service contracts framework was taken as a way to invite foreign and private investment in the natural gas (upstream)¹⁹ sector, while also accounting for the country's strict constitutional exploration and production restrictions (Soto, 2005).

The natural gas sector was chosen for three reasons. First, PEMEX's limited financial resources had been concentrated on keeping the country's oil production,²⁰ the source of 35% of the Mexican government revenue through PEMEX tax payments (Morales, 2011). Second,

¹⁹ Since 1994, the North American Free Trade Agreement (NAFTA) has opened up Mexico's natural gas downstream to private and foreign investment without any constitutional changes regarding state-owned PEMEX's sole rights in the oil and natural gas sector (Morales, 2011).

²⁰ PEMEX oil production peaked at 3.38 million barrels per day in 2004 (Morales, 2011).

PEMEX also relies on unsustainable borrowing to finance its oil upstream efforts (Soto, 2005).²¹ The decision to adopt the multiple service contracts was taken to relax some pressure on its oil upstream financial concerns. Third, PEMEX faced a difficult task in meeting high domestic natural gas demand, coming mostly from the power sector (Soto, 2005). By using multiple service contracts in natural gas projects PEMEX would be able to increase the country's domestic natural gas potential. Overall, Mexico has held two bidding rounds from 2003 for non-associated natural gas blocks (Kerr, 2009) with five multiple service contracts awarded in the first round and two awarded in the second round (Kerr & Hunter, 2005).

In order to make the contracts more attractive especially for the regions with more technical difficulties, including the deepwater Gulf of Mexico, and to be able to have larger IOCs with more capabilities, the Mexican government announced a new version of incentive-based multiple service contracts²² in 2009 (Dow Jones International News, 2009). This policy was challenged by Mexican Congress in courts. In December 2010, the Mexican Supreme Court ruled in favor of adopting the new incentive-based multiple service contracts, which paved the way for a new bidding process for three fields that require secondary enhanced oil recovery (Morales, 2011). Among 17 companies that were qualified to participate the bidding process (Business News Americas, 2011a), PEMEX awarded three incentive-based oil exploration and production multiple service contracts on three mature fields to two companies (Economist Intelligence Unit - ViewsWire, 2011).²³ PEMEX has also started the process of a second bidding round on incentive-based multiple service contracts for 6 northern areas with mature fields (Business News Americas, 2012). Sixteen companies were pre-qualified in the second round (Kerr, 2012a) and PEMEX offered incentive-based service contracts also known as performance-based service contracts in four out of the six blocks that were originally on offer (Kerr, 2012b).

In December 2012, PEMEX started the process of the third licensing round on the Chicontepec Basin. For this round, 6 blocks were on offer and 16 companies were pre-qualified. However, PEMEX only awarded service contracts on three blocks to companies with lowest per

²¹ In 2003, of a total of \$37.1 billion in Mexican government's borrowings, \$10.9 billion were used to finance PEMEX's upstream operation (Soto, 2005).

²² Incentives could be considered for fulfilment of activities such as "seismic processing and interpretation, geological modeling, fields engineering, production engineering, drilling, facility design and construction, facility and well maintenance and natural gas transportation Services." (Soto, 2005, p. 13). The incentive-based approach could also be used in order to persuade the private and foreign companies to increase their operation efficiency. Private companies are also offered incentives if they increase the reservoirs' recovery, or if their exploration and production activities increase PEMEX's reserves (Morales, 2011).

²³ A UK-based company and a Mexico-based company (Economist Intelligence Unit - ViewsWire, 2011) were awarded three incentive-based service contracts. However, since the Mexico-based company could not meet the requirements of the Carrizo field oil service contract, the contract was re-awarded to Dowell Schlumberger de Mexico, which had offered the second-lowest bid at \$9.40 per barrel oil equivalent (Dow Jones International News, 2011).

barrel fee as the main bidding category. Even though the third round licensing was held under similar 2008 energy reform proposal, the third round contracts also known as integrated exploration and production service contracts due to the additional exploration scope (Kerr, 2013a).

In December 2013, however, the Mexican president signed in to law the Mexican Congress approved new energy reform bill according which a newly formed government body, the National Hydrocarbons Commission, resumes the administrative role of awarding the contracts. In addition, the new law permits four contractual frameworks including service contracts, production sharing contracts, profit-sharing contracts and licenses (Kerr, 2013b).

9. Bolivia's Service Operations Contracts

Bolivia, with second largest natural gas reserves in South America,²⁴ adopted operations contracts as a variation of the service-type contractual framework following the 2004-2006 re-nationalization of the country's oil and natural gas sector. The re-nationalization of the state-owned oil and natural gas company Yacimientos Petrolíferos Fiscales Bolivianos (YPFB) as well as the forced conversion of all 44 contracts²⁵ (Vargas, 2007) to a service-type contractual framework were part of a major policy shift towards more state control over the hydrocarbon resources in Bolivia. Until then, and starting the 1990s, Bolivia had pursued a series of policy modifications²⁶ with the objective of opening up the hydrocarbon sector in order to incentivize private and foreign company investment in the country's up- and down-stream sectors. Such policies led to an increase in Bolivia's natural gas production and export potential. However, growing criticisms of the government's revenue under the new royalty/tax regime, combined

²⁴ Bolivia holds over 26 trillion cubic feet natural gas reserves as reported by Energy Information Administration (EIA) (2011) from *Oil & Gas Journal*.

²⁵ These 44 contracts include contracts with major IOCs such as Total, Repsol YPF, UK BG and Petrobras (The Oil Daily, 2006).

²⁶ In 1990, Bolivian National Congress, under the private-sector participation law, allowed 50-50 joint ventures at wellhead prices, known as operation and association contracts, for exploration and production with private and foreign companies. The 1990 law also opened the country's natural gas transmission and downstream to private sector. A few years later by mid 1990s and following the recommendations of international financial organizations, the Bolivian government announced another major policy modifications, including a new hydrocarbon law, of privatizing the state-owned YPFB; creation of a regulatory agency and stripping the YPFB from its regulatory roles; implementing a new royalty/tax code with clear royalty distinction of 18% for new and 50% for old fields and at the same time increasing the government take through direct income tax and allowing private and foreign companies to trade and market the produced hydrocarbons (Navajas, 2010).

with the economic slowdown since 1999 led to a series of events known as re-nationalization that also included the adoption of service-type contracts since 2004 (Navajas, 2010).²⁷

Under the new operations contracts in place since 2006, the YPFB has to pay to the government three types of royalties (amounting to 18% of production value) plus direct tax (32% of the production value) from the production gross revenue. The remaining amount minus the operating cost is the shared profit between the YPFB and the contractor, which is divided based on the production volume. This means that contractors are still entitled to a portion of the production without produced hydrocarbon ownership transfer.²⁸ However, under the new sliding mechanism the government's take is adjusted with the market value of the produced hydrocarbons in such a way that the sum of royalty and tax accounts at least for 50% of the value of the produced hydrocarbon (Vargas, 2007).

Based on the 2006 operations contractual framework, Bolivia had its first bidding round in 2012. In April 2012, the Bolivian President issued a decree to incentivize the operations contract by letting the operators to earn USD 30 per produced barrel oil equivalent fiscal credit note in addition to the USD 10 per barrel oil equivalent cash as outlined in the contracts. In May 2013, it was announced that the government is taking additional steps in incentivizing the exploration activities by having more flexible contractual terms based on the type of explored fields, sizes of reserves discoveries and also by arranging faster capital cost recovery for the contractor (Kerr, 2013d).

10. Ecuador's Service Contracts

Ecuador is the other South American country with a recent move from production sharing contracts towards service-type contracts (M2 Presswire, 2012). The move towards service-type contracts is part of a broader policy shift by the Ecuadorian government towards more state control over the oil sector. The other elements of such policy shift are the 90% windfall tax²⁹ on IOCs and the joint venture cooperation framework proposal between Ecuador's state-owned oil

²⁷ Four most important such events include the 2004 referendum on the 50% royalty and the status of the YPFB, the 2005 National Congress new law on additional 32% royalty and new rent distribution mechanism to entities such as universities and the army, which was followed by a Supreme Court ruling in favour of the re-nationalization and finally the 2006 presidential order to transform the joint ventures to service-type contracts (Navajas, 2010).

²⁸ As a result, operations contracts are also considered hybrid contracts between production sharing and service contracts (The Oil Daily, 2006). However, under operations contracts as reported for Repsol YPF (The Oil Daily, 2006), the contractors cannot book the proven reserves.

²⁹ Ecuadorian government also used the windfall tax as a means of pressure to persuade the IOCs to accept the new oil service contracts (Business News Americas, 2011b).

company, PETROECUADOR, and other countries' state-owned oil companies³⁰ for new oil exploration and production (APS Review Gas Market Trends, 2011). The process of persuading the IOCs to accept the transformation of their contracts to service contracts started in 2007 (Business News Americas, 2011b), and by 2010, eight service contracts were signed (Kerr, 2010).

In these new service contractual frameworks, the IOCs' cost recovery is based on agreed-upon flat fee (Business News Americas, 2011b), and the government takes are 85%-90% of the oil fields' revenue³¹ (Petroleum Intelligence Weekly, 2010). In February 2012, a joint venture of four companies, including Schlumberger Ltd. and Canadian Canacol Energy Ltd.,³² signed an incremental production contract, as a new variation of service contract, on two mature fields in northern Ecuador. The main scope of the contract is to increase the production of the two fields in return for U.S. \$39.56³³ per each additional barrel of produced crude. The contractors could also enjoy other benefits including a 50%-50% split of the gain from operation cost³⁴ reduction besides the per barrel reimbursement (Canada Stockwatch, 2012).

In December 2012, the Ecuador administration started licensing process of 16 exploration blocks under the general service contractual framework introduced in 2010 (Kerr, 2012c). Among the 16 blocks, foreign companies could bid on 13 blocks and three blocks were reserved for the state-owned oil company, Petroamazonas EP.³⁵ By December 2013, foreign companies/entities bid on three of the thirteen blocks. The Petroamazonas-backed consortium of several national oil companies also bid on one of the three reserved blocks, which brought the total bid offers to four out of sixteen offered blocks (Kerr, 2013c). In addition, Petroamazonas EP is in the process of offering integrated specific service contracts on 16 mature fields with enhanced oil recovery requirements. These new contracts will be aligned with earlier service contracts that Petroecuador had signed in 2012 (Kerr, 2014).

³⁰ These state-owned companies include Venezuela's PDVSA, Chile's ENAP and Indonesian PERTAMINA. However, Brazil's PETROBARS was not willing to accept new higher taxes on its operation on Block 31, or to convert its production sharing contract on Block 18 to a service contract. Also the company did not accept the joint venture proposal (APS Review Gas Market Trends, 2011).

³¹ This seems to be the overall government take. In the case of the Repsol YPF service contracts on Block 16 and 36, the government's share of profit is 70% with 36% direct crude oil allocation up from 17% and 18% from each block respectively through the production sharing frameworks (APS Review Gas Market Trends, 2011).

³² Canadian Canacol Energy Ltd. has a similar producing field service-type contract on Rancho Hermoso field in Columbia. Canacol Energy Ltd., as the operator of the field, receives U.S. \$17.56 per barrel production fixed fee in addition to transportation cost, and the produced crude is delivered to ECOPETROL S.A. (Canacol Energy Ltd., 2012). ECOPETROL S.A. is the principal petroleum company in Columbia owned by 40 large international oil companies (ECOPETROL, 2012).

³³ This is pretty high compared to other countries' service contracts.

³⁴ PETROECUADOR should cover the operation cost in this contract (Canada Stockwatch, 2012).

³⁵ Petroamazonas is the largest state-owned oil company after it absorbed Petroecuador's upstream assets in November 2012 (Kerr, 2014)

11. Turkmenistan's Service Contracts

Turkmenistan is another country showing recent interest in service-type contracts. Based on the country's 2008 hydrocarbon law, the government has four contractual options: concessions, production sharing contracts, oilfield service contracts, and service contracts. However, for its offshore natural gas fields, the Turkmen government has relied upon production sharing contracts and oilfield service contracts³⁶ as the two preferred methods of cooperation with foreign companies (International Comparative Legal Guide Series). For the onshore natural gas fields, the government has shown indications of preferring the risk service contract as a variation of service-type contract³⁷ with adequate rewards for the risks taken by the IOCs (International Energy Agency (IEA), 2010). However, no such contracts have been signed due to the IOCs' dissatisfactions with the terms of Turkmenistan risk service contractual framework (Roberts, *At the Wellhead*, 2010).

The prospects of any service contracts on Turkmenistan's onshore gas fields are far from certain. International oil companies such as ExxonMobil and Chevron still show interest in participating in developing the giant Galkynysh gas field. However, they seem to disagree at least on two major areas with the Turkmen government. First, the IOCs insist on taking "upstream stakes" over the gas fields that supply gas to the planned Turkmenistan-Afghanistan-Pakistan-India (TAPI) gas export pipeline. Second, they seek a "leadership role, including assistance in helping to construct and arrange finance the TAPI pipeline." On the other hand, the Turkmen government still insists in having the service contract as the framework for the IOCs cooperation, which contradicts with the IOCs request in having "upstream stake". In addition and still as part of the Turkmen government's determination to keep its control over the extracted resources, the government wants to have the state-owned Turkmen Gas as the sole entity marketing the produced gas in international markets. In addition, the Turkmen government prefers to deliver the gas at the Turkmenistan boarder which means that the government does not will to participate in details of export pipelines issues outside its borders. The departure of Statoil from Turkmenistan by closing its office in the capital, Ashgabat, is also a sign that there is no immediate prospects for the above mentioned service contracts in Turkmenistan in near future (Roberts, 2013).

³⁶ Turkmen government has used direct foreign loans to finance hiring service companies for its offshore oilfield service contracts (Roberts, *At the Wellhead*, 2010). Turkmenistan has acquired a 9.7 billion U.S. Dollars loan in 2009 and a 4.1 billion U.S. Dollars loan in 2011 for offshore Galkynysh natural gas field, formerly known as Yoloten. China's CNPC has been involved in both projects (Trend News Agency (Azerbaijan), 2011).

³⁷ China's CNPC is the only international company with an onshore production sharing contract in Turkmenistan (Gurt, 2012).

12. Iraq's Service Contracts

Iraq has also adopted variations of service-type contracts, all known as technical service contracts, in its massive plan to boost oil production to 12 million barrels per day by 2017.³⁸ Table 4 includes a summary of the four rounds of auctioning. Iraq uses three different versions of technical service contracts: producing field technical service contracts; production and development technical service contracts; and a service-type framework for exploration in the fourth round (Ghandi & Lin, 2014a). Producing field technical service contracts have been awarded on the fields with production prior to the start of the contracts. This baseline production has been used for the cost recovery of the development in these fields. In production and development technical service contracts, a different mechanism is used for the cost recovery since these contracts have been awarded on the fields with no production before the start of the contracts. For more on Iraq's technical service contracts, see Ghandi and Lin (2014a) and Sankey, Clark and Micheloto (2010).

Table 4: Iraq's Four Rounds of Auctioning since 2009 (Ghandi & Lin, 2014a)

Round	# Pre-qualified bidders	Important Dates	Bid Projects' Scope	Outcome
1	35 [1]	June 30, 2009 results announced. [1]	To develop 6 oil and 2 non-associated natural gas fields [1]	One contract was awarded (Rumaila). Three other oil contracts were signed later. [1]
2	9 [1]	December 12, 2009 results announced. [1]	To develop 10 oil fields [1]	Seven contracts were awarded. Three contracts did not have any bidders. [1]
3	13 [4]	October 20, 2010 results announced. [4]	To develop 3 non-associated natural gas fields including two from the first round	Three fields were awarded to two international consortia [4]
4	46 [3]	Promotional Conference: August 2011 [2] Final Tender: November 2011 [2] Bidding Event: May 2012 [5]	To explore 12 oil and natural gas blocks [2]	Not yet determined
Sources				
[1]	Sankey, Clark, & Micheloto (2010)			
[2]	The Petroleum Services Group (PSG) at Deloitte (2011)			
[3]	Reuters (2012)			
[4]	Hassan Hafidh (2010)			
[5]	Hassan Hafidh (2012)			

³⁸ In 2013, the Iraqi government negotiated new plateau production targets on its awarded contract to 9 million barrels per day (combined) by 2017 (Kent, 2013).

13. Conclusion

In this paper, we show that in at least eight major oil producing countries, there have been efforts and interest in adopting service-type contracts an alternative to the production sharing framework. Among the five main reasons for adopting service contracts are field ownership rights, produced crude ownership rights, field's operatorship, international oil companies' compensation mechanism, and risk aversion of the state-owned oil companies. It seems that adopting the service contract could best be partially explained by the sovereignty concerns over natural resources (field and produced cruder ownership rights) in these countries. While the service-type contract could be an interesting framework with respect to the sovereignty concerns, the framework can also lead to economically inefficient outcomes. To avoid such outcomes, countries with an interest in service contracts should also consider having their state-owned oil companies follow dynamic profit maximization objectives. However, even without adopting dynamic profit maximization objectives, it is possible to improve the outcomes under a service contract, as Ghandi and Lin (2012) and Ghandi and Lin (2014a) show for Iran and Iraq, respectively.

In reviewing the service contract energy strategy, this paper also examines the current contractual situation in each of eight oil or natural gas producing countries. Our review suggests that the new interest in service contracts might be explained partially by heightened sovereignty concerns and the political environment on one hand, and the need for international oil companies' capital and know-how in developing oil and natural gas fields in the host countries on the other. However, even though service contracts may address sovereignty concerns, the outcomes of these contracts may not be economically efficient.

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