

Supply Chains for the Oil & Gas Sector. Identification and Location of the Oilfield Service Operators in the Contemporary Geopolitical System

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ABSTRACT: Upstream in Oil&Gas sector is the beginning of most operations at entire supply chain management. A close-knit bound between this sector and further links of logistics providers is perceivable on daily basis. Any turnaround has a significant impact on the whole supply chain and its management. Awareness of market fluctuations and knowing its strongest players helps to conceptualize the strategy of optimization and prepare for unpredictable. In this work I aim to identify factors which have to be taken into consideration while optimizing the supply chain for the Oil&Gas Sector.

1 CHARACTERISTICS OF SUPPLY CHAINS IN THE OIL & GAS SECTOR

According to Council of Supply Chain Management Professionals (CSCMP) definition – “logistics is that part of Supply Chain Management that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services, and related information between the point of origin and the point of consumption in order to meet customers’ requirements”

Following to Douglas M. Lambert: “Supply chain management is the management of relationships in the network of organizations, from end customers through original suppliers, using key cross-functional business processes to create value for customers and other stakeholders” where:

- Logistics is an important part of supply chain management but is not supply chain management
- Successful logistics is a key for economic development and corporate profit performance

- Logistics can be used to provide value to customers which offsets a premium price
- For most firm’s logistics represents an opportunity to build a sustainable competitive advantage

As mentioned earlier in supply chain management, the Oil & Gas sector is deepening with the tendency to integrate over time. The main factor conducive to this is the integration of production and logistic processes taking place in individual areas, the control of one enterprise. The role of Integrated Oil & Gas Operators is performed by all companies included in the International Oil Company (IOC) group. Twentieth century dominated in the discussed sector. Similar aspirations are also visible in the growing number of companies from the National Oil Company (NOC) group, which are national operators in oil-rich countries that control their resources. Mention should be made in particular of Russian Gazprom, Chinese PetroChina or national operators from the Gulf countries, in particular Saudi Aramco.

The question arises in this context about the typical and specificity of supply chain solutions in the

Oil & Gas sector against the background of model and real solutions in the area of logistics management applied in other areas of the economy, and which are a generalized achievement of logistics and management sciences. The purpose of the following analysis will be to highlight the specificity of supply chain management in the Oil & Gas sector and its various sources and premises.

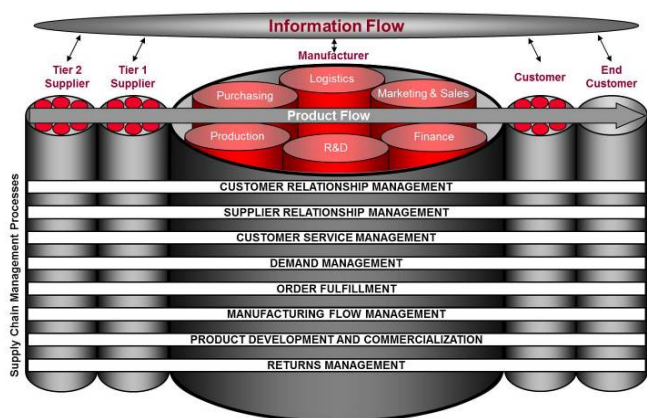


Figure 1. Lambert, D.M., 2014 Editor, Fourth Edition, Ponte Vedra Beach *Supply Chain Management: Processes, Partnerships, Performance*: p.3

Moreover, Michael Porter said that “a business is profitable if the value it creates exceeds the cost of performing the value activities. To gain competitive advantage over its rivals, a company must either perform these activities at a lower cost or perform them in a way that leads to differentiation and a premium price (more value)”.

In the context of supply chain management for oil & gas sector it could be translated as a permanent trend to never ending optimization following to technological and political changes.

1.1 Configuration of the chain

The dynamics of the development of logistics applications in management in the last two decades has meant that currently the issues of logistics participation in management and optimization of logistics processes cannot be limited only to the limits of an individual enterprise. These processes should include wider structures, referred to in the literature as chains and logistics networks.

This approach is based on logistics as a chain approach, which - taking into account the factor of chronological appearance - includes the following chains:

- Chain of goods. Understood as a way "that they overcome products from the moment of extraction or acquisition to the place of consumption by the final buyer", which means that the chain of goods is "the sum of distribution channels defined as roads by which the product is moved from the producer to the customer". The chain concept is mainly used in research on global processes of goods flow, including in the context of the role of transport in this respect. This issue is particularly important in the logistical activities undertaken by

the most important IOC company interested in this study, so it will come back to it later in this study.

- Logistic chain. It is also known as the storage and transport chain, which is a technological combination of storage and trans-shipment points along freight routes, as well as organizational and financial coordination of operations, procurement processes, inventory policy and all other links in the chain. It is also understood as the production, commercial and service capacities that are working in different functional areas of the company, aimed at creating additional value for the client, between which flows streams of products, information and financial resources.
- Supply chain. Perceived in the literature as "a group of at least three companies representing the sphere of supply, production and distribution, implementing logistic and extra-logistic processes" whose aim is to "ensure efficient flow of materials, products and services, starting from the place of origin of the good and ending with the final recipient. Supply chain management are processes that control the above processes to achieve the best satisfaction and benefits for all links in the supply chain."
- The value chain. Covering, in accordance with the concept of G. Gereffi and M. Christopher, a full range of processes necessary to create a given good, starting from the idea through subsequent production and post-production phases (marketing), to delivering it to the final recipient. Also the concept of value chain, like the chain of goods, due to its potentially global reach, should be considered when considering the issue.

1.2 Current design (model – and how it currently looks?)

In the current standards, logistics chain management should be integrated, which also means the integration of logistic processes infrastructure, i.e. the occurrence of operational, functional and formal links between individual infrastructure elements and systemic protection against various types of threats. This observation refers primarily to trends in supply chain management, not to the realities of the Gas & Oil sector. In fact, as will be discussed a bit further, there is a lack of among the companies in this sector that in a model manner implemented in the supply chain management integrated paradigm. The closest are companies from the IOC group and many from the NOC and Oilfield Services Companies (OFSC group).

The main goal of the integrated supply chain in the Oil & Gas sector is to ensure maximum customer service at the lowest possible cost. From the point of view of competition rules, efficient supply chain management is a competitive advantage, the basic exponent of which is customer satisfaction and loyalty. These goals are also appropriate for companies in the Oil & Gas sector.

In the technical and technological dimension, it is perceived as a warehouse and transport route, whose main purpose is to supply raw materials from the

place of extraction to raw material warehouses, from there to processing installations, and finally from raw material warehouses ready for target customers. On the other hand, in the process dimension, which is more interesting in this study, "the essence of the supply chain comes down to the coordination of activities in individual phases of the flow of energy and fuels, and with them the flow of information and cash." In the product dimension, the duality of the supply chain is expressed in the existence of relatively autonomous supply chains of raw materials and finished products. They require not only, for example, different means of transport, but also significantly different economic instruments, which results, for example, from the separate methods of influencing the prices of the raw material and on prices and the level of sales of finished products.

Regardless of the dimension in which the supply chain is perceived, it covers a series of successive processes.

1.3 Chain links / participators - from the subjective side

Stakeholders of the supply chain in Upstream are mainly companies in the fields:

- Sourcing
- Buyers
- Procurement
- Suppliers
- Manufacturers
- Logistics
- Planners
- Finance
- Risk management
- Sales

Generally speaking, the integration of the supply chain in the Gas & Oil sector should not be limited only to the integration of individual functional areas, but also the integration of individual processes. Integration in the processual dimension should be seen in the context of supply chain risk management. You can see much more clearly for its proper functioning at the level of processes than functions. In this context, reference is made to the transport processes, especially in the section between the place of production of technological components for OFSC's and the place of its exploration and exploration.

On this episode there are cumulative threats, the reduction of which even the most powerful economic organization has no greater impact. Transport systems used for transporting loads are exposed not only to the risk of technical failures, but also extreme weather events, tectonic movements, sea level rise, terrorist attacks, and seizure by sea pirates. Potential impacts of supply chain managers should go towards minimizing the impact of external factors or their elimination from logistic processes.

In translating into management decisions, it may find its expression e.g. in the change of the supplier of transport means. If they are characterized by high failure rate, or resignation from using uncertain supply routes or route delimitation (vessels, aircraft or trucks), bypassing politically unstable areas by providing additional protection to those who are

swimming in areas threatened by, for example, maritime piracy.

The integration of the supply chain, whether at a functional or process level, allows OFSC companies to manage risk more efficiently and effectively, and thus protect the primary goal of the integrated supply chain, which is creating additional value for the client.

2 MODELS – HOW CAN THE PROCESSES BE INTEGRATED

2.1 Relationships between processes

The essence of the concept of supply chain integration is merging of demand and supply management processes, understood as multifunctional integration, enabling integration and optimization of the main functions occurring inside the enterprise, integration of many enterprises, enabling the merger of enterprises with their business partners and clients.

The value chain exists in both vertical and horizontal integration models. The values for the customer are to be created, based on defined goals and actions, in the following links of the supply chain in the Oil & Gas sector:

- exploration and production;
- hurt / trading;
- storage;
- distribution;
- sale;
- new areas (e.g. implementation of high technologies).

Analogously to the above, the value chain at IOC includes the following stages:

- Conducting seismic surveys for the occurrence of oil / gas deposits both on the mainland and under the seabed, using state-of-the-art equipment and using state-of-the-art technologies.
- Construction of wells along with technical, transport, storage and environmental protection facilities (e.g. construction of landfills for operational waste).
- Strengthening and stabilizing wells, ensuring stable operation from the most efficient levels.
- Launching production from the most efficient seams and ensuring the best quality raw material.
- The production process, including: a) mining of the raw material; b) transport to the refinery (pipeline, sea, rail, etc.); c) direct use of the raw material for energy production or its refining to produce gasoline, diesel oil and other petrochemical products.
- Distribution. Transport (pipeline, sea, rail, etc.) to fuel terminals, and hence to petrol stations (petrochemical products).
- Sales of fuels in petrol stations and other petrochemical products in petrochemical depots.

Upstream, the main field where operates OFSC's is focused of course on first four points, where Exploration, Field Development and Production Operations is playing main role.

2.2 Value added – which is generated within individual cells

With the perception of the supply chain in terms of the value chain, it corresponds to the demand for sustainable development, i.e. the idea that contemporary development should not be at the expense of diminishing the opportunities of future generations, which is increasingly raised both by science and practitioners. All refer to the non-letting of natural resources. The priority of ecological requirements in the supply chain is ranked first in the hierarchy of priorities of oil and gas sector companies, against health and safety at work and reliability in financial management. In this respect, geographical variations in the preferences for sustainable development components are characteristic.

The greatest emphasis on its environmental aspect lies in Europe, while in North America this factor gives way to reliability in financial management. This is an important factor in the case of companies operating on the global market, subject to a variety of conditions - depending on the geographic region. As it is emphasized in the literature, the activities of Oil & Gas sector companies are among the most risky negative environmental effects.

For this reason, they may encounter numerous developmental difficulties, which may at least minimize through the use of state-of-the-art technologies, maintaining positive relations with the environment (social partners, co-operators, state institutions, political factors - as part of corporate social responsibility) and the most advanced supply chain management procedures, covering areas with diverse conditions. In the light of research, the sustainable development inhibitors include inadequate infrastructure, high costs, lack of knowledge about the idea of sustainable development and lack of ecological awareness. These weaknesses have a negative impact on the procedures of sustainable management of the supply chain (values).

3 GLOBAL OPERATORS AND ENTITIES INVOLVED IN THE OILFIELD SERVICES

Sustainability and environmental aspects are one of the most important factors shaping current supply chain in Oil&Gas, especially after Deepwater Horizon explosion in April 2010. Currently for all IOC and NOC proper purchasing management in Upstream and Midstream seems to be most important factor apart from economic and technical issues.

The following companies represent the biggest entities classified by Oilandgas.com in 2018 as Oilfield Services Companies – OFSCs (exclude all NOCs and IOCs).

– Schlumberger - founded by Conrad and Marcel in France back in 1926. Schlumberger operates in over 85 countries and employs about 100,000 people of 140 nationalities. The company, registered in the Dutch Antilles and headquartered in Houston, Paris and The Hague supplies numerous products and services including seismic

acquisition and processing, formation evaluation, well testing and directional drilling, well cementing and stimulation, artificial lift, well completions and consulting, and software and information management. The trophy for top oilfield services company remains in Houston as sector leader, Schlumberger, stays top of the pile. The firm earned over \$30bn last year and penned a major contract for drilling rigs and services for oil and gas wells with Saudi Aramco. It will also develop a manufacturing base in the kingdom. The Abu Dhabi National Oil Company (ADNOC) has collaborated on a joint training facility to benefit UAE Nationals.

- Halliburton - earning over \$20bn in 2017 and with 55,000 employees worldwide, Halliburton is a bona fide top three entrant and one of the world's oilfield service leaders. The firm has recently signed a three-year deal with Aramco to boost the Saudi firm's unconventional gas production. Halliburton has seen increased drilling services, project management activity, and completion tool sales in the Middle East with a 6% spike in regional revenues.
- Weir Oil & Gas - Scotland's Weir Group has enjoyed a stellar start to 2018 with a 35% increase in orders for its oil and gas division – thanks in main to its exposure to the accelerating US tight oil business. But the company has a respectable Middle East footprint and can be found from Saudi Arabia to Iraq. Weir nabs third place due to its raft of innovative solutions, including Weir Edge, its newly-branded aftermarket services program which provides engineers in the field.
- Baker Hughes, a GE company - Baker Hughes, a GE company is likely to lose the GE part of its name as parent company, General Electric, struggles to reduce its debt levels. But the firm remains a serious oilfield services outfit. Recently, it secured a \$175mn deal from Aramco to boost gas field production in the kingdom, as well as a subsea award from BP off the West African coast. The company has also linked up with Egypt's government to support modernisation of the country's oil and gas industry.
- Emerson - the number of companies offering automated solutions to the industry is a crowded space, but Emerson heads the pack. The company has seen a key facility in Saudi Arabia open, while the acquisition of software provider Paradigm, which has combined with Emerson's own Roxar business, has created a comprehensive exploration and production software portfolio. France's Total is utilising it to maximise reservoir subsurface modelling and formation evaluation.
- National Oilwell Varco (NOV) offers rig technologies, wellbore technologies and completions solutions. It has assets of more than \$20bn and 37,000 employees worldwide. The company's innovative solutions have found ready markets the world over but NOV continues to see success in its bits, borehole enlargement and coring businesses in the Middle East. It has just

inked a major joint venture deal with regular partner Aramco to establish a rig manufacturing facility.

- Schneider Electric - french energy management and automation specialist Schneider Electric is this year's big mover. The company has major clients in the region including working with ADNOC on its impressive Panorama Control Centre at its Abu Dhabi HQ and helping to smart train the Kuwait Oil Company's employees via its EYESIM virtual reality technology. Its deal to acquire Aveva, the UK engineering software developer, for \$3.8bn, takes it to another level.
- Siemens - Germany's Siemens leaps into our top ten, thanks to its innovative solutions and its commitment to driving its digital presence across the region. The company is spending \$500mn establishing MindSphere Application Centres around the globe where data specialists and engineers will work with Siemens customers to develop applications for data analysis and machine learning. A tie-up with Tenable offers cybersecurity assistance to the industry.
- Weatherford Oil & Gas - CEO Mark McCollom has had a tough task since taking over last year. Weatherford was dented by the 2014 oil price plunge and he is determined to streamline the business and save \$1bn by 2019 with debts estimated at \$7.5bn. Started in the US in 1948, Weatherford employs around 46,700 employees and operates in more than 100 countries. The company provides a whole host of services including drilling, evaluation, conveyance, completion systems, production, maximising recovery and well optimisation. Weatherford has sold 31 land rigs to ADES International (a new entry at number 15) encompassing operations in Kuwait, Algeria and Saudi Arabia. Record US production has helped total revenue rise 6% to \$1.5bn.
- China Oilfield Services Ltd. - The Beijing-based China Oilfield Services Ltd (COSL), is state-controlled, but also trades on the Chinese stock exchange. Founded in 1967, COSL has around 8500 employees and its services cover exploration, development, and production of offshore oil and natural gas operations. Its four business segments are drilling services, well services, shipping, and geophysical services. COSL claims a 95% share of China's market for offshore drilling services, 70% of the marine support and transportation market, 60 % of the well survey services market and more than 50% of the seismic data collection market. While active in the Middle East, COSL is believed to be looking at a number of acquisition targets to further increase its presence in the region.

4 SPECIFICITIES AND CODITIONS BETWEEN PURCHASING AND DISTRIBUTION PROCESSES FOR SPECIALIST CARGOES

In the book "Building High Performance Business Relationships Supplier" (Douglas M. Lambert, A.Michael Knemeyer, John T Gradner defines relationship management as "the business process that providers the structure for how relationships with suppliers are developed and maintained".

Demands imposed by OFSC's on suppliers related to very specific kind of cargo has created within last year's specific niche on logistic operators market called generally as a "project cargo" logistics. Most of international operators has created separate divisions dedicated to handle such kind of shipments to fill-up high requirements to Upstream customers.

The market of logistics services is divided similarly like IOC and NOC – means there are present huge international companies and also national logistics entities, which creates these markets very diversified.

The biggest platers on global freight are ranked by three main factors: Gross Revenue, Ocean TEU's and Air Metric Tons:

Top 25 Global Freight Forwarders

Ranked by 2017 Logistics Gross Revenue/Turnover and Freight Forwarding Volumes***

A&A Rank	Provider	Gross Revenue	Ocean TEU's	Air Metric Tons
1*	DHL Supply Chain & Global Forwarding	27,598	3,259,000	2,248,000
1*	Kuehne + Nagel	22,574	4,355,000	1,570,000
2	DB Schenker	18,560	2,169,000	1,300,000
3	Sinotrans	9,530	3,360,300	533,300
4	DSV	11,374	1,389,611	635,655
5	Expeditors	6,921	1,070,424	985,549
6	Panalpina	5,621	1,520,500	995,900
7	Nippon Express	16,720	600,000	835,755
8	UPS Supply Chain Solutions	7,981	600,000	935,300
9	Bolloré Logistics	5,012	864,000	640,700
10	CEVA Logistics	6,994	729,000	480,000
11	Hellmann Worldwide Logistics	3,305	897,379	654,104
12*	GEODIS	6,255	690,000	330,000
12*	Kintetsu World Express	4,752	663,915	580,228
13**	Yusen Logistics	3,914	774,822	368,198
13**	Kerry Logistics	3,951	1,053,485	313,800
13**	DACHSER	6,911	522,300****	335,500
13**	C.H. Robinson	14,869	698,000	175,000
14	Agility	3,500	740,000	415,000
15	Hitachi Transport System	5,935	500,000	280,000
16	Damco	2,700	664,000	206,000
17	Toll Group	4,660	434,000	91,000
18	XPO Logistics	9,506	131,500	72,600
19	CJ Logistics	4,454	310,850	57,014
20	NNR Global Logistics	1,735	144,483	321,704

Figure 2. https://www.logisticsmgmt.com/article/top_25_

Freight_forwarders_strong_growth_abundant_opportunity

From this group separated divisions responsible for Project Cargo are present mainly at DHL, Kuehne + Nagel, DB Schenker, DSV, Panalpina, Bolloré Logistics, CEVA, Geodis, Agility, Deugro and C.H Robinson.

The evolution of supply chain management towards a sustainable model, taking into account the ecological aspect, related to value chain management, should be considered in terms of development opportunities of the Gas & Oil sector enterprises.

This is particularly concerning of OFSC's companies operating globally, but with the resources necessary to strengthen its position as a global leader. In particular, they have the potential to use ICT in improving the efficiency and effectiveness of supply chain management. In science, however, a number of factors are perceived, which should be perceived from

the point of view of the companies of the analyzed sector in terms of threats. Conducting business operations on a global scale is associated with a high level of uncertainty as to the smooth and smooth functioning of the supply chain.

The systematic delivery of loads is of key importance in this respect, without which the remaining functional areas cannot function properly. In the planning and implementation of processes relevant to the supply chain in the Oil & Gas sector, the uncertainty factor should always be taken into account, constantly monitored and verified the scale of threat that the company's operations will sustain.

The supply chain in the analyzed sector should have both a strong theoretical as well as empirical foundation, created in the latter case based on systematic observation of the global environment in which the vast majority of oil and gas companies operate. In its real form, it cannot be a theoretical construct but have an empirical dimension, taking into account the real conditions, environment, potential and goals of a given company. Only management based on the empirical model can be effective and effective, especially in the field of value chain creation, in the above understood sense.

5 DISTRIBUTION AND FORWARDING IN AIR, SEA AND ROAD TRANSPORT

The leading OFSC's companies operate in an international economic environment, turbulent, uncertain, exposed to more or less expected crisis phenomena. This is a set of determinants for the supply chain, qualitatively different from domestic ones.

The global reach of its functioning, which generates fundamentally different challenges to ensuring the efficiency and security of its functioning, is characteristic for the international supply chain. In the international supply chain, the importance of modern technological solutions increases significantly, allowing not only to support its efficiency, ensure security in the transnational space, but also to control its complex infrastructure on an ongoing basis and react as quickly as possible to emerging threats.

Upstream and OFSC's are geographically diversified mainly at old USSR courtiers, Middle East, West Africa, South America (Mexican gulf, Venezuela, México, Brazil) and North America, which is demanding challenge taking into account that high technology providers are located mainly in US and Europe.

Freight forwarding in supply chain management is using for logistics operations several advanced systems of purchasing space and price from air lines, ship owners and overland companies. Additionally, very sensitive points of transport systems are terminals, ports, warehouses, storage yards and customs brokerage agencies.

In simplified terms, the logistic process for onshore and offshore oilfield operators in an example looks like this:

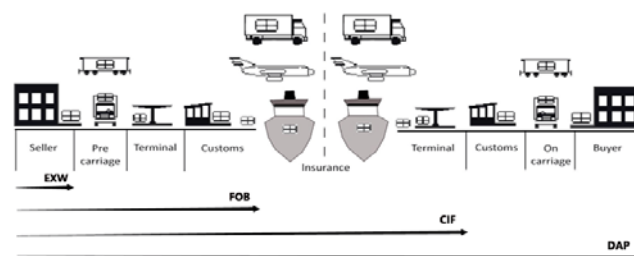


Figure 3. Incoterms 2010

In all these places, it is required to conclude transport and shipping contracts, long-term storage contracts and customs clearance authorizations. In order to manage thousands of subcontractors, logistics operators use many IT tools to effectively and safely transport entrusted loads.

6 FINAL CONCLUSIONS AND SUMARRIES

Many years of experience in the cooperation of oilfield service operators with Logistics providers has meant that the management of global chains now has a solid basis for functioning.

However, the oil and gas sector, depending on the price of crude oil, is very susceptible to fluctuations and crises. Every time the oil barrel curve goes drastically up or down it has an immediate reflection in the supply chains around the world.

Today in 2019, provide chain management is maybe additional necessary for upstream business than within the past and its role can for certain grow within the close to future.

For the last years - actually throughout the 20th century, the demand for oil increased constantly reaching in the middle of 2008 more than 160 USD per barrel.

In the context of geopolitical and economic changes, supply chain management is often an elementary basis of the company's competitiveness strategy, which is driven by increased emphasis on cost control, outsourcing and expanding the area of operations around the world, and consequently increases the demand for logistics services for customers.

Over the last decade, new concepts for the development of economies and economic systems have emerged. The new AI technologies, including autonomous transport, development of renewable energy sources, and quantum computer work will cause further dynamic changes with significant impact on oil exploration and production.

Therefore, the key issue for OFSC'c is not only managing the costs of the integrated supply chain, but also continuous work on the optimized costs of exploration, where effective management of supply chains is increasingly perceived as an additional source of revenues for oil and gas companies.

Therefore, the most significant challenges for OFSC's for the future will be to effectively assess the impacts associated with optimizing the supply chain resulting in real needs on the changing global market.

Due to the ambiguous data, it is extremely difficult to estimate the contribution to the revenue that the supply chain can bring to the general operation of OFSC companies. This is an area of much-needed research that should allow even better mapping of logistic processes.

The contemporary approach to SCM and SRM shown, for example, in the works of Douglas M. Lambert - many benefits of conscious management of the supply chain and subcontractors in a holistic approach.

OFSC's have a wide range of management activities covering supply logistics with a special emphasis on cooperation with logistics operators on the functioning and effectiveness of the tools described in this work, probably because the tools and skills are not well developed.

In order to be able to achieve a perfectly functioning supply chain for OFSC's, it is necessary to cooperate with logistics operators in the field of defining KPI's, finding common benefits and methods

of their mutual fair distribution among all participants of the chain.

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