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Preface

This master thesis concludes two years of education in northern Norway, Russia and Germany, where I had the possibility to learn from high graded professionals of industry and science from different parts of the world. I gained comprehensive knowledge and new insights about the O&G industry. As this highly controversial business has a major impact on the global economy, it was especially interesting to get to know, that there is a number industry representatives putting a great effort into making O&G business more sustainable. Contrary to the public opinion O&G business has a great potential for further growth, if motivated people tackle the future challenges with an open minded and sustained mindset. My thesis deals with a very actual theme, which may provide certain industry participants along the O&G supply chain an orientation line for long-term strategic decision making.

At this point I want to thank all my interview participants from Aker Solutions, Baker Hughes, Technip-FMC, Rosneft and BP for offering their time. It is very challenging to get access to industry professionals. Thus I really appreciate it to business inside at first hand. Also I want to thank my Thomas Leirvik from the Bodø Graduate School of Business at the Nord University for supervision and the representatives from Siemens Power and Gas, who offered me to write such an interesting master thesis for them and supported me with valuable information and mentoring.

Last but not least, a special thanks to our program coordinators from the Nord University, Elena Dybtsyna, Anatoly Bourmistrov and Elena Zhurova, who organized such a comprehensive and unique study program. We had the opportunity to attend the High North Dialogue in Bodø and additionally study in Sankt Petersburg, Arkhangelsk and at the MGIMO University in Moscow. I made many new friendships and met a lot of interesting people. During the last two I passed a very challenging path, which helped me to expand my mind from a personal and professional point of view. With the support of my family and friend, however, I grew with this challenge.

Abstract

The 2014 oil price collapse resulted in a history charged industry downturn along the whole Oil and Gas (O&G) player landscape. With an oil price fall from \$114 per barrel in 2014 down to \$28 in 2016 Exploration and Production (E&P) companies faced pricing pressure from their customers, which they transfer along the supply chain down to their supplier base. This happens in form of reducing Capital expenditures (Capex) and Operational expenditures (Opex). While Capex reductions result predominantly in the shutdown of planned and already initiated green field projects, Opex reductions impacted in the first place an industry wide headcount reduction. Further on the majority of O&G operators is strongly dependent from their suppliers, which is supported by the fact that up to 95 percent of E&P spending is investments for Oilfield Service and Equipment (OFS) companies.

Already before the 2014 oil price collapse oil companies have been struggling due to a number of challenges like the scarcity of easy accessible conventional resources, climate warming issues and the rise of renewable energies as well as a rising competition of gas becoming a substitute product for oil, because liquefaction enables gas to be treated as a flexible commodity. While the Capex and Opex reductions and its negative influences presented a shock reaction in order to overcome short term challenges, there is an imperative to take appropriate measures to ride out long term challenges. This requires new innovative approaches to get the cost per barrel below the break-even point price, as the oil price is expected not to recover to previous levels. Officially recognized experts and institution insist on an oil price moving between \$40 and \$60 per barrel in the short-term and not to exceed \$90 in the long-term.

In this thesis I want to elaborate the industry prospects for Original Equipment Manufacturers (OEM's), whether it is strategically worth it to continue engaging in O&G or not. As OEM's produce equipment, which is compatible for O&G as well as for other industries, the prosperity of the O&G industry is of essential importance for them. Thus this thesis deals with the core issue, whether and how a win-win situation can be achieved for all O&G project participants. How can suppliers create value for their customer, so that HSSE standards are fulfilled and profits are still generated at a "lower for longer" oil price?

Therefore this thesis provides a qualitative market research with the involvement of industry professionals, where O&G spending and business models (BM's) before and after the 2014 oil price collapse are elaborated. Based on that findings, there are opportunities and challenges derived for OEM's, in order to offer an orientation line for further strategic decision making.

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Glossary of concepts

Acquisition: One company takes over the ownership of another company entirely or partially in exchange for cash or shares.

Cloud Computing: The supply of an IT infrastructure in form of storage space, processing power or application software as a service via internet. Cloud Computing enables IT-infrastructures to be provided over a computer network, without requiring them to be installed on a local computer.

Conventional resources: Concentrations of O&G occurring in discrete accumulations or pools. Such pools are trapped under impermeable rock formations, which are overlaid by highly porous and permeable rock formations. Conventional O&G are developed with vertical well bores and minimal application of stimulation.

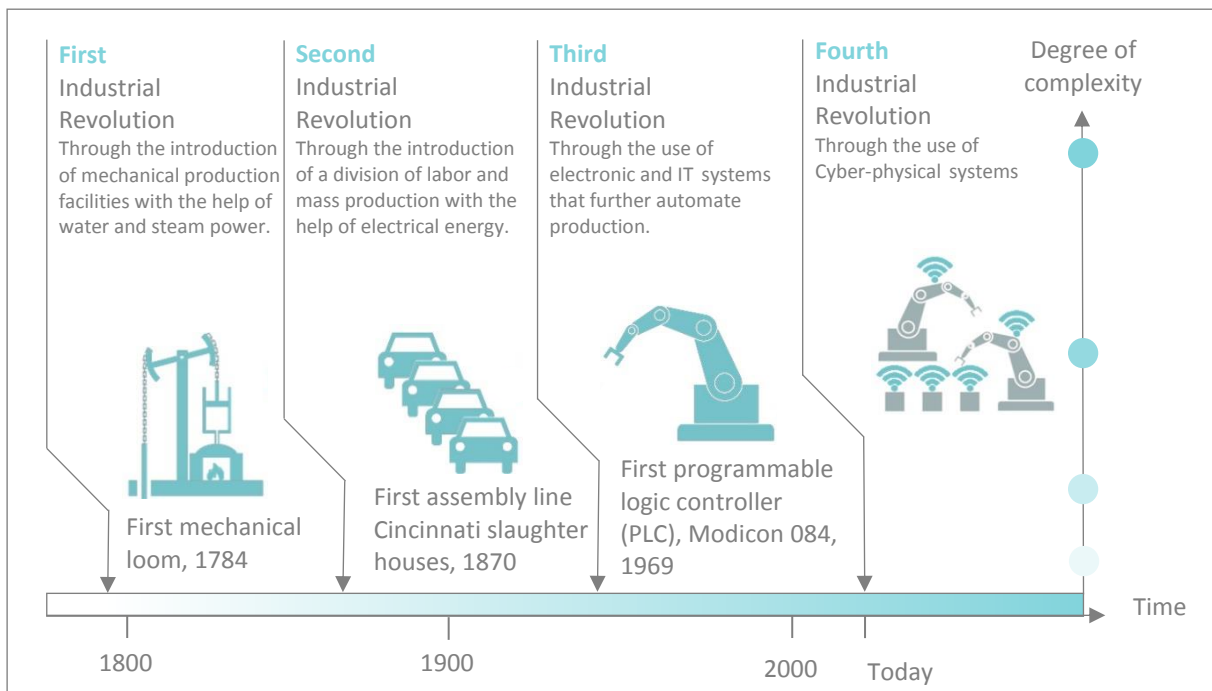
Unconventional resources: O&G resources hosted in a variety of rocks, which requires additional technology to release resources from the bedrock. The permeability and porosity of that rocks doesn't enable extracting through vertical well bores. The development of unconventional hydrocarbons requires extensive well fields and additional surface infrastructure. Unconventional ways for production are typically used for ultra-deep oil, oil-sands, shale oil and gas, which requires horizontal drilling coupled with hydraulic fracturing.

Digitalization in the context of industry 4.0: The fourth stage of industrialization is characterized by an industrial production, which is interlocked with innovative information and communication technologies, based on digitally networked systems. It enables value chains to optimize through real-time exchange of information between humans and all different kinds of technical equipment.

Joint Venture: A Joint Venture is a legally independent common enterprise between two or more partner enterprises who hold a share in the business. All participant companies bear financial risk of investments and hold management responsibility.

Merger: Two previously separated companies combine all their equities and merge to one company under a common name.

Stages of Industrialization:



Source: own representation based on Wahlster, 2013

Stakeholder: Stakeholders represent all persons, groups and institutions, which are directly or indirectly influenced by a company's activities. They try to impact a company, as they have certain interests in it. According to the stakeholder concept, a company's purpose, targets and strategies are geared to satisfy interests, expectations and demands of powerful stakeholders. Ignoring such requirements can threaten a company's existence. Stakeholders are categorized in an internal and an external group. Internal stakeholders include employees, managers and owners, while external stakeholders include customers, suppliers, shareholders, society, government and creditors.

Strategic alliance: "... where two or more organizations share resources and activities to pursue a strategy" (Johnson, Scholes, Whittington, Angwin, & Regnér, 2014, p. 341). Thereby they need to observe both, their own interest and the collective strategy. Such an alliance is characterized by the participant's level of commitment to partnership. Strategic alliances are divided into entity alliances, like Joint Ventures for instance, and in non-equity alliances like long-term sub-contracting for instance.

Abbreviations

AR	Augmented Reality
bln	Billion
BH	Baker Hughes
BM	Business Model
BMC	Business Model Canvas
BMN	Business Model Navigator
BOP	Blowout Preventer
BP	British Petroleum
CAGR	Compound Annual Growth Rate
Capex	Capital Expenditures
E&P	Exploration and Production
EPC	Engineering, Procurement, Construction
EPCI	Engineering, Procurement, Construction, Installation
ESP	Electric Submersible Pumps
FBC	Fixed Price Contract
FEED	Front Engineering End Design
GE	General Electric
HRM	Human Resource Management
HSSE	Health, Safety, Security, Environment
IBC	Incentive Based Contract
M&A	Mergers and Acquisitions
NASDAQ	National Association of Securities Dealers Automated Quotations
OEM	Original Equipment Manufacturer
OER	Oilfield Equipment Rental
OFE	Oilfield Equipment
OFS	Oilfield Service
OFS	Oilfield Service and Equipment
ONGC	Oil and Natural Gas Corp
OPEC	Organization of Petroleum Exporting Countries
Opex	Operational Expenditures

ROI	Return on Investment
ROV	Remotely Operated Vehicles
SURF	Subsea, Umbilicals, Risers and Flowlines
WSJ	The Wall Street Journal

1.0 Introduction

The emphasis of the following master thesis lies in the investigation of potentials for innovative BM's in the O&G supply industry. The Oil field supply industry is established very broad along the O&G value chain, as highly qualified engineering, technical, organizational and financial knowhow is required to execute such projects. Considering the fact, that O&G are the most traded commodities worldwide, supporting branches along the O&G value chain play a significant role. Thus, the industry's prosperity is essentially important even for companies, whose business and geographical location is not directly involved into O&G production.

As a consequence of the 2014 oil price collapse Capex and Opex for O&G projects were cut significantly (Brkic & Franchini, 2016). Logically, this development had corresponding ripple effects, which has reduced business profitability, stopped the development of new projects and exposed the industry to unexpected suffering. With a rising oil price, however, the industry is expected to recover and deploy resources more effective: "Following an unprecedented 2 years of double-digit declines, global exploration and production spending is expected to increase 7% in 2017," (Oil and Gas Journal, 2017).

The global need for energy in combination with the currently insufficient capacities for renewable energy and a rising world population sets a critical signal for the worldwide security of energy supply. In this sense the balance between oil and gas players and the segments, they are active in, has been subject to change crucially from an market environment that has been dominated by giant oil companies from the USA and western Europe to a highly competitive global market for hydrocarbons, which is characterized by several major structural changes and a wide and complex supply and value chain with a broad variety of participants with different scopes of specialization and risk exposure.

Against the background of the described facts, I want to elaborate in this research paper what opportunities and challenges arise for OEM's from the trends, which have evolved in connection with the newly developing BM's under the current market development. There is research in academics and in real economy having been done for the O&G industry in general, in terms of how the industry can get out stronger from the current market dynamics. My research takes up a specific player from the broad O&G player landscape, which is OEM's. They produce equipment for O&G operations, which can however be used in related industries as well. Thus, for OEM's in particular it is of essential importance how business models are evolving within the O&G industry under a low oil price market environment, as it determines

whether to continue engagement in O&G. The market trends, business models and problem statement, which have been taken up in paragraph are introduced deeper in chapter 1.3.

1.1 Historical review

During the two-year ongoing master degree program in Energy Management at Bodø Graduate School of Business, I have been attending various seminars and conferences, where professionals from different institutions among the oil and gas industry participated. My personal impression is, that the “Big Oil” has reached its peak due to essential structural changes in the O&G industry. In particular the supermajors of E&P have been exposed to those shifts. Consequently, the ripple effects impact all participants along the value chain of the world’s biggest industry.

To describe the major structural changes, mentioned in the previous paragraph, I want to lean on a report from Alexey Bereznoy from the Higher School of Economics – the National Research Institute in Russia, who has been making research on the subject of business model innovation (BMI) for supermajors. A few points of importance in this respect are as follows:

- First of all there has been a major shift in control of hydrocarbon reserves in favor of National Oil Companies. By the year 2012 NOC’s controlled around 90 percent of the worldwide hydrocarbons, while it was less than 10 percent in the 1970’s, when the world market was characterized by the “seven sister” oligopoly (Menenberg, 2013).
- Moreover the main area of hydrocarbon consumption has been relocated from the OECD countries to the Asia-Pacific region, in particular China and India. According to the International Energy Agency (IEA), the share of fuels decreased in OECD countries in the timeframe from 1973 until 2014 from 60.3 percent to 38.4 per cent, while Asia’s consumption rose within the same time from 14.1 per cent to 34.1 percent (Agency, 2016). By 2040 China and India are expected to exceed the OECD countries’ level of energy consumption.
- Thirdly, the technical revolution of liquefied natural gas (LNG) has enabled the transportation of liquefied gas on specialized tanker vessels to any random place around the globe. Consequently the global gas market, consisting of relatively isolated regional segments, turned into a global market.
- Last but not least the development of renewable energy, which is in the society rather positively accepted than fossil energy sources, are becoming increasingly cost competitive, even without government subsidiaries, and thus with increasing market share a serious threat for the O&G industry.

The entirety of those circumstances, one more or less than the other one, has nurtured the US O&G industry to engage increasingly into O&G production out of oil- and gas rich shale rock layers. As technologies for extracting unconventional hydrocarbons improve and LNG is considered to be the bridge technology into a “green energy future”, International Oil Companies (IOC’s) found them self increasingly often with the choice of setting the focus on extracting conventional or unconventional reserves. Conventionals are relatively easy to explore and produce, from a geological and technical point of view, but mostly located in countries with high political risk. At the other side, unconventional are definitely more resource intensive, but located in countries with a stable political situation. In this context Simon Henry, the former CFO of Shell stated: “The risks in OECD are technical, but they’re easier to manage than political risk” Moreover he continued: “In the OECD you have more control of your operations. This circumstances have led to the relocation of Shell’s Capex from a 50/50 relation in 2004 to 70/30 in 2011 in favor of activities in OECD countries compared to the rest of the world (Chazan, 2011).

Moreover political circumstances have been contributing indirectly in the rise of oilfield service companies (OFS’s). Since O&G reserves are located at state territories, which are controlled by the corresponding governments, their policies established state owned National Oil Companies as soon as reserves have been proven. The so called independent oil companies played a decisive role in the rise of NOC’s. The severe industrial expansion after world war second increased the world-wide demand for oil. Subsequently the market was entered by another major market participant group, the independent oil companies.

In contrast to the vertically integrated supermajors, independents were focusing on specific activities in the upstream, midstream or downstream sector. After the nationalization of oil hydrocarbon reserves in Iran, producer countries realized the imperative for strategic control rather than sheer receiving a revenue share from a supermajor. In this sense governments initiated promoting technical, financial and managerial assets. “Between 1953 and 1972 more than three hundred private firms and fifty state-owned firms entered the industry, drawn by the explosion in oil consumption and substantially diminished barriers to entry. (Jacoby, 1974, p. 120)” Even though the independents couldn’t compete on technical stage, they impacted essentially on the industry structure (Levy, 1982). By developing new fields, in Lybia and Algeria, for instance, they offered better conditions than supermajors in terms of revenue and participation to the host countries.

According to Gaddar independents made governments and their NOC's recognize what potentials they actually have. Following from economic and political recovery as well as growing national sentiment, numerous third world countries, changed their attitude and resilience towards IOC's essentially (Kobrin, 1985, p. 20). IOC's were increasingly forced back from the market or compelled to rearrange their terms of production.

As oil and gas seemed to be a lucrative business for those NOC's there has been invested decisively in Research & Development (R&D), so that the NOC's evolved over time to serious competitors of IOC's. According to Bain & Company the relatively young NOC's compared to IOC's exceeded the IOC's spending in R&D. In 2011 it was \$5.3 billion spent by NOC's in contrast to IOC's spending of \$4.4 billion (Bereznoy, 2015). Such engagements resulted in substantial results, as Statoil for instance developed first class technologies for oil production in the Arctic shelf or the Brazilian Petrobras achieved a pole position in deep-water operations.

Due to the threatening rising competition IOC's considered it necessary to increase efficiency and begun with restructuring the organization internally. Firstly outsourcing oilfield services as independent operations and later on releasing them to the market (Bereznoy, 2015). A number of them evolved independently or by partnerships to global OFS corporations, which are known today as Schlumberger, Halliburton, Baker Hughes, Weatherford, Transocean, etc. They specialized deeply in specific operations, such as drilling, data logging, etc. and offered their services and products to the whole range of E&P companies controlling hydrocarbons. In this connection Tim Weller, the former CFO of Petrofac, stated: "A shift in control over oil and gas assets away from so-called IOC's to NOC's has left oil service companies well positioned to fill the skills gap created by sovereign states wishing to maintain formal control over their assets rather than simply hand them over to western oil majors." (Kavanagh, 2012) In this connection it's also worth to mention, that with the rise of an increasingly broader range of industry participant groups and their in-depth specialization in certain fields of activity, Engineering, Procurement and Production Companies (EPC's) established as powerful links between OFS's and E&P's.

1.2 Background

The oil and gas market has been subject to change essentially during the last years. This development is based principally on two factors. On the one side it is the revolution of unconventional fossils, in the form of shale oil and shale gas, which enabled the world's biggest economy – the United States – to shift from the position of a global major oil and gas importer

to a major exporter of those commodities. As a consequence there was an economic battle initiated between the biggest producer of conventional and unconventional fossil resources. The OPEC increased the oil supply to a level, at which the global supply exceeded the global demand (IEA, 2017). This resulted in the latter factor of the current market change. The price for a barrel of Brent crude oil collapsed in 2014 from \$114 to \$57 and reached its minimum in the beginning of 2016 at \$28 (NASDAQ, 2017). At this point it is important to consider the fact, that, in many countries the production costs have been exceeding the oil price, when it was at its minimum level (WSJ, 2016). The 2014 drop in oil prices was a big negative surprise for the industry, since it is difficult to forecast. Consequently, the O&G industry has been facing efficiency problems and the need to cut internal costs to cover the short-term challenges and optimize business workflows for covering long-term challenges. This has also an effect on the Oilfield service and supply companies, who supply exploration and production companies with essential services and products, in order to make their activities possible to execute.

Since oil is the world's most traded commodity, measured by volume, the oil price collapse resulted in tremendous economic downturn impacts on the oil and gas industry itself and correspondingly on their suppliers and sub-suppliers. The economic downturn had also its influence on third industries and economics. However this paper is putting an emphasis on the supply industry in the upstream sector of the oil and gas business, because operators (NOC's, IOC's, independents) are setting their suppliers the pace via exerting pressure by cutting Capex. The supply industry in the upstream sector is namely that part of the value chain of an O&G operator where the most costs accrue and where the most specialized professional skills are necessary. Due to the low oil price, service companies (EPC, OFS, OEM) have been exposed to pricing pressure, resulting in a reduction of necessary contractor's workforces and consequently a quality downturn of their services.

According to a number of analysts and institutional forecasts the oil price won't recover in the upcoming years to a comparable level where it was located before the oil price collapse, resulting in a market environment characterized by a lower oil price for a longer timeframe (Business Insider, 2015). The price per barrel is expected to stabilize between \$40 and \$60 in midterm (Moody's Investor Services, 2017). Up to that turning point of oil price decrease in 2014, oil and gas operators used to work pretty inefficient compared to other industries, as the high oil price allowed them to generate sufficient profits. After the price per barrel of crude oil fell below the break-even-point in various regions, operators were faced the imperative to optimize their value chain of operations in order to be able to maintain a long term positive

economic result. In this sense operators need to secure supply, which meets the requirements in terms of HSSE requirements and productivity at sufficient expenditures. Since O&G operations require extremely high technology as well as engineering and project management skills, operators are highly dependent from specialized suppliers and vice versa along the whole value chain.

Finally operators have to pay for all those services and since they are closer connected with the consumer market, negotiating power is in favor of operators. In addition the engineering service market at used to be oversupplied until the downturn. For this reason the upstream supply sector has to revise its business model, so that they can meet operator's requirements in respect of HSSE, productivity and legal frameworks, while operating economically viable under the consideration of the current oil price. Besides of the current oil price there are also major factors, for which the upstream industry's strategies as a whole need to be prepared for: technological development, global economic growth and the energy policy of national states, which include energy security, geopolitics and environmental issues, as well as regional differences in terms of geological availability and consistency.

1.2.1 The oil and gas supply industry

The determining support, which OFS's offer to E&P companies, empowered operators to cope successfully with more complicated ventures, than they would have done without them. The specialization of solutions for a certain frame of operations enables service companies to profit from economies of scope and scale. Parallel many E&P companies focus stronger on coordinating and supervising operations and administrative issues as well as project management related issues. Of course this dispersion of competencies doesn't apply for the whole industry, but there is a clear trend in that direction.

Today the OFS industry and their suppliers have established themselves as an "*essential element in the oil and gas value chain*", which is clearly illustrated in a report published by the World Economic Forum in cooperation with A.T. Kearney, as in 2014 "... *\$531 billion out of \$764 billion in total upstream spending...*" were investments in the OFS industry. (The World Economic Forum in Cooperation with A.T. Kearney, 2014) The purposefully investments into R&D have shifted them in a position, where they are evolving to equity associates in certain assets as they service NOC's directly. In addition they keep holding their role as crucial outsourcing partners for IOC's.

This trend supports the fact, that operators have less knowledge of their geology and depend more on external proficiency. Consequently E&P companies take on a high degree of risk as they used to take the responsibility of the project outcome, while relying on external competencies. They have to maintain a good relationship with various stakeholder groups, such as the government and the society and manage political risk. Such circumstance make E&P companies vulnerable to external impacts, like it is with the fallen oil price nowadays. This vulnerability is impacting the participants located on the outskirts along the value chain directly, which leads to the problem this paper is addressing.

1.2.2 The O&G value chain

An oil and gas operator goes through the following phases and their subordinated stages of a value chain, when working in the upstream stage of a project (Olesen T. R., 2015):

- 1.) **Tender and concession:** The operating company obtains permission from authorities to explore and produce fossil resources at a certain field
- 2.) **Exploration:** The physical location gets examined and installation of equipment is planned. This stage includes Seismic Examination, Exploration Drilling and Commercial Evaluation.
- 3.) **Installation:** The required equipment gets produced, if necessary, and transported to the site where it will be installed. This stage includes building the production platform, transport and logistics, installation of the production platform and drilling of the production wells.
- 4.) **Operation:** Energy source gets extracted. This includes extraction, maintenance, supply service and standby service.
- 5.) **Decommissioning:** After full exploitation of resources, the field is abandoned. Here the well gets plugged and the whole production facility decommissioned.

The majority of those stages along the value chain are usually conducted by suppliers and/or sub-suppliers. Olesen (2015) classifies the suppliers in of E&P companies in the three categories, which are positioned in several links of the value chain, as direct suppliers, sub suppliers or 3rd tier suppliers. Although he refers on offshore projects, this accounts also for onshore projects.

Table 1 Three ideal types of offshore suppliers

<p>Specialized suppliers</p>	<ul style="list-style-type: none"> • Direct suppliers or sub-suppliers • Value chain specific competencies (refers to services, not necessarily to whole companies) • only applicable in one value chain) • vulnerable to changes at the macro-level • include drilling contractors, well management companies, manufacturers of drilling equipment, turbines, etc.
<p>General logistics suppliers</p>	<ul style="list-style-type: none"> • Often a direct supplier or second tier supplier, but in some cases also third tier supplier • Non-value chain specific competencies, which are applicable in multiple value chains. • Less dependent on changes at the macro level, which affects investments in one value chain or the other • include supply vessel operators, haulage providers, shipyards and construction yards, ROV operators, maintenance providers (e.g. in steel or electronics), commercial divers, project managers, etc.
<p>General suppliers</p>	<ul style="list-style-type: none"> • Traditionally third tier supplier of equipment (often for shipyards), but increasingly also direct (first tier) supplier of after sales services, etc. • applicable in multiple value chains • positioned in various links • various levels of specialization • able to switch from one value chain to another • includes manufacturers of pumps, safety equipments, steel sections, telecommunication, painting, etc.

Source: (Olesen T. R., 2015)

1.3 Problem Statement

The actual paper is targeting at the long-term development for the O&G supply and service in the upstream business. In the previous section the basis for the necessity of changing strategies in the given field was described. In order to maintain competitiveness, US companies revolutionized the oil and gas business with the breakthrough of unconventional hydrocarbons. Consequently the world supply exceeded demand, and the oil price collapsed to a historical low point. With falling prices E&P companies had to shorten their spending and curtailed Capex and Opex. Thus the supply and service industry has begun to change strategies slowly but steady, and this development is subject to continue as long as the business faces such challenges as it is the case nowadays. The strategy changes are driven by new technologies and business models, resulting in customer costs staying at a lower level for long-term. The actual thesis is designated to conduct a qualitative market research, which analyzes the relevant industry shifts.

The target is to elaborate a possible future development of the oil and gas player landscape and to explore what measures the supply (OEM) and service (EPC, OFS) industry in the upstream sector can derive from it.

1.3.1 Research Question

How are O&G spending and business models changing in a dynamic oil and gas market environment and what impact does it have on the oil and gas supplier landscape?

Sub-tasks:

- 1.) To evaluate the reallocation between Capex and Opex in oil and gas projects and its influence on OEM's, EPC's, OFS's.
- 2.) To outline the O&G player landscape with the corresponding business models and their drivers in consideration of the 2014 "lower for longer" turnaround point.
- 3.) To analyze findings of primary and secondary research from previous subtasks and identify opportunities and challenges for OEM's.

The first subtask is focusing on how procurement spend is changing, as Capex are getting reduced. Subsequently, I want to analyze what impact this reallocation has on the supplier side and E&P companies. The second subtasks includes an analysis of the O&G player landscape. Here I want to present the different players in the industry and their relationship to each other. In this context I want to give a short-term historical review, how business models have evolved before the 2014 turning point in oil prices and the development afterwards. Here I want to weigh up the advantages and drawbacks and assess later on in subtask three how business models and market segments will evolve in the future. As I am interested in the German market, and the German O&G market is mainly represented by OEM's, I will elaborate recommendations for OEM's as a final outcome.

1.3.2 Changing cost levels

The existence of O&G projects is first of all dependent on the cost levels. Generally speaking, accruing costs over a project's lifetime can be divided on the one side in Capex and on the other side in Opex. A decisive part of the Capex and Opex are paid to OFS companies for their products and services, supplied along the entire value chain.

Capex consist of all required initial investments for producing oil and gas, in order to achieve the forecasted results of executing that project. Additionally to fixed capital, Capex include working capital costs as well as cost of land and further non-depreciable costs. Also they cover all development expenses, beginning from the generation of the initial idea up to the

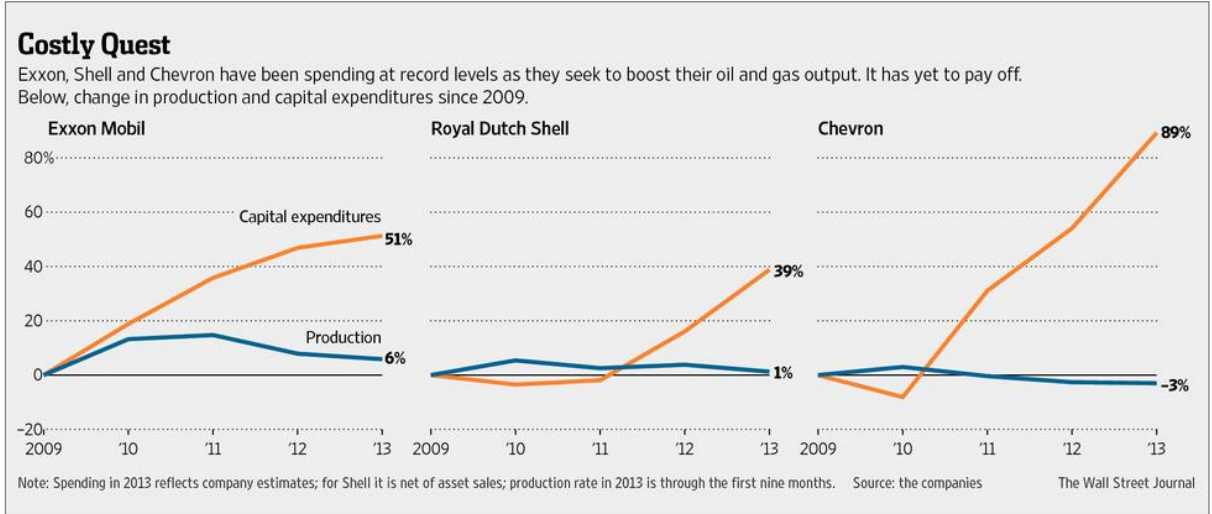
commercial shutdown. For instance constituents of Capex are, conceptual studies, FEED, exploration of offshore field development, building of all kinds of operational facilities from pipelines over onshore terminals to offices (F1F9).

Opex are related to costs that accrue over a whole projects lifetime in order to keep a field operated. They are the sum of manufacturing costs and general expenses. General expenses include marketing and sales, R&D and administrative expenses, like executive salaries for instance. In the following the constituents of manufacturing costs are represented with some examples associated to them (F1F9):

- **Variable costs:** material, catalysts, labor, power, utilities, royalties, licenses, patents
- **Fixed costs:** depreciation, taxes, insurances, rent, interest, lump sum royalties
- **Overhead costs:** HSE, medical care, restaurant, plant overheads, storage facilities
- **Repairs and maintenance:** replacements, inspections, shutdowns, routine maintenance

There has been a trend throughout the last years that Capex were increased, as the supermajors could venture it due to a reasonable high oil price. The production outcome, however, was declining. That development can be attributed to the challenges related with structural changes, the supermajors have been confronted with. The following graph shows this development up to 2013, one year before the oil price collapsed. Since E&P’s have been cutting Capex, in connection with a fallen oil price, their suppliers need to design their businesses more efficiently in order to maintain an economically viable business.

Figure 1 O&G Capex and Production development from 2009 until 2014



Source: Gilbert & Scheck, 2014

1.3.3 Importance of Business Models

Due to the fallen oil price, E&P companies have been pressing the value chain to lower costs, resulting in decreasing margins. In turn the service industry had to respond by downsizing. However it is a fact, that if E&P companies see OFS's sheer as a commodity, they won't receive the best possible services. The most essential challenge is to decrease customer costs, in order to be able to use the company's resources as best as possible, satisfy stakeholders and achieve positive economic results. Consequently, the mutual dependency between operators and suppliers in combination with the low oil price, constitute the imperative for the whole industry to revise BM's.

A business model describes an organization's logical manner of functioning and the way the company is generating profits. As every model a BM should simplify the complex reality of an existing or future business. Basically business models should help illustrate how business should function and to identify the key factors of an enterprises success or failure and. According to Staehler a Business model consists of the following three components: (Staehler, Business Models as an Unit of Analysis for Strategizing, 2002)

- **Value proposition:** The business model describes, what value customers or other partners receive in terms of product and service quality.
- **Architecture of value creation:** The business model describes the different stages of value creation, the different participants involved in value creation and their roles. It's addressing the questions how a service is provided in what configuration and what services are provided at what markets?
- **Revenue model:** The business model describes what revenues are generated out of what sources. Future corporate profits are the basis for assessing a business model and its sustainability. The core question is about, what profits are earned from?

After the 2014 harsh oil price collapse O&G players recognized the imperative for change in their business activities. In the framework of this paper it should be assessed, whether a BM innovation is subject to the long term survival of the industry by creating a win-win situation for operators and suppliers. Considering the current market dynamics we can observe trends like the breakthrough of digitalization in the context of industry 4.0, standardization instead of customized solutions, a wave of strategic alliances and new revenue models, like performance based contracting for example. This will be deeper elaborated in the empirical part of this study.

1.4 Limitations

In this chapter I want to clarify some limitations about my research, which needs to be considered.

The selection of the theoretical framework has an essential effect on the guideline and the outcome of my research, as this paper is mainly focused on the BM's and its drivers. So the focus lies in evaluation statements from representatives of E&P's different customer groups. Here I have questioned their position towards the O&G market development and their behavior addressing strategies and cooperation with other participants along the value chain, in contemplation of harsh circumstances of cost pressuring. In this connection, I assumed that the representatives, I have been in contact with, have a competent overview of the O&G player landscape, including the role of their own company, regarding its potentials and limitations. I had to rely on my assumption, considering the matter of fact that the interviewees work in worldwide competitive O&G companies.

Within the research six expert interviews have been conducted, consisting of sophisticated participants within the OFS and E&P industry. Three of them are representatives from OFS companies, one from a merger of a specialized OEM and EPC company, and two from E&P's. Since the focus on this paper lies in the OEM's, different customer groups and OFS's are located in between OEM's and E&P's. They were interviewed in order to analyze similarities and distinctions regarding their attitude and capability of adapting to new emerging circumstances and trends. However, a higher number of interviews could have possibly lead to a different insight, due to a broader scope of data, affecting the analysis.

Moreover this research is limited exclusively to industry players, active in the upstream sector. This is simply referable to the intensity of spending in the upstream. The O&G industry is roughly divided into upstream, midstream and downstream sectors. The spending in upstream states the majority in O&G. For this reason the upstream sector affects the economic well-being of the related industry correspondingly intensive.

Last but not least, I want to indicate that it might be feasible, that within this qualitative research there can be a bias among the interviewees' standpoint, what can be attributed to the specifications of the data collection method. Since the interviews are conducted with a variety of industry participants, each with different attitudes and interests, their articulations can be biased in order to show up superior or inferior to demonstrate their company. Thus, as a researcher I have to do conduct my analysis at the basis of this possible limitations.

1.5 Thesis Outline

The master thesis is composed of the following six chapters:

Chapter 1: Introduction	<ul style="list-style-type: none">• Introduces the topic, background and problem statement.
Chapter 2: Theoretical framework	<ul style="list-style-type: none">• Presents theories relevant to analyze strategies of business models and change in E&P procurement spending.
Chapter 3: Methodology	<ul style="list-style-type: none">• Explains how the research has been conducted methodologically.• Illustrates methodical choices and research conduct.
Chapter 4: Empirical results	<ul style="list-style-type: none">• Presents primary data findings collected from interviews in combination with secondary data.
Chapter 5: Analysis	<ul style="list-style-type: none">• Combines the theoretical framework and empirical results together, in order to elaborate the analytical findings.
Chapter 6: Conclusion	<ul style="list-style-type: none">• Provides contribution for theory and practice as well as limitations and opportunities for further research.

2.0 Theoretical framework

The theoretical framework will provide the literature, which is useful and necessary in my research in order to understand and delineate the problem statement. The different viewpoints regarding strategy and BM's will provide me a theoretical baseline for designing the empirical and analytical outcome. As stated in the title, this paper is about BM's. The concept of BM's is grounded on the core concepts of business strategy and theories associated to it. Especially the value chain concept (Porter, 1985) and the frame of value systems and strategic positioning (Porter, 1980) state important linkages to BM's. As the BM involve competitive advantage, it is also based on the resource-based theory (Barney , 1991). Regarding the integration into broader networks of value creation, BM's relate to cooperative strategies (Morris & Hergert, 1987) to the strategic network theory (Håkansson & Snehota, 1995). Moreover the model encompasses issues regarding company boundaries, e.g. vertical integration and the transaction cost concept (Jarillo, 1988; Williamson, 1975). After the concept of strategy has been presented as a basis for BM's, I will present the BM's (Osterwalder & Pigneur, Business Model Generation, 2010) and BM innovation (Gassmann Oliver, Frankenberger , & Csik, 2013) in the latter part of the theoretical framework.

2.1 The nature of strategy

There is a wide range of definitions for strategy. The term has been used in various ways, although it wasn't initially designated for such contortions. In the field of business studies it found its acceptance from the 1960's (Ansoff, 1965; Chandler, 1962; Andrews, 1971) and became increasingly subject for research. In economics, strategy is generally perceived as short-term, mid-term and long-term behavior patterns, which are designated to achieve defined goals in consideration of the market environment. However, such behavior patterns are criticized nowadays, due to the assumption of planning capability. For that reason the subject of strategy was extended by major economic scientists, like Henry Mintzberg for instance. However a deeper explanation of Mintzberg's concept of strategy would go beyond the scope of this paper and doesn't affect the core point of this paper, which are BM's. However, an overview of that concept is provided in appendix 1.

2.1.1 Competitive Strategy

According to Michael E. Porter every company, active in the free market economy pursues a strategy, which is guiding competitiveness in order to reach specific goals (Porter, 1980). To do so strategic management is necessary. Schendel and Hofer (1979) describe strategic management as the process of wording and implementing a strategy in order to achieve an economic entity's goal, while considering available resources and evaluating internal and external factors, that impact company performance. More precisely, it provides the enterprise a course, through which targets are specified, policies developed and plans outlined and finally resources assigned for implementing a strategy.

Resources are a constricted good of every enterprise and as a logical consequence their availability limits strategic variances. Daft and Barney outlined firm resources as "all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. controlled by a firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness" (Barney, 1991). Johnson et al. (2014, p. 70) have illustrated this concept from an extended point of view with the resource based view. The resource based view, or in other words the strategic capabilities stresses the interrelation between an enterprises' tangible and intangible resources and illustrates how their coordinated interaction "contribute to its long-term survival or competitive advantage". Tangible resources are "the assets that organizations have or can call upon" while intangible resources are considered as the competencies, with which "those assets are used or deployed effectively". In this connection the figure below shows

on practical examples the three essential components of strategic capabilities how resources and competencies interact together.

Table 2 Components of strategic capabilities

Resources: what we have		Competences: what we do well
Machines, buildings, raw materials, products, patents, databases, computer systems	Physical	Ways of achieving utilization of plant, efficiency, productivity, flexibility, marketing
Balance sheet, cash flow, suppliers of funds	Financial	Ability to raise funds and manage cash flows, debtors, creditors, etc.
Managers, employees, partners, suppliers, customers	Human	How people gain and use experience, skills knowledge, build relationships, motivate others and innovate

Long-term survival and competitive advantage

Source: Johnson, Scholes, Whittington, Angwin, & Regner, 2014, p. 71

David Teece, an economist from the University of Berkeley, criticizes the concept of strategic capabilities from that point of view, that they do not consider decisive shifts within the market environment. For this reason he has developed the concept of dynamic capabilities. Dynamic capabilities describe an economic entity’s property to regenerate and reestablish its strategic capabilities in order adapt to a changing market environment. The imperative for that capability arises from circumstances by which strategic capabilities can be taken off by competitors, e.g. when strategic capabilities possessed by a company become general practice or become needless with a changing market environment. So the essential inference is, that existing capabilities need to be recreated or brought to the next level, in order to maintain a long-term competitiveness under influence of external factors. (Teece, Pisano, & Shuen, 1997) Thus, Teece indicates three forms of dynamic capabilities:

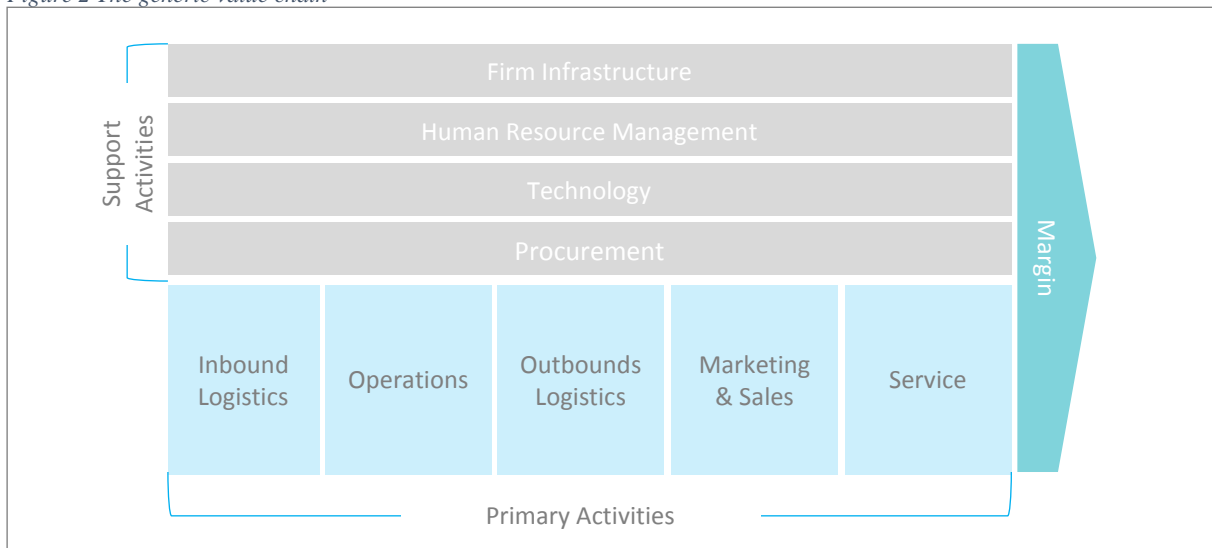
1. **Perception:** Every economic entity needs to permanently analyze the market for technological and marketing related possibilities. For instance, oil companies have clearly sensed the potentials of horizontal drilling and the threat of lacking availability to easy accessible conventional hydrocarbons.
2. **Seizing:** As soon as an opportunity has been perceived, it should be taken into consideration for realization and its potentials should be elaborated for application throughout all different kinds of products, services, processes and activities. In this sense the major multinational oil corporations have started to acquire small sized north-American regional operators, who have profound competencies in hydraulic fracturing.

3. **Reconfiguring:** In order to seize a prospective possibility, companies need to refresh and reconfigure established strategic capabilities and invest into potential innovations. As already described in the introduction, Shell has increased the focus of activities from a 50/50 relation to 70/30 in favor of OECD countries in order to take advantage from the rising shale extraction. Shell has neglected a stiffened focus on geologically easy accessible conventional hydrocarbons, and set their focus more into technological innovation in extracting hydrocarbons in politically stable, but geologically difficultly accessible regions.

2.1.1.1 The Value Chain analysis according to Porter

Porter's value chain provides a tool for identifying value creation in a company from an organizational viewpoint. Porter's value chain analysis divides the enterprise into nine strategically relevant activities. The primary activities represent the sequence, how resources are entering the company, how they are processed to products, and afterwards sold to the customer, shipped and maintained by the customer service. Analogically there are the secondary activities, which serve for securing the primary activities. Thereby, costs and value creation can be illustrated in a subdivided manner. The target point is to find concrete starting points for the business activities, in order to achieve competitive advantage through realization of cost reduction potentials or performance differentiation (Porter, 1985, p. 36).

Figure 2 The generic value chain



Source: Porter, *Competitive Advantage: Creating and Sustaining Superior Performance*, 1985, p. 37

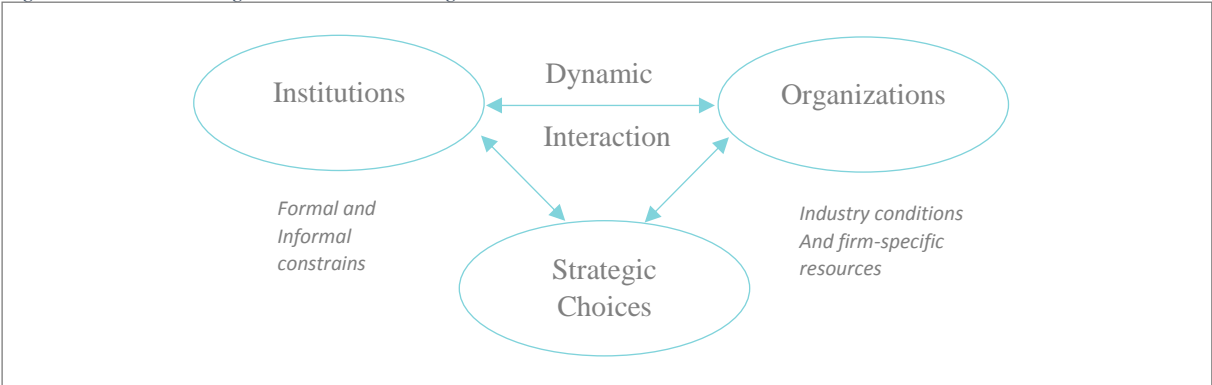
2.1.2 Institutional Theory

The institutional based view is a macro-economic related theory, which explores the influence of institutions on economic entities. The institutional theory is characterized by two prevalent trends, the old institutionalism and the new institutionalism. The old institutionalism assumes,

that economic entities act rationally, that there is perfect market competition and all market participants possess the same level of information. As this assumptions, don't reflect reality, this is criticized already at its early stage. In the year 1937 Ronald Coase sets a new milestone, when introducing the approach to new institutionalism with his article "the nature of the firm". That paper is regarded as the invention of transaction costs, which are a central object of investigation in the new institutionalism, since their existence defines the relevance of institutions for successful transactions (Coase, 1937). Later on, Oliver Williamson shapes the concept of the new institutionalism in 1975 with the transaction theory (Williamson, 1975).

Institutions in terms of new institutionalism consists of formal and informal rules and the mechanism for their establishment. Scott defines institutions as "regulative, normative and cognitive structures and activities, that provide stability and meaning to social behavior" (Scott, 1995). Referring to Scott the formal peculiarity of new institutionalism comprises "political rules, judicial decisions, and economic contracts", while "informal constraints, on the other hand, include sanctioned norms of behavior, which are embedded in culture and ideology" (Peng M. W., 2002, p. 252). As institutions are independent elements of a free market economy, the institution based view of business strategies addresses the interplay between economic units and institutions, as the formation of strategies results from such a cooperation. For this reason a number of scholars have acknowledged the importance of state and society (DiMaggio & Powell, 1991) – who are represented by institutions – for businesses, as the resource-based view (Barney , 1991) alone is not sufficient for maintaining a business. In this sense, Peng describes the interplay between institutions and organizations and the strategic choices resulting out of the mutual interplay, as referred in the following graph:

Figure 3 Institutions, organizations and strategic choices



Source: Peng M. W., 2000, p. 45

Institutions limit the behavior of individual entities into transactions and provide them with a reduction of insecurity. Such transactions are always accompanied with transaction costs, which

is regarded as the essential difference between new and old institutionalism. Transactions or in other words the exchange of rights of disposition are generally executed in four stages, which take place in a logical manner before and/or after the exchange of goods or services. They appear before or after an exchange has taken place and are strived to be as low as possible. Under the assumption of identical production costs they serve as a benchmark of efficiency for institutional arrangements: (Picot, 1982, p. 270)

- **Initiation costs:** costs for information search and acquisition about transaction partners and their conditions
- **Arrangement costs:** negotiation costs and costs for setting up and agreement of contracts
- **Monitoring costs:** costs for assuring compliance of agreements on time, quality, quantity, price and other factors, like secrecy for instance.
- **Adaption costs:** costs accruing for possible changes in circumstances in the course of the time of the agreement. They include for instance costs for deadline, quality, quantity of price shifts.

Subsequently the optimal organization arises from the minimization of the described costs. In the process of time various forms of cooperative organizations have been developed, in order to achieve such efficiency targets.

Williamson (1975) develops the organizational failure framework, which explains the essential influencing factors on transaction costs, consisting of the interplay between human and environmental factors and involving the transactional atmosphere between transaction participants. The first human factor is limited rationality, which means that humans have restricted capabilities to process information and communicate. It happens when human capacities are exhausted or there is a lack of information availability. The second human factor states opportunistic behavior, which implicates that economic players rather tend strategically than communication-oriented in order to outcompete other market participants. To do so, they break social norms in order to promote advantage for themselves. A further side effect of the second human factor is asymmetric information distribution, which suggests that transaction partners use information advantages opportunistically. Besides human factors, technological progress contributes to the choice of efficient organizations, as they enhance human rationality and result in a reduction of transaction costs due to reduced costs for information processing.

Moreover the frequency of transaction plays a decent but important role, as the intensity of economically unviable transactions result in a failure of market mechanism. Finally, the availability of knowledge and financial capital impact the choice of an optimal coordination mechanism. If a company is not capable to perform specific accomplishments autonomously due to a lack of that factors or too high transaction costs, they tend to step into long-term cooperation with partners in order to attain that resources. This circumstance leads us to the next chapter, which is addressing the cooperation of companies within an industry network.

2.1.3 Networking Theory

The previous chapters have covered the resource-based view, which is focusing sheer on competitive advantage and the institution-based view, which extended the logic of the economic cycle towards interactions between institutions and individual organizations. The network theory extends the previously described concepts to a mash of social, economic and political relationships (Schubert, 1994, p. 46), which exists to serve participants of a certain network of market players to achieve their entrepreneurial goals. Networks come out as a consequence of interactions between multiple organizations and develop further on the basis of those interactions. The network theory refers to indirect relationships between interrelated resources, actors and activities, which arise from personal and organizational linkages. The central concern behind this concept is to distribute the scarce resources, which are allocated separately among the single network participants, optimally over the whole network for the benefit of all participants. Generally the network theory provides for the first time a theoretical concept for the analysis of relationships between various companies and their stakeholders.

The interaction-oriented concept of network theory, firstly developed by Hakansson at the University of Uppsala, provides an essential contribution to the illustration of network theory. As already described before, it basically targets the interdependent relationships between whole organizations and single players and conceptualizes markets or branches as networks of interacting enterprises. Hakansson emphasized the importance of relationships, as “relationships are one of the most valuable resources a company possess.” (Hakansson, 1987, p. 10) Thus, representatives of the networking theory associate interaction relationships with investments, especially in consideration of the huge resource effort. Moreover interaction relationships are important in order to achieve access to competition relevant resources, because “through its activities in the network the firm develops the relationship that secure its access to important resources and the sale of its products and services” (Johanson & Mattsson, 1987, p.

36). Following, they offer companies possibilities to new strategical choices (Mattsson, 1987, p. 235).

On the other side, however, interaction relationships can also restrict space of action. Issues like coordination problems, deficit of control, opportunistic behavior, unintended brain drain, unspecific scope of action and thus increasing emergence of unintentional consequences from collective and uncoordinated interactions on the network level may arise (Wurche, 1994, p. 144). Consequently, networks are characterized by both, cooperation and competition. The quality of network relationships can be determined on the basis of several attributes, which are cooperation between network participants, trust and reciprocity of network relationships, power of network participants and level of economic interdependence. Every network participant strives for its own prosperity, what can lead to conflict situations due to a lack of hierarchical structures. At this point the importance of the institutional framework arise, which is designated to mitigate such complications as far as possible.

2.1.4 Characteristics of inter-organizational cooperation

A narrower characteristic of the network strategy is interorganizational cooperations, whose main target is to achieve synergy effects. This means, that a common usage of complementary company resources and competencies between network partners results in scale advantages in form of cost savings or productivity increase. The positive outcome of such synergy effects can be the access to so far inaccessible markets and resources, in-depth understanding and specialization, and cost and time advantages due to a streamlined coordination of business processes. Organizations step into cooperations in order to work towards common targets. Common targets define compliance with all participants and they consider stakeholder interests. This could be for instance striving for profit and sales, profitability, securing company potential, safeguarding jobs, security, liquidity, image and power, ethical and social aspirations and many more. According to Morris and Hergert (1987, p. 15) the most international cooperations are initiated in order to develop a product, service or solution together. Here it is important to consider the assumption of the transactioncost theory, as the common operations should be so far cost-cutting or differentiating, that they don't exceed the costs of the common operation (Porter, 1985; Lutz, 1993, p. 26). Moreover it's worth mentioning that the different characteristics of interorganizational cooperations achieve different competitive advantages, and so, can be present in all value activities. Interorganizational cooperations can exist in two ways and realized either by M&A's or by strategic alliances like JV's for instance. The two forms are presented in the following.

2.1.4.1 Horizontal cooperation

A horizontal cooperation suggests, that two or more companies connect certain aspects of their activities with each other, which are on the same level of the value chain within a certain pattern of business. Thus, a horizontal cooperation can nurture a market extension, if a foreign cooperation partner develops a new market. Moreover it can nurture product extension, for instance when a provider of reservoir and well technology like Schlumberger merges with a provider of wellhead and surface technology like Cameron.

Within the framework of horizontal integration, two or more companies, positioned at the same stage of a value chain, strive to achieve competitive or market advantage, which they couldn't have achieved separately by themselves. Thereby cooperation is mostly restricted towards certain functional areas, like R&D or sales. In the case of merger, however it can be extended. Lutz (1993, p. 44) complemented the nature of horizontal integration with the interdependency discussion, which suggests that one partner without another is not just unable to reach its target. Rather it reduces one's own capability of target attainment.

2.1.4.2 Vertical Integration

The vertical integration encompasses the cooperation of two or more enterprises, who are active in different but successive value creation stages. Thereby the subordinate enterprise takes over certain functions from the main company, and thus, gets involved stronger in the business processes and binds itself to the main company (Johnston & Lawrence, 1989). With this kind of functional externalization, which is called "vertical disaggregation" by Miles and Snow (1986), the exchange of services is regulated by the market, in contrast to horizontal integration. The enterprises deliver a common performance in their market, but stand in competition with third companies (Jarillo, 1988).

2.1.5 Summary of the strategy concept

The theoretical framework on strategy, which has been explained in this chapter provides a basis for understanding what BM's are essentially about, and how they cope with an increasingly dynamic market environment, which is the core issue of this paper. They were built one after another and complete each other, in order to create a framework, which describes the circumstances of a dynamic and globalized market. The major thinker of competitive strategy Michael E. Porter regards a business as an isolated entity, which focuses merely on its core competencies and strives for profit maximization and competitive advantage, through acquiring a superior position in a market characterized by social and economical influencing factors. Within the framework of institutional theory an organisation's crucial merit is its social

competence and ability of interpretation, as they strive to fulfil the society's needs. The organizational field strives for developing institutions, by establishing regulations, in order to adapt to environmental changes and acquire resources more efficiently. The network theory treats an enterprise as a node, which is a fixed element of a certain environment and channel for transformation of resources. An enterprise strives for building those relationships with other actors, which allows it to establish a position within a network, through which lacking resources can be acquired, even if they are possessed by competitors.

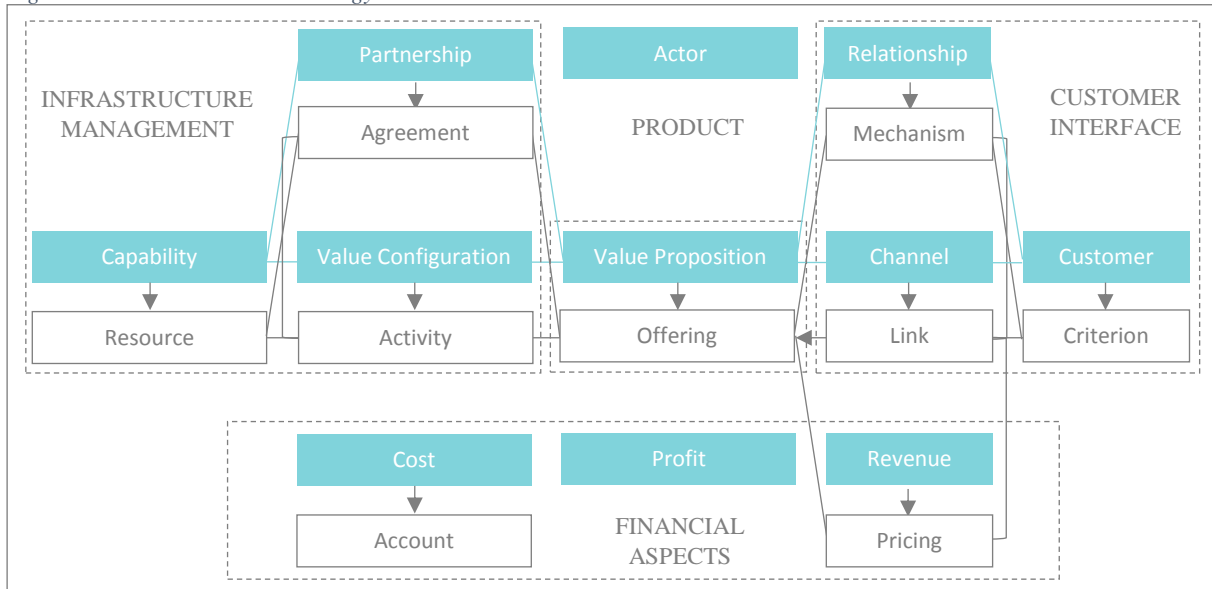
2.2 Business Models

The term business model has been widely used in economic literature from the 1990's, although it was mentioned already in 1957 in a scientific paper (Bellman, Clark, Craft, Malcom, & Ricciardi, 1957; Osterwalder, Pigneur, & Tucci, Clarifying business models: Origins, present, and future of the concept, 2005). The birth of the world wide web initiates the subject to be discussed extensively and contentiously, in particular in the field of electronic business. So the interest for research on the term was upscaled due to its interdisciplinary and diverse possible applications from the electronic business to information systems and classical strategic management (Burkhart, et al., 2012). While there is a common essential understanding for competitive business models, it lacks for its components (Mitchell & Coles, 2003; Morris L. , 2009; Osterwalder, Pigneur, & Tucci, 2005). However there is no officially approved definition of what a business model is in detail (Linder & Cantrell, 2001; Osterwalder , 2004). Thus, I listed some publicly well known and frequently cited definitions arranged according to timeline. They can be seen in the appendix 2. In the next steps they are going to be summarized to a common basis.

The definitions on business models, presented in the appendix 2, emphasize the lacking consensus of a consistent BM definition. External influencing factors, value creation and value proposition of companies are also important elements of BM definitions as well as actors and their roles (Weiner, Renner, & Kett, 2010). Subsequently, Osterwalder (2004) developed an ontology, which categorizes the components of definitions from the different authors and assigns them. It results in nine components, which together shape a model. Thus, this ontology connects different preliminary definitions and reduces them to a common denominator (Osterwalder , 2004). However it is important at this point to mention, that Osterwalder neglects external competition and focuses rather on the internal shaping of BM's.

As Osterwalder's ontology is widely recognized, both in research and in business (Gassmann Oliver, Frankenberger, & Csik, 2013), it is going to be used within the framework of this paper. Figure 4 illustrates the nine components of BM ontology as well as actors and profit:

Figure 4 The business model ontology



Source: Osterwalder, *The Business Model Ontology A Proposition in a Design Science Approach*, 2004, p. 44

Thus a BM is defined by Osterwalder and Pigneur as follows: (2005, p. 5): “A business model is a conceptual tool containing a set of objects, concepts and their relationships with the objective to express the business logic of a specific firm. Therefore we must consider which concepts and relationships allow a simplified description and representation of what value is provided to customers, how this is done and with which financial consequences.”

Hence, Eriksson and Penker (Eriksson & Penker, 2000, p. 9) have listed five objectives, a business model serve, besides being the basis for information management:

- “To act as the basis for creating suitable information systems that support the business.
- To act as the basis for improving the current business structure and operation.
- To show the structure of an innovated business.
- To experiment with a new business concept or to copy or study a concept used by a competitive company (e.g., benchmarking on the model level).
- To identify outsourcing opportunities.”

2.2.1 Dissociation of familiar terms

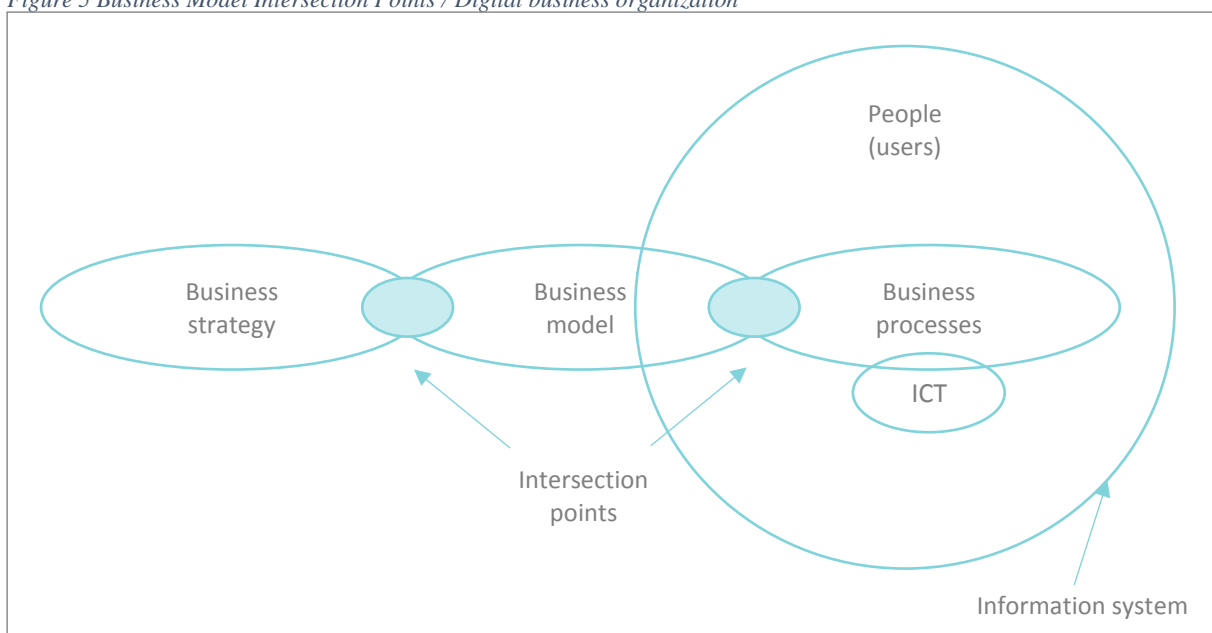
Due to the fact, that some authors equal or integrate a strategy or individual components of a BM to an entire BM, this chapter presents the dissociations of familiar but still distinct terms (Linder & Cantrell, 2001; Pateli & Giaglis, 2003). The distinction between BM and strategy is

often not distinct in business sciences (Al-Debei , El-Haddadeh, & Avison, 2008, p. 4). For instance, Alt and Zimmermann (2001) integrate the value proposition, which most major thinkers regard as an essential element of BM's, in the strategy and so intermingle these concepts. Other authors demarcate BM's and strategy as distinct but complementary terms. Thus a strategy is the driving force for the application of generated values, while a BM describes the generation of those values (Shafer, Smith, & Linder, 2005, p. 203; Weiner, Renner, & Kett, 2010, p. 24).

In consideration of the pace, in what BM's are changing, Weiner et al. (2010, p. 24) categorize strategy as an external influencing factor and, thus, not as an intergrated element of a BM. The strategy provides a reference frame for the development and design of a BM, while in the framework of a BM there can be various configurations (Bieger, zu Knyphausen-Aufsess, & Krysz, 2011, p. 25). Scheer, Deelmann and Loos (2003) consider a BM as a linkage between the business idea and its business plan, where the business idea is generated temporaly before the BM and it is more abstract. Thus, the BM helps to design, monitor, asses and communicate the business idea in a more efficient way (Rentmeister & Klein, 2003, p. 20).

Osterwalder et al. (2005, p. 12) consider the BM as an abstract view at a firm's logic. In contrast, a business process model illustrates, how a specific business case can be implemented into individual processes. BM's describe the generation of a specific output through the combination of various input factors (Veit, et al., 2014). So, a BM serves as a linkage between a strategy and a business process model:

Figure 5 Business Model Intersection Points / Digital business organization



Source: Al-Debei , El-Haddadeh, & Avison, 2008, p. 6

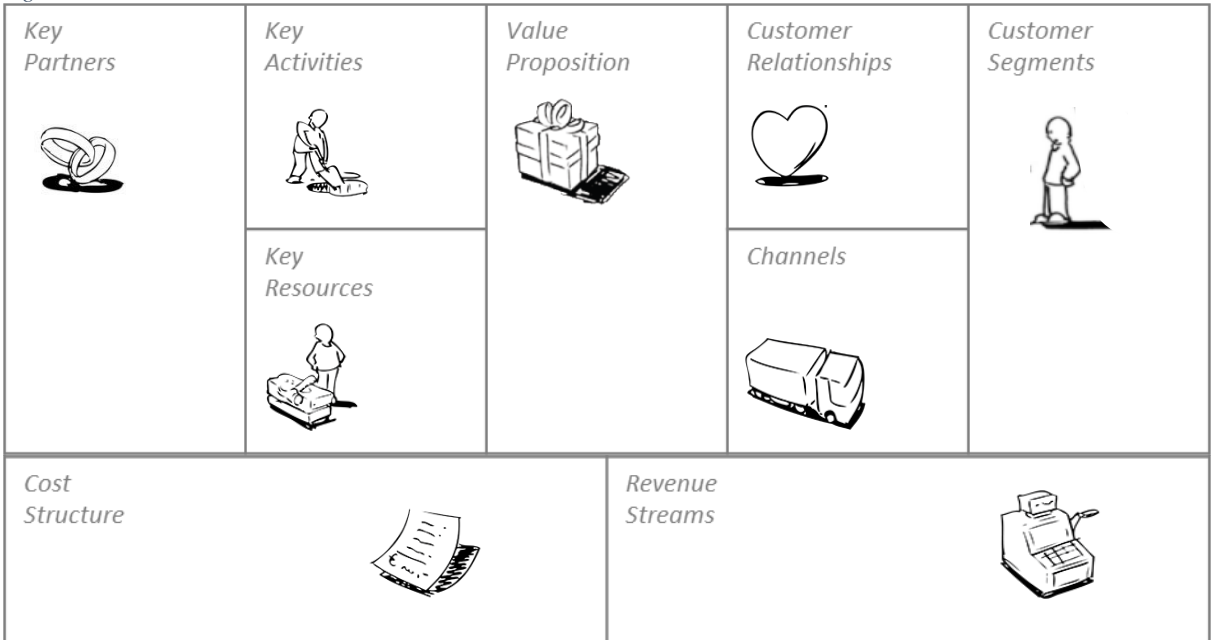
Weiner et al. (2010, p. 24) define a business plan as a specific entity of a BM. Thereby the business plan is rather detailed and describes the BM less abstractly (Rentmeister & Klein, 2003). So, the BM can be transferred in various ways into business plans. Thus, the business plan (Osterwalder , 2004) presents an important decision criteria for further measures (Weiner, Renner, & Kett, 2010, p. 24).

According to Linder and Cantrell (2001, S. 3) many authors apply the term of BM wrongly, as they use it for individual partial components of BM’s. Although those component’s are essential elements of BM’s, they can’t be mixed up with a BM as a whole. Since there a specific branch of research for BM’s is developed, confusions have decreased (Weiner, Renner, & Kett, 2010, p. 25). Thus, the following two chapters represent the components of BM’s from internal and external view points.

2.2.2 Components of Business models

BM’s are often described as a system, consisting of various components. (Alt & Zimmermann, 2001; Chesbrough & Rosenbloom, 2002, p. 533; Johnson, Christensen, & Kagermann, 2008, p. 60; Osterwalder & Pigneur, 2010, pp. 16-19) As already mentioned in chapter 2.2, I work with the conception of BM’s, which is based on components according to Osterwalder (2004).

Figure 6 The Business Model Canvas



Source: Osterwalder & Pigneur, Business Model Generation, 2010, p. 44

Osterwalder and Pigneur regard the value proposition in the centrum of a business model. That’s why they address one half of the components to the enterprise, which consist of key ressources, key activities, key partners and cost structure directly. The other half, consisting of

customer relationship, communication and distribution channels, customer segments and revenue streams refers to the market side (Osterwalder & Pigneur, 2010).

2.2.2.1 Internal influencing factors on BM's

The first component describes the customer segments, which need to be served. As a company's existence is dependent from customers, making payments, this component is of essential importance (Morris, Schindehutte, & Allen, 2005, p. 730). After customer segments are determined, the BM's can be developed "around a strong understanding of specific customer needs" (Osterwalder & Pigneur, 2010, p. 21).

The next component, described by Osterwalder and Pigneur, is the value proposition, which combines products and services in order to generate value to a specific customer segment. "Values may be quantitative (e.g. price, speed of service) or qualitative (e.g. design, customer experience)." (Osterwalder & Pigneur, 2010, p. 23) Moreover the purchase decision is influenced by factors like actuality, the (technical) performance, design, the level adoptability to specific customer needs and the brand itself. Generally speaking, the authors argue, that the buyer decision process is directly influenced by the attributes of the value proposition, whether to decide in favor of a company or not. So, the value proposition fulfills customer needs or solves their problems (Bieger, zu Knyphausen-Aufsess, & Krys, 2011, p. 35; Johnson, Christensen, & Kagermann, 2008, p. 60).

The third component is channels and it illustrates how customer segments are approached and addressed in order to convey the value proposition (Bieger, zu Knyphausen-Aufsess, & Krys, 2011, p. 42). They consider in particular the communication, distribution and sales channels, which constitute the direct contact points to customers (Schallmo D. , 2013, p. 63). Customers get more aware of a company's products and services and the value proposition they get offered throughout the whole product and/or service life cycle (Osterwalder & Pigneur, 2010, p. 26).

The component of customer relationship describes, what kind of relationship an enterprise enters with its customers from various segments. Customer relationship management targets long-term relationships of customers to a company, in order to secure revenues, to utilize cross-selling potential and to save transaction costs for acquiring new customers (Makosch, 2012).

The turnover, earned with customer segments are described by the revenue streams (Bieger, zu Knyphausen-Aufsess, & Krys, 2011, p. 46). Osterwalder and Pigneur (Osterwalder & Pigneur, 2010, p. 30) categorize between transaction-revenues from one time sales on the one side and recurring revenues from ongoing payments on the other side. Revenues can be earned through

the sales of goods or licences, through membership and usage fees, and through renting out goods. On the basis of this variety of offerings, pricing mechanisms are composed out of fixed menu pricing and dynamic prices. Fixed pricing is defined on static variables, while dynamic prices change with market conditions (Osterwalder & Pigneur, 2010, pp. 31-33).

According to Johnson et al. (2008, p. 61) key resources state the most important goods for a well functioning BM. Osterwalder and Pigneur (2010, p. 34) categorize them into human, intellectual, physical and financial resources. They have some direct or indirect influence on the BM performances, whereby they don't necessarily need to be possessed by a company. They can also be acquired or rented by key partners (Schallmo D. R., 2013, p. 68). As specific human resources like knowledge and creativity are difficult to imitate, they present especially important success factors for a BM (Morris, Schindehutte, & Allen, 2005, p. 730).

The next essential BM component is key activities. They contribute analogically with the key resources, to an enhanced value proposition and customer relationship and finally to earning profits (Osterwalder & Pigneur, 2010, p. 36). The key activities differentiate depending on the BM (Morris, Schindehutte, & Allen, 2005, p. 730). Depending on the BM, they focus on different task areas, like the production of goods, consultancy, or providing of web-based platforms for example (Osterwalder & Pigneur, 2010, p. 37).

The network of suppliers and third partners is designed within the context of key partnerships. (Schallmo D. R., 2013, p. 71). The basic intention of partnerships is achieving volume advantages and scale effects, optimizing the distribution of resources and activities as well as reducing risk and uncertainty. As the most companies usually do not possess all necessary resources, the acquisition of certain activities and resources becomes often a crucial reason for partnerships (Osterwalder & Pigneur, 2010, p. 39).

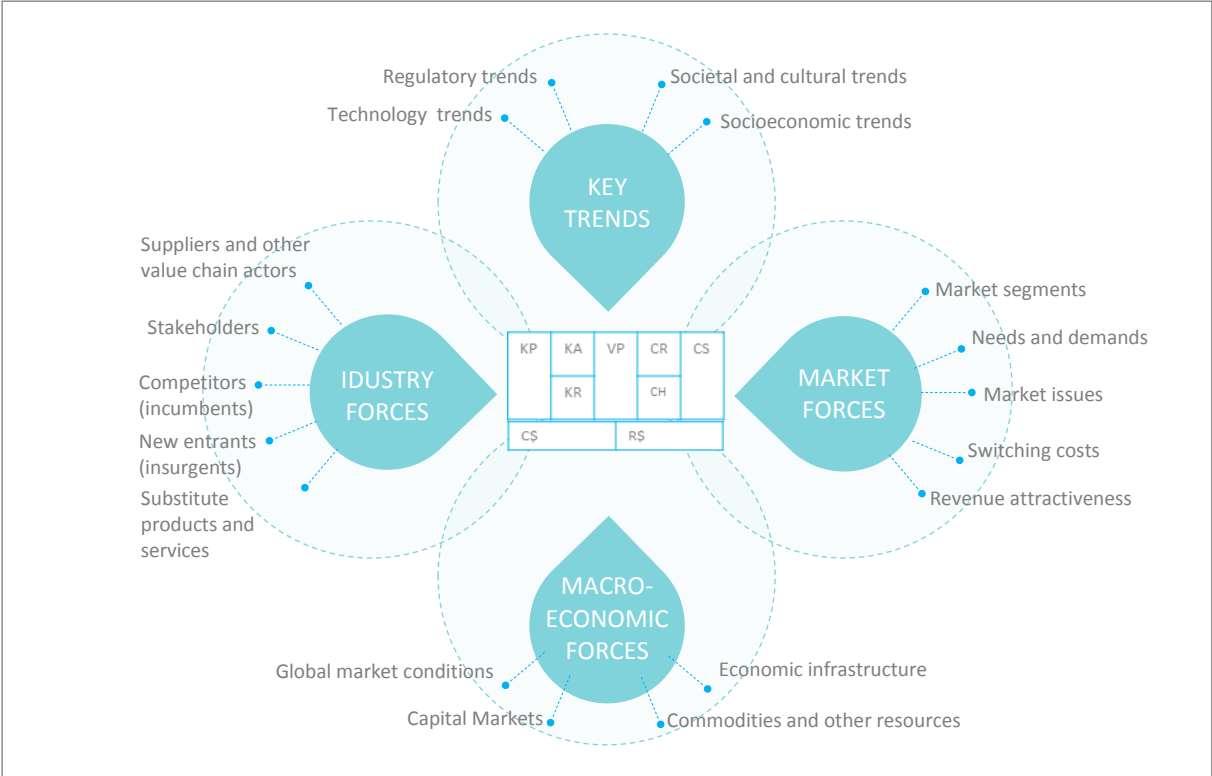
The costs accruing during the execution of a BM are described in the cost structure. All activities and resources, utilized within a BM, cause costs and expenses (Morris, Schindehutte, & Allen, 2005, p. 730; Schallmo D. R., 2013, p. 75). After the determination of key resources, -activities, and -partnerships these costs are calculable. The cost structure is remarkably dependent from the specific BM. Osterwalder and Pigneur (2010, p. 41) distinguish between cost-driven and value-driven structures and argue that many BM's are located in between them.

2.2.2.2 External influencing factors on BM's

Due to the increasing complexity of the economic environment, huge insecurities through technological innovations and profound market shifts through new types of value proposition,

monitoring the direct environment of the business model has become of vital importance (Osterwalder , 2004, p. 19). Osterwalder and Pigneur categorize the BM environment into market forces, industry forces, key trends and macroeconomic forces (Osterwalder & Pigneur, 2010, p. 200) and, thus, extend the concept of Weiner et al. (2010, p. 26). Figure 7 presents the four demarcated sections and extends them on another level with concrete business factors.

Figure 7 Key external forces that influence BM's



Source: Osterwalder & Pigneur, Business Model Generation, 2010, p. 201

The market forces comprise all market aspects, addressing the current market shifts. The market segments and their forecasted growth potential contribute to market forces as well as customer needs and demands (Osterwalder & Pigneur, 2010, p. 202). Moreover the authors impute the customer's payment reserves and switching costs.

The competition analysis of the industry forces is familiar to Porter's industry structure analysis, as it analyzes competitor's strengths and weaknesses as well as new entrants' value proposition (Schallmo D. , 2013, p. 36). In addition, the competition analysis comprises the analysis of stakeholder's influence, supplier's growth potential and substitutes as possibilities of evasion for customers (Schallmo D. , 2013, p. 36; Osterwalder & Pigneur, 2010, p. 204).

In terms of the key trends Schallmo (2013, p. 35) considers trends in technology, legislation, society and socio-economics. In this connection the level of influence of those trends on the

BM is determined primarily. Moreover it includes regulatory realignments and demographic factors (Osterwalder & Pigneur, 2010, p. 206; Schallmo D. , 2013, p. 35).

The macroeconomic forces comprise subjects regarding the general economic situation. This includes issues regarding the access to financing options at the capital market and the stability of price development for key resources (Osterwalder & Pigneur, 2010, p. 208). Further on ,the quality of public infrastructure and its influence on the BM is also an object of reflexion of macroeconomic forces.

2.2.3 Business model innovation

Staehler is one of the major thinkers, when it comes to BM innovation. He categorizes BM innovations into incrementals and disruptives (Staehler, 2002, S. 71). He argues furtheron, that incremental innovations are the only parts of BM´s, however they don´t influence the basic BM architectre. According to Schallmo (2013, p. 25) disruptive BM innovations imply the development of new and so far totally unknown BM´s. Perez and Freeman (1983; 1991) perceive incremental innovations as improvements in products and services, which arise mostly in production from constant learning by doing. Incremental innovations enhance existing organizational competencies, while disruptive innovations require new competencies and problem-solving mechanisms (Tushman & Anderson, 1986). Disruptive innovations happen seldom, however they change the essential structures of an industry or the whole economy.

At this point it is worth mentioning some important characteristics of disruptive BM innovations, which are related to the content of this paper. Among others it is new patterns of behaviour at the company level, may it be single persons or the whole organization. Those patterns require new strategies, structures and processes (Tushman, Newman, & Romanelli, *Convergence and Upheaved: Managing the Unsteady Pace of Organizational Evolution*, 1986, p. 38; Herbig, 1994, p. 6). Moreover they drive changes of competitive position, as first-mover advantages and mobility barriers have to be removed (Porter, 1985, p. 197).

Indicators of incremental innovation, standing in close connection with the actual research are:

- they relate to existing products and services (Perez, 1983; Freeman, 1991).
- they appear in small steps in the late phases of a product life cycle (Abernathy, 1978, p. 7).
- they arise within an existing industry, stem from industry participants and enhance their position (Tushman & Anderson, 1986; Porter, 1985).
- they help to increase efficiency of existing operations.

Gassmann et al. (2013a, p. 9) require, that at least two out of four basic components of BM's, which will be described more precisely in chapter 2.2.5 need to be innovated, in order to label a shifting BM or a BM innovation. That four components state the abstractive illustration of the nine components, presented in chapter 2.2.2. Comes and Berniker (2008, p. 78) consider completely new market players, who differentiate from previous BM's in particular with value proposition and revenue model, as a result of a BM innovation. According to Staehler (2002) disruptive BM innovations are subject to a subjectiv assessment of a company, because they are dependent from respective view points, like the company size for instance.

2.2.4 Frameworks for Business Modell Innovation

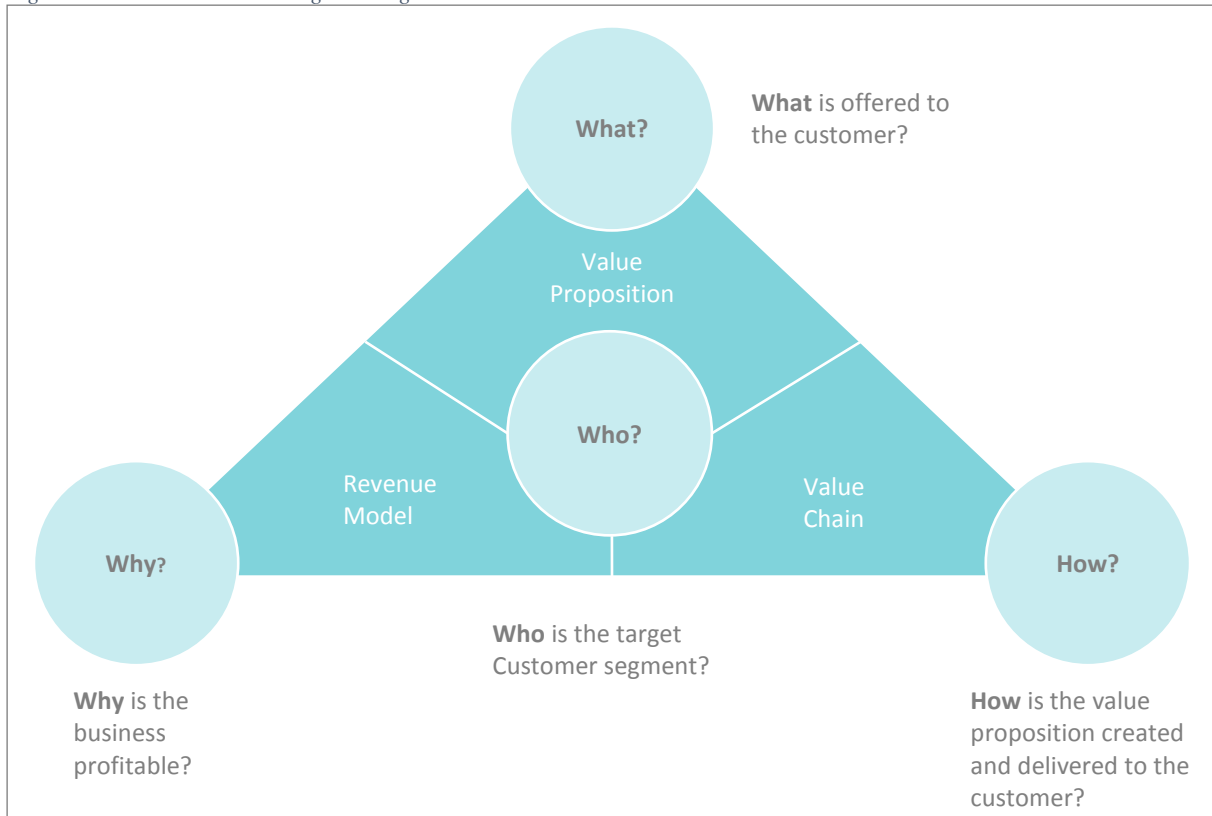
After the concept of business models has been deliniated, I want to introduce an important approach for evaluating a BM and its innovation, as this paper is adressng BM's in a highly competitive and dynamic market. There is a number of frameworks, which help to support the process of developing a BM. They generate utility for the planning, analysis, structure, vizualizing, communication and implementation of BM's (Gassmann, Frankenberger, & Csik, 2013a; Osterwalder, Pigneur, & Tucci, 2005; Scheer, Deelmann, & Loos, 2003). Among them, the Business Model Canvas, which bases on the components described in chapter 2.2.2.1, is one of the most utilized frameworks for BM's in research (Weiner, Renner, & Kett, 2010, p. 31) and in business practice (Gassmann Oliver, Frankenberger , & Csik, 2013, S. 25). According to Weiner et al. (Weiner, Renner, & Kett, 2010, p. 56) BM's can be described very precisely with the Busines Model Canvas. Moreover it offers the possibility to include the relationship between the individual components explicitely in the modelling. On the other side the BMC is criticized for restricting the scope of action for BM's on the nine components (Weiner, Renner, & Kett, 2010, p. 32). Mauer and Faschingbauer (2013, p. 45) augment the critics in regard of the applicability in a dynamic environment. They argue, that the market environment shouldn't been treated as a poor source of information, but as partner, that should be involved in the BM. For this reason the Sankt Gallen Business Model Navigator (BMN) is a relevant approach for the topic of this paper, as we consider the highly competitive and danymic O&G market.

2.2.5 Sankt Gallen Business Model Navigator

Gassmann et al. (2013a) developed in cooperation with an number international established companies and the Center for Design Research from the Standford University the St. Gallen BMN. The core finding of this research project suggests, that nine out of ten evolving BM's can be attained through a recombination of already existing BM's. The authors identify 55

different patterns of BM's, which serve as a potential inspiration for the new development of a unique BM. Thereby, the development process is described more abstractly than with the nine component concept. Gassmann et al. (2013a, p. 5) constrain the process to four dimensions, which are illustrated in the “magic triangle”. They argue, that it is more expedient than the complex BMC.

Figure 8 St. Gallen BMN – Magic Triangle



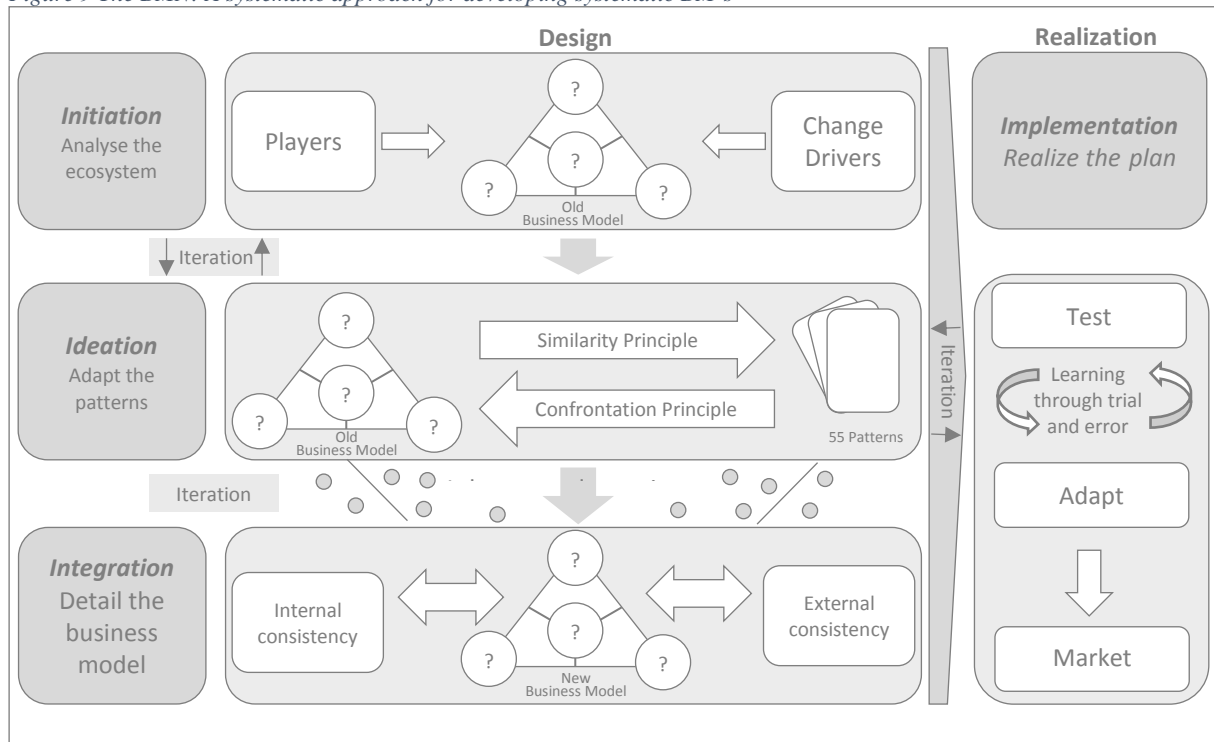
Source: Gassmann, Frankenberger, & Csik, 2013a, p. 6

The four dimensions of the triangle question the basic factors of a BM: the customer, the value proposition, the value chain and the revenue model. Familiar to the BMC, described in chapter 2.2.2 where the components are categorized into enterprise and market side, within the St. Gallen BMN customers and value proposition are attributed to the external dimensions of a BM, and the value chain and revenue model to the internal dimension (Gassmann, Frankenberger, & Csik, 2013a).

2.2.6 The procedure model of the St. Gallen BMN

Within the framework of the BMN the BM development is divided into various stages. As illustrated in figure 9 the major divisions are design and realization, while the design phase is again subdivided into initiation, ideation and integration.

Figure 9 The BMN: A systematic approach for developing systematic BM's



Source: Gassmann, Frankenberger, & Csik, 2013a, p. 16

The first stage of the design phase is about the initiation of the project. Osterwalder and Pigneur (Business Model Generation, 2010) and Gassmann et al. (2013a) are on the same line when arguing, that it is indispensable for developing an innovative BM to understand one's BM and to know all relevant players and influencing factors. In the initiation phase the actual BM and its environment is analyzed and modelled. Gassmann et al. (2013a, p. 22) emphasize the necessity of a heterogeneous composition of the analysis and modelling team as well as an appropriate level of abstraction in order to avoid too detailed specifications.

In the stage of ideation, ideas are collected for potential BM's. Gassmann et al. (2013a, p. 33) stress that innovative BM's consider besides of empirically inquired customer needs also potential future needs. In this connection the authors cite Henry Ford's statement: *"If I had asked people what they wanted, they would have said faster horses"*

After potential ideas have been generated, they are designed in the integration phase, whereby it is striven to achieve internal and external consistency when overpassing from ideation to integration (Gassmann, Frankenberger, & Csik, 2013a, p. 45). This means basically, that a BM should be consistent with internal company requirements, but also with the external environment. The internal consistency requires a coherent coordination of the what, how, who and why factors, whereby the questioning is leaned strongly on the nine components, worked out by Osterwalder and Pigneur. The external consistency aims at bringing the business environment into accordance with the BM

(Gassmann, Frankenberger, & Csik, 2013a, p. 47). The main focus stays with satisfying the needs of the respective actors and the appropriate reaction towards current trends and competitive condition. The preliminary design of the BM is determined after completing the design phase.

The realization and so the implementation of the BM is the most challenging task in business practice (Gassmann, Frankenberger, & Csik, 2013a, p. 49). The authors argue the complexity with opposition from the market, from partners and from own employees. Thus, they recommend the rapid-prototyping approach, in order to test a business model at first on the small scale, because a prototype offers essential cognition. While testing the prototypes, it is very important to get feedback from different stakeholders in order to identify weaknesses in the BM.

2.2.7 Recombination of existing BM patterns

Gassmann et al. (2013a, p. 21) argue that simply copying a BM is not efficient. Instead enterprises need to understand BM's elements and how they are interconnected and adapt them to their own business. This empowers companies to innovation leadership through imitation of BM patterns outside their own industry. In the context of the research, three basic strategies were identified, which have been applied in the industry (Gassmann, Frankenberger, & Csik, 2013a, pp. 17-21):

- **Copying:** An existing BM is transferred to another industry. The benefit of this strategy is that one can learn from mistakes of third companies and make it better instead.
- **Combining:** Two or more BM patterns are combined with each other, in order to utilize the benefits from all of them. On the other side, utilizing a number of BM's increases complexity as well as barriers for imitation towards competitors.
- **Replicating:** This strategy is used occasionally from companies, who intend to use a successful BM pattern in other product areas. The authors emphasize, that this three basic strategies can be used individually, but also in combination.

In order to provide one example of the 55 BM's the "Razor and Blade" pattern is described in the following (Gassmann, Frankenberger, & Csik, 2013a, pp. 203-204). This pattern is characterized by an inexpensive or free of charge basic product. However, an expensive complementary product is required in order to be able to use the product long-dated. Thus, the complementary parts generate the major turnover for the company. The basic idea is to reduce the purchasing barriers for customers initially through a low purchasing price and just in the second instance to retain customers. So, the sale of the complementary product can be regarded as a cross-subsidization of the basis product. The authors emphasize, that exit barriers, for instance through patents, need to be established in order to be able to profit from such BM's. The described pattern can be identified today in various industries, like shavers with razor blades, printers with ink cartridges, coffee machines with coffee pads or caps.

Gassmann et al. (2013a, p. 34) suggest two different approaches for the adaptation of BM's with the principle of similarity and adaptation. The principle of similarity states little requirements towards the abstraction capability of the team, since the scope of research is limited and the solution space correspondingly as well. The central question is about the change induced through transferring an external BM to one's industry. Thus, BM patterns should stem from familiar industries, so that the gap to one's own BM can be manageable.

With the principle of confrontation a certain BM gets intentionally challenged by a BM from another industry. On the basis of the gap of alternative patterns and the original condition the access to existing thinking patterns is eased, and openness towards new ways of thinking fostered. Due to the imperative of a positive and creative mindset within the team and the depth of work, which has to be conducted, Gassmann et al (2013a, p. 38) suggest, that the approach according to the principle of confrontation is not suitable for every person group. Hence, the authors recommend a mixture of presence workshops and virtual elements of the creation of ideas.

2.2.8 Summary of the BM concept

Osterwalder is considered to be one of the major thinkers of BM's as his BMC has found broad acceptance and applicability in research and business practice. It is simple to apply and it covers company matters from a number of important internal viewpoints. However it is criticized for not adapting external market forces, especially in dynamic markets. This paper is about a dynamic market, characterized by a sharply fallen oil price, sustainability issues and high competition. Considering the challenges of a dynamic and globalized market, Gassmann et al. (2013a) brought the concept of BM to another level and developed a tool for innovating BM's, the St. Gallen BMN. A BMI is an insistent change of existing business models or the generation of a new business model, which meets customer needs better. BMI's are strategic innovations, because they change the basic structure of a business. A sheer business model doesn't present a strategy, while its insistent change does. A business model innovation is basically about creating competitive advantage and improvement of a company's economic situation. Measures to promote such business model innovations could be product innovations, process innovations, organizational innovations or their entirety (Utterback, 1994).

3.0 Methodology

The present thesis is subject to qualitative research, where findings are derived from primary data in form of in-depth interviews and a number of sources of secondary data. The actual chapter describes the process of how research has been conducted methodologically. It contains

a delineation of the research design and the methods of gathering and analyzing data. Finally the research process will be considered in terms of ethical considerations, validity and reliability.

3.1 Research Design

The fundamental nature of research is how to find necessary and appropriate information, how to analyze it and how to present it accurately in order to solve a problem or answer a research question or hypothesis (Booth, Colomb, & Williams, 2003). The research design deals with the process of gathering, analyzing and interpreting data. The requirement for executing these tasks is an initial problem or object for research (Easterby-Smith, Thorpe, & Jackson, 2012). In the actual case it is the pricing pressure, caused by a fallen oil price and resulting in a shortage of headcount, cancellation of already begun projects and generally a setback for the O&G industry.

There are three different categories of research design which are more or less suitable depending on the circumstances. Sreejesh et al. (2013, p. 29) categorize research into explorative, descriptive and causal design. It is illustrated in appendix 4 with a detailed structure and subordinated characterizations. For the actual paper I use the exploratory research design. A researcher applies the exploratory research design, when one is conducting research on a subject, which one has done little or no prior research on and correspondingly has little prior knowledge about. For that reason researchers explore, as they want to surface the key issues from a subject and form a basic understanding as a starting point for further research. Consequently explorative research is usually of qualitative nature, because in an exploratory phase there is less need to work as precisely and accurately as with quantitative research. The next categories of research design are more precise and hence of quantitative nature, as they are built on the findings of explorative research (Sreejesh, Mohapatra, & Anusree, 2013, p. 31). The approach of data collection in the frame of the explorative research design for the actual paper will be described more precisely in chapter 3.2.1 and 3.2.2.

3.1.1 The philosophy of research

The philosophy of research examines the paradigms of how reality can be perceived. That reality considers a certain philosophical position to be investigated in the context of the research design. When scientists develop methodologies, they are usually guided by a set of beliefs, which stems from different ontological or epistemological assumptions. Such as sets of beliefs or world views are known as paradigms. Guba and Lincoln define a paradigm as a “basic belief system based on ontological, epistemological and methodological assumptions” (Guba & Lincoln, 1994). Ontology relates to beliefs regarding the nature of reality. It deals with the

question of the truth, existence and reality of a reality or object of investigation. Epistemology and methodology are driven by ontological beliefs. Epistemology is “a set of general assumptions about ways of inquiring into the nature of the world” (Easterby-Smith, Thorpe, & Jackson, 2012, p. 27). It refers to the question of how to ascertain the acquired knowledge. Methodology is the approach of attaining knowledge systematically. It differentiates from epistemology through a deeper specification and practical relevance. Thus, methodology composes “a combination of techniques . . . to inquire into a specific situation” (Easterby-Smith, Thorpe, & Jackson, 2012, p. 27), while the methods and techniques encompass the specific techniques for collecting data.

Table 3 Relevant philosophical perspectives for research

	Positivism	Social constructionism
Ontology	Realism – only one reality exists	Relativism – reality is subject to be revised by groups or individuals
Epistemology	Objective in nature	Transactional and subjective
Methodology	Experimental	Interpretative
Methods and techniques	Quantitative	Qualitative

Source: own illustration

According to Bailey (1997) there are two dominant perceptions of reality from an ontological perspective: realism and relativism. Within the context of a realist ontology truth or facts about reality is found out through experimenting. Realism is a belief, that there exists a reality, which is driven by natural laws. This reality is characterized by objectivity, independence of theories and human beliefs, and its existence, even if it is not yet known. Realism describes the ontological form of a quantitative or positivistic research paradigm. Positivism examines the only one constant and objective reality or facts about it. Since the positivistic reality can be discovered, the epistemology is objective, which means that the researcher stays at distance from the object of research and investigates it from outside and from a certain distance, in order to prevent any impacts on the research findings. For this reason, hypotheses or the research question is tested by quantitative methods.

The opposite side of realism is relativism, which is characterized by the search for meaning in individual’s experiences, because reality can’t exist without context. Hence, relativists believe, that there is more than only one cognitive interpretation of reality. The relativistic realities are impacted by social interactions and experiences. Here it’s important to consider, that every individual has its own “proper” reality. Relativism describes the ontological form of a qualitative or constructivist research paradigm. Social constructionism examines the meaning or reality stemmed from interaction between individuals or groups with the social environment.

In contrast to positivism knowledge is constructed and not found. Thus, there might be numerous realities, which are considered to be correct. Consequently, from the viewpoint of epistemology, findings are brought forth by the interactions of researchers and the persons they stand in contact with. The methodologies based on interactions, are designated to find consensus regarding the subject of research. Therefore, qualitative methods, like in-depth interviews are used in order to describe context.

Easterby-Smith et al. illustrates the major distinctions between positivism and social constructionism according to the following table:

Table 4 Contrasting implications of positivism and social

	Positivism	Social constructionism
The observer	Must be independent	Is part of what is being observed
Human interests	Should be irrelevant	Are the main drivers of science
Explanations	Must demonstrate causality	Aim to increase general understanding on the situation
Research progresses through	Hypotheses and deductions	Gathering rich data from which ideas are induced
Concepts	Need to be defined so that they can be measured	Should incorporate stakeholder perspectives
Units of analysis	Should be reduced to simplest terms	May include the complexity of “whole” situations
Generalization through	Statistical probability	Theoretical abstraction
Sampling requires	Large numbers selected randomly	Small numbers of cases chosen for specific reasons

Source: Easterby-Smith, Thorpe, & Jackson, 2012, p. 39

The described philosophical ways of interpreting paradigms from a positivistic and social constructionism viewpoint are of essential importance for this thesis. The basic task is to outline BM’s in the O&G supply industry by communicating with representatives from different regions and companies, including E&P’s and OFS’s. The information gathered by social interaction with the interviewees will impact and define the outcome of my research. The intention of this thesis is to outline different viewpoints regarding the trends going on in the O&G industry. As already described in the introduction part of this paper, the O&G business is constantly facing new developments. Thus, I consider the framework of social constructionism, as I do qualitative research by conducting several in-depth interviews with a number of experts with different background, experiences and opinions.

3.1.2 *Case study*

There is a large number of participants along the O&G value chain. In this connection a case study helps me to limit my sample, which is necessary due to constraints in time and capacity. In other words a case study is connected with a bounded system in form of time, geographical space or other constraints a researcher has to deal with. A case in this context can be any random entity in form of a problem, activity, process, event, company, person or group of persons, etc. Further on case studies are characterized by multiple sources of data, like involving different kinds of primary and secondary data, so that the researcher can develop an in-depth understanding of the case.

Yin (1984, p. 23) defines a case “as an empirical inquiry that investigates a contemporary phenomenon within its real-life context; especially when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used.” The phenomenon of the actual case study is the pricing pressure towards O&G contractors caused by a fallen oil price. The negative concomitants on the whole O&G player landscape and their stakeholders illustrate the respective context.

When it comes to the executing a case study of a research strategy, the researcher has to ensure that this strategy fits with the methodological choices of research design so that it provides the appropriate approach for answering the research question. This requirement is fulfilled in the context of this paper, as a case study can be used within the explorative, descriptive and causal research. The case study gives the initial insights into a phenomena, which is required within the explorative research.

Further on the type of case has to be selected as a single or multiple case study. A single instrumental case study is when a researcher focuses on a certain issue/problem and then selects one certain case to study that issue/problem. The multiple case study is similar to the single instrumental case study, because the researcher first focuses on an issue or problem. The difference is, that in the latter type the researcher selects several bounded cases for illustrating that bounded issue or problem. So, multiple case study is used in order to show various perspectives about an issue or problem. (Yin, *Case Study Research: Design and Methods*, 2003)

Continuously the depth of research is selected, where the researcher again decides between two categories, which don't have any relationships between each other. On the one side, there is the holistic case study, which studies the case as a whole entity. On the other side there is the embedded case study, which examines only some aspects of cases. Usually holistic case studies

are connected with single instrumental case studies and embedded case studies with multiple case studies. This is based on the time and capacity constraints, which case studies base on, as such combinations keep the research work in limit. When the gathered data is analyzed within the “cross-case analysis” the researcher interprets the data of each case from various settings and determines common themes. This enables the researcher to acquire knowledge from different cases and collect critical evidence for modifying course. (Miles & Huberman, 1994)

The focus of my research is how the O&G market is changing with its appropriate BM’s. This is characterized by a complex interdependence of O&G players and their stakeholders. In this sense, I step into interactions with various players from OFS and E&P companies in order to generate a sense and understanding for the requirements towards BM’s, from which the O&G business will profit as a whole. In order to achieve such a win-win situation for the broad variety of O&G players a network of strategic capabilities needs to be realized. In order to approach such a future realization, I step into interaction with different specialists, each having different background and skills. The admired result from that conversation is to address the different trends, mentioned in the introduction part of this paper, since every interviewee will put an emphasis on own priorities and backgrounds, as one might be more proficient in procurement while the other has experience in market development or sales and marketing for instance. Thus this case study will be multiple with an embedded depth.

The issues covered in case studies can vary pursuant to different views of participants. According to Easterby-Smith et al. (2012, p. 55) constructivist epistemology gives “a rich picture of life and behavior in organizations and groups.” Consequently it is not possible to generalize findings of case studies. However I’m intending to develop an in-depth understanding, rather than generalize empirical findings.

3.2 Research Method

As already described in chapter 3.1.1 there are two distinct practical methods for conducting research, the qualitative and the quantitative approach. While qualitative research examines the relationship between numbers and variables, qualitative research explores the meaning of people’s mindsets or a particular issue or case. That’s why research questions within the framework of qualitative research start usually with “what” or “how”. Hence, there is usually no hypothesis in qualitative research, because it is of exploring and not of predicting nature.

The data gathered for qualitative research constitute words and they can be taken from primary and secondary data. The data arises from the natural settings where participants usually are, as

researchers go into the field of participants and spend time there to interview and observe the participants and their environments. Moreover there is no instruments in qualitative research for data gathering. In contrast to quantitative research, the researcher oneself represents that instrument, as questions are asked and observations made independently without using any surveys.

Further on, qualitative research is characterized by an emergent design, as methods can change during the study when participant’s insights are being acquired. The intention of qualitative research analysis is about creating themes. Researchers interpret all the gathered data and organize it into themes. This is generally more time intensive than quantitative research analysis, where data is analyzed with specific instruments like statistics software, etc. Qualitative research is inductive in nature, which means that the research question, the data collection and analysis, etc. is not based on a theory or notions, that the researcher has, because “researchers tend to let the data speak for itself and although they are still employing a process, they allow for more intuition to guide them in the development of their understandings of the data” (Easterby-Smith, Thorpe, & Jackson, 2012, p. 281).

The final report in qualitative research is usually narrative in nature, which is characterized by an interpretive style of writing, where the author writes from the perspective of the first person and includes a lot of quotes from participants. Silverman (2004, p. 17) defines qualitative research as a “research that seeks to provide understanding of human experience, perceptions, motivations and behaviors based on description and observation by utilizing a naturalistic interpretive approach to the subject and its contextual setting.” The following table summarizes and illustrates a clear differentiation between qualitative and quantitative research methods:

Table 5 Distinctions between qualitative and quantitative research

	Qualitative research	Quantitative research
Purpose	Meaning of issues/cases	Relationship between variables
Research Question	“What”, “How” ⇒ No hypothesis ⇒ Exploratory ⇒ not predictive	“What”, “How”, “Does” ⇒ Utilization of hypotheses ⇒ Experimental research ⇒ predictive
Data	In-depth collection of non-numerical data	Numerical data
Analysis	Inductive	Deductive
Final report	Narrative	Rigid

Source: Own illustration

In consideration of the given circumstances, qualitative research illustrates the appropriate method for collecting data, as it enables me to understand the different insights of my interview participants in order to derive the future trend for shifting BM's in a dynamic O&G market. For writing the thesis I have utilized primary and secondary data, while primary data arose from conducting expert interviews and secondary data was taken from different literature composing of scientific papers, articles, reports and books, etc. The primary data helps me to attain an in-depth understanding of the research problem, as the interview partners address my gaps of knowledge directly through their personal insights.

3.2.1 Primary Data

Primary data is the most valuable information of my research, because it provides new information, which addresses the research question directly and offers “the opportunity for the researcher to probe deeply to uncover new clues, open up new dimensions of a problem and to secure vivid accurate inclusive accounts that are based on personal experience” (Burgess, 1982, p. 107). “The value of it is that it can lead to new insights and greater confidence in the outcomes of the research” (Easterby-Smith, Thorpe, & Jackson, 2012, p. 19). However gathering primary data can be quite challenging, because the direct conversation with interview participants can be expensive and time consuming (Easterby-Smith, Thorpe, & Jackson, 2012, p. 382).

The primary data is collected through six in-depth interviews with specialists from different OFS and E&P companies. All interviews were performed via telephone or skype conversation. While conducting primary data collection, I faced numerous challenges. Firstly, it was very difficult to access the relevant participants for conducting the expert interviews, because most of them were not interested to sacrifice their time for something they had no value from, especially when they didn't have any relationship to the researcher. In this context my personal network helped me to bring me in touch with interviewees through their personal relationships. Secondly it was quite challenging to conduct the interviews by telephone or skype. Due to geographical distance I had no opportunity to conduct the interviews face to face. The disadvantage of telephone interviews in comparison to face to face interviews is, that the call quality can be poor and misunderstandings in regard of a lacking control of interviewee's reactions, body language and facial expressions can occur. In connection with that difficulties it is a very time consuming effort to transcript the conversations.

In regard of conducting in-depth interviews there is the distinction of structured, semi structured and unstructured interviews. For my interviews the semi structured type is the most appropriate, respective to my research design. The interview is composed of predefined open ended

questions, enabling to discuss the research topic in more detail. In comparison to the highly standardized structured interviews, the semi structured and unstructured types react more personally towards the interviewee. It allows to guide the interview process, while enabling flexibility in terms of making leeway towards arising questions and topics from the conversation, which may be relevant, but haven't been planned in advance. BM's are a constantly changing and highly sensitive issue for every successful company. Hence, it is important to me to run the interview flexibly, because with an open interview structure the interviewee usually replies more personal (Easterby-Smith, Thorpe, & Jackson, 2012, p. 220).

3.2.2 Secondary Data

The use of secondary data is crucial for my research, as it supports the explorative research design. According to Easterby-Smith et al. secondary data presents the "research information that already exists in the form of publications or other electronic media, which is collected by the researcher" (2012, p. 345). I have gathered secondary data from several literature sources, including articles from professional journals, newspaper articles, books, former research papers and reports and statistics from companies, consultancies, organizations and educational institutions. From the very beginning and throughout the whole research I read numerous sources of secondary data, which helped me to develop an understanding for the O&G player landscape and the market dynamics resulting of a low oil price and cost pressure, they are subjected to. The advantage of secondary data is their relative easy accessibility, compared to primary data, which saves a lot of time. In addition company and government publications can be regarded as high quality data (Easterby-Smith, Thorpe, & Jackson, 2012).

However there are also risks about secondary data respective its significance. These risks are connected with currency, the relationship between secondary and primary data and the availability of secondary data (Brodeur, Israel, & Craig, 2011). I referred to official data, which can be retrieved from reputable institutions and journals like Goldman Sachs, Barclays, Bloomberg, the World Economic Forum, IHS Energy, Rystad Energy, A.T. Kearney, the Financial Times, the Wall Street Journal, the Oil and Gas Journal and others. The information cited from journals is taken from officially recognized market research institutes like IHS Energy for instance. I assume that the conducted work of the authors from my secondary data sources matches with the institution's project management methodology. Moreover I read numerous sources of secondary data in order to understand the topic deeper and organize the interviews more precisely. Therefore I believe, that the secondary data used in my paper is valid and reliable.

3.2.3 Interview participants

In the context of gathering primary data, I have conducted six in-depth interviews. Four interview partners represent O&G suppliers and two interview partners are from integrated oil companies. My interview partner from BP, used to work in the down-stream sector in marketing strategy consulting. Even if he couldn't give me specific insights in regard of BM's for my research topic, as he is not from upstream, he gave me some valuable impressions on the Russian O&G player landscape. Finding appropriate interview partners was a very challenging and partially a frustrating task, as the majority of people, who I have requested didn't respond or did not agree to participate. Thus I tried to make use of every possible interview. In the following I shortly present my interview partners, their positions and companies they work for. The Information about the respondent contains my interview partner's name, position or responsibility in the company, department and company name, and location of the company.

Information about respondent	Company type	Business areas
Jon Knudsen , Head of Customer Value, Global Business Development, Vice President, Aker Solutions , Fornebu, Norway,	OFS	Umbilical, Subsea, Drilling technologies, Maintenance, modifications, and operations, Process systems, Engineering, Oilfield service and marine assets
Name is kept confidential , Region Manager – SURF, Russia and Kazakhstan, Technip-FMC , Technip Norge, Lysaker, Norway	Merger of OEM and EPC	Subsea, Surface Technologies, Process Technologies for onshore and offshore, Project Management and EPCI
Name is kept confidential , Business Development and Market Analysis, Baker Hughes Completions and Well Interventions , Houston, USA	OFS	Reservoir Development Services, Integrated Operations, Drilling, Evaluation, Completions, Production, Pressure Pumping, Tubular Services, Downstream Services, Specialty Chemicals
Marc Matthesius , Procurement Analyst, International Procurement Controlling, Baker Hughes , Celle, Germany	OFS	Production of Drilling Service Systems, R&D,
Firuz Butaev , Deputy Head of Upstream Mega Projects Department, Rosneft , Moscow, Russia	E&P	OFS, Engineering, Construction, Upstream, Midstream, Downstream
Stan Mikhailov , used to work in Marketing Strategy at BP and Bashneft in Russia	E&P	E&P, Midstream, Downstream

3.3 Data Analysis

For data analysis Easterby-Smith et al. (2012) distinguish between content analysis and grounded analysis. While content analysis is “a relatively deductive method of analysis where codes (or constructs) are almost all predetermined and where they are systematically searched

for within the data collected” (Easterby-Smith, Thorpe, & Jackson, 2012, p. 340), grounded analysis provides a more open and holistic approach with deeper affiliation to the data extracted from the interview. The following graph illustrates the comparison more precisely:

Table 6 Content vs. ground analysis

Content Analysis	↔	Grounded Analysis
Searching for content (prior hypothesis)		Understanding for context and time
Casually linked variables		Holistic Associations
Objective subjective		Faithful to views of respondents
More deductive		More inductive
Aims for clarity and unity		Preserves ambiguity and contradiction

Source: Easterby-Smith, Thorpe, & Jackson, 2012, p. 163

According to Glaser and Strauss (1967), grounded analysis presumes in-depth interviews, where the researcher develops “theory through ‘comparative method’, which means looking at the same event or process in different settings or situations” (Easterby-Smith, Thorpe, & Jackson, 2012, p. 58). This is the actual case in my research work.

In order to relate to grounded analysis, I follow a procedure defined by Easterby-Smith et al. (2012, p. 167), which consists of seven stages of interview analysis:

- 1.) Familiarization: Careful reading of all interview transcripts.
- 2.) Reflection: Evaluation and criticizing of data in accordance to the research question.
- 3.) Conceptualization: Articulation of gathered data as explanatory variables. This makes me aware of uncovered data, which I should gather in the next interviews.
- 4.) Cataloguing concepts: outlining of different viewpoints. In my interviews, however, most of the statements regarding the upcoming trends in O&G were coincident.
- 5.) Re-coding: Categorizing the statements or concepts of my interview partners.
- 6.) Linking: Merging categories in one unified pattern. In this research this refers to the integration of several market trends in O&G.
- 7.) Re-evaluation: Outlining further steps, which should be done to complete the research question, but go beyond the scope of this research work.

However, I want to notice at this point, that the primary data, collected from my in-depth interviews has left open certain questions regarding market trends in the O&G supply industry. To cover those aspects, I have intentionally looked for certain secondary data. From this point of view, I make a leeway at some points towards content analysis. Nevertheless, the research is clearly predominated by grounded analysis.

3.4 Reliability and Validity

Every scientific work needs to be evaluated in terms of its validity and reliability. Validity describes to what extent research findings represent the circumstances, they are supposed to present. According to Golden-Biddle and Locke (1993) in social constructionism validity requires: (Easterby-Smith, Thorpe, & Jackson, 2012, p. 91)

- Authenticity: "...convincing the reader, that the researcher has a deep understanding of what was taking place in the organization"
- Plausibility: "... requires the researcher to link some ongoing concern/interest among other researchers
- Criticality: "... encourages the readers to question their taken-for-granted assumptions, and thus offer something genuinely novel"

Reliability describes "the consistency of measurement in a composite variable formed by combining scores on a set of items" (Easterby-Smith, Thorpe, & Jackson, 2012, p. 570). To get back to social constructionism again, reliability leads to an equal result if the research would be conducted by another researcher, if it was executed under similar conditions. Moreover it is of essential nature for a reliable research, that the researcher works honestly, presents the data in a logical manner and interprets it appropriately. As I collected a large extent of secondary data and interviewed various specialists with different roles and skills from E&P's and their service suppliers, it can be expected, that the outcome would still be similar, if the choice methods and interview partners were changed.

Validity and reliability is important in order to escape errors, which are usually caused by humans through choosing wrong methods and samples and interpreting data biased. Therefore internal and external validity provide a tool for evaluating possible mistakes throughout the research process. Internal validity addresses questions in connection with the interview, whether the appropriate respondents have been chosen and how trustworthy the data is. External validity refers to the outcome depending on the methods, the choice of respondents and interview process.

3.5 Ethical considerations

Ethical issues are an issue, which shouldn't be neglected throughout the whole research process and after completion. In this connection Bell and Bryman (2007) formulate ten ethical principles, which should be followed when doing research: While the first seven principles aim

at protecting the researcher participant’s interests, the last three principles target accurate data gathering and on avoiding a bias of results.

Table 7 Key principles in research ethics

#	Principle:
1.	Ensuring that no harm comes to participants.
2.	Respecting the dignity of research participants.
3.	Ensuring a fully informed consent of research participants.
4.	Protecting the privacy of research subjects.
5.	Ensuring the confidentiality of research data.
6.	Protecting the anonymity of individuals or organizations.
7.	Avoiding deception about the nature or aims of the research.
8.	Declaration of affiliations, funding sources and conflicts of interest .
9.	Honesty and transparency in communicating about the research.
10.	Avoidance of any misleading or false reporting of research findings.

Source: Easterby-Smith, Thorpe, & Jackson, 2012, p. 162

Regarding the protection of my interview I informed and asked them for permission to tape the interviews, as it helps me to focus more on the conversation itself in the course of the interview. In this connection I had to agree with certain requirements of the respondents, for instance that they refrain to mention certain names during taping. After the interviews have been transcribed, I sent the transcripts to my interview partners in order to get permit what information can be published and what can’t. As I am very grateful to my respondents for getting the opportunity to attain primary data I respect all their requests. I don’t want to cast my respondents in a negative light, thus I don’t publish information, which could be harmful for my respondent’s company (Easterby-Smith, Thorpe, & Jackson, 2012).

3.6 Summary

The present chapter has delineated the methodological process of how data has been collected and analyzed for this paper. The whole research project is subjected to a qualitative research method based on a social constructionism paradigm in connection with an explorative research design. In order to collect primary data I have conducted semi structured in-depth interviews with representatives from E&P and OFS companies, who have been involved with the current market dynamics and their subjected BM’s. Moreover I used secondary data, appropriate to the research topic. The gathered data has been presented and assessed pursuant to validity, reliability and ethnically related considerations. Moreover all collected and analyzed data have complied with recognized techniques, in order to guarantee similar findings and interpretations

in case of a third person doing similar research. The next chapters will present my empirical findings and subsequently their analysis.

4.0 Empirical results

Empirical data delivers facts, which are based upon experiences of industry professionals. My findings are based on primary data, which has been collected from representatives of leading OFS's and E&P's. Moreover there was a merger between an EPC and OEM within my interview participants. I also used secondary data, accordant to my problem statement, which backed up my research if primary data was insufficient.

This chapter outlines the O&G player landscape with the corresponding BM's before and after the 2014 oil price collapse. Afterwards the development of E&P spending is going to be presented as well as its influence and consequences on supply chain partners. Finally market trends are introduced, which drive BMI in the O&G supply industry. That information is backed up with a summary at the end of this chapter.

4.1 The O&G player landscape

The oil and gas business is characterized by a high level of complexity from a technological point of view, and additionally copes with increasing challenges on a macro economical, geological, political and legal level. Against this background the O&G player landscape is correspondingly difficult constructed. The O&G industries value chain is divided into upstream, midstream and a downstream segment. The actual paper focuses on upstream activities, which are related to exploring and producing hydrocarbons. The midstream segment encompasses transportation and distribution of hydrocarbons, while downstream deals with refining and transferring the hydrocarbons in other petrochemical products as well as with retail operations. All three phases of the O&G value chain are supported by service companies. They provide services like manpower, equipment and all necessary skills to oil companies, but they are not directly involved themselves into producing petroleum or any petroleum products. The range of that services with their corresponding executive bodies is illustrated in figure 11.

As the easily and cheaply accessible oil becomes scarce, the industry tackles unconventional ways of developing hydrocarbons, such as deep-water drilling or hydraulic fracturing for instance. Such approaches require innovative technological solutions like ROV, horizontal drilling and horizontal drilling solutions coupled with hydraulic fracturing for hydrocarbons located in shale layers. Such solutions are connected with appropriate high Capex and Opex. In

order to push such solutions forward the O&G business has invested strongly into technology (Perrons, 2014; Donnelly, 2014).

The very first phase of the petroleum value chain encompasses the identification of hydrocarbons. Usually national governments hold the ownership and the power over the resources, located at their state territory, and set up the rules for exploiting them. In this connection operators have to consider the government take, which is the share of revenues retained by the government going up to 90 percent in some countries. But even such a rate allows companies to make profits in some regions of the world, when the difference between production costs and the oil price is high enough. However this profit potential was considerably diminished with the 2014 oil price collapse (United States Government Accountability Office, 2007).

After an O&G operator has received a license for developing hydrocarbons, it is likely to engage in activities, which are aimed at reducing geological and commercial risks and uncertainties about a project. If the results of a seismic study during the exploration phase are positive, operators will launch exploration drilling. During the so called appraisal phase the reservoir gets commercially evaluated. If the necessary requirements are fulfilled in terms of production potential, the development phase begins, where the production facility gets built up and installed. The phases from land acquisition until production can take up to ten years, and consequently a large amounts of money is invested into a project before revenues are earned with it (Jahn , Cook , & Graham, 2008; Bret-Rouzaut & Favennec, 2011). In this context even unsuccessful exploratory wells, which are dry or commercially not viably to extract, are connected with numerous contracts for OFS's and OEM's. The following figure illustrates all actors and activities involved in projects along the whole O&G value chain:

Figure 10 Supply and value chain in petroleum development

		Value Chain								
		Seismic/Reservoir	Drilling	Field development			Operations	Decommissioning		
Supply Chain	Oil companies	Reservoir	Drilling		Projectingm., engineering,		Operations			
	Main Contractors								Decommissioning	
	System Integrators		Systems and equipment	Subsea	Fabrication and package suppliers	E, I & T	Maintenance and modifications	Down-hole and well services	Solutions for cleaner production, Oil spill and Safety	
	Product Suppliers	Seismic, models and equipment				Marine system and mechanical equipment				
	Service companies						Logistics and transport	Down-hole and well services	Solutions for cleaner production, Oil spill and Safety	
	R & D, services, institutions			R & D, consulting, training, finance, legal, institutions						

Source: Norwegian Energy Partners

The global O&G industry is characterized by broad structural variety of different types, sizes, capabilities and responsibilities. As already described in the historical review in the introduction part of this paper, there are three different types of oil companies in the market, described below. Independently from the type of E&P company, the major responsibility is to fulfill a governments requirements, what goes with acquiring a license for E&P from a government. Such responsibilities include besides of meeting environmental standards, taking financial risk, managing the portfolio of assets, under certain circumstance job creation and the analysis of the project’s prospects. The analysis of that geological risk requires the drilling of certain amounts of exploration wells and drafting of geological data, as well as creating jobs. There is an increasing trend, that national governments, possessing natural resources, approve E&P’s to exploit their resources on the condition of local content requirements, which means that a certain percentage of staff and produced equipment needs to be of domestic origin (Tordo, Warner , Manzano, & Anouti, 2013).

- **Independents:** Nonintegrated companies, which focus on certain activities within one of the major sectors of the O&G business, like production or downstream activities.

- **International Oil Companies:** Vertically integrated oil companies, which compete in the O&G business globally. They are also called integrated oil companies, majors and supermajors. Usually they refer to the largest O&G companies worldwide, which are ExxonMobil, Chevron, ConocoPhillips, Royal Dutch Shell, British Petroleum and Total.
- **National Oil companies:** Integrated O&G companies, which are controlled by national governments and sometimes partially by private investors with the aim to manage a country's hydrocarbon reserves. There are NOC's which operate only in their home countries like Pemex, while others are internationally active like Gazprom, Petrobras or Statoil for instance.

As already mentioned in the beginning of this chapter, operators are supported in all O&G major sectors by service companies. Thereby it is worth mentioning, that even the integrated company types of operators contract service companies, even if they try to operate independently of them. The Petroleum value chain, illustrated in figure 10 by the Norwegian Energy Partners, subdivides the service sector into various specific parties, which in reality may intersect with each other. Thus, I classify the service sector in a more shallow way, as it is difficult to set clear boundaries for a whole industry where the supply of certain types of suppliers begin and end. The involved parties have been appealed in the introduction part:

- **Oilfield Service companies:** OFS's offer services and specialized oilfield equipment of critical importance for the exploration, installation and operation phase in order to "find, develop produce, and manage oil and gas reservoirs" (Inkpen & Moffett, 2011, p. 18). As OFS's don't strive for ownership of rights to oil and gas reserves, they are of crucial importance to operators, in particular for NOC's. Usually the appropriate departments of operator companies plan the technical scope of O&G projects, and subsequently contract OFS's to execute predefined tasks.
- **Engineering, Procurement and Construction companies:** "EPC is a particular form of contracting arrangement used in some industries where the EPC contractor is made responsible for all the activities from design, procurement, construction, to commissioning and handover of the project to the End-User or Owner (Mobina Oil & Gas)." Usually operators hire them following on the FEED phase as general contractors for intricate projects, in which the operator's technical procurement teams don't have the necessary competencies to manage them by themselves. Such projects are characterized by an outstanding complexity, for instance developing petroleum from

hydrocarbons (MNP, 2015). There are also EPC contractors providing project management and commissioning.

- **Original equipment manufacturers:** OEM’s produce generalized equipment for O&G projects. While OFS’s manufacture specialized equipment like blow out preventers (BOP’s), which can be used only for O&G activities, the generalized equipment can be used also for related activities, for instance electronic engines for wind turbines. They supply their equipment to all participants within the O&G player landscape described in this article including E&P’s, EPC’s and OFS’s.

The O&G supply industry has experienced major structural shift connected with the 2014 oil price collapse. The difference in market segments between 2014 and 2016 in connection with the activities of OFS along the petroleum value chain are illustrated in Figure 11 on the examples of the world wide leading O&G suppliers.

Figure 11 Upstream revenues for the largest service companies



Source: Rystad Energy SCube, 2016

A significant downturn is observed in particular for well services and commodities. To a large extent this can be traced back to the shale revolution, as the exploration and production costs from shale rock layers are essentially higher than those from conventional reservoirs. With the pricing pressure, connected to the fallen oil price, investment cuts have significantly influenced the workload of drilling activities, as the capital intensive horizontal drilling activities needed

to be reduced because of the cost pressure. The market reacted with an increased trend towards industrywide strategic alliances as indicated in the introduction part of this paper. According to the data provided in figure 11 by Rystad Energy, this trend is confirmed, as the market concentrates increasingly. While in 2014 the three largest OFS's hold around 20% of market share, the same fraction is held in 2016 only by Schlumberger and Halliburton (Rystad Energy SCube, 2016).

4.1.1 BM's before the 2014 oil price collapse

At this point I want to outline the O&G industry's BM's before and after the 2014 oil price collapse. As explained in the introduction part of this paper, the IOC's are the longest established players in the industry. They used to have the biggest market shares and consequently they used to have the biggest impact on the market dynamics and so on other market participants.

The overall BM of the O&G industry arose in the 1990's and it was built on the pillar of production maximization under the assumption of a steadily growing demand for oil, based on the following three circumstances (Stevens, International Oil Companies: The Death of the Old Business Model, 2016):

- Maximizing shareholder value
- Maximizing bookable reserves
- Minimizing costs

The shareholder value maximization was intended to be reached by discovering more proved reserves. One major tool for shareholder value maximization is the capital asset pricing model (CAPM). This tool offered a scientific approach to measure return on capital for projects financed by shareholders and a quantitative method to determine cost of capital in order to calculate a projects net present value, which is essential for identifying a projects financial viability. This innovative financial tool, which was introduced in the 1980's, encouraged rising share prices through appropriate performance accompanied by sustainable dividends.

Maximizing bookable reserves is achieved through exploration drilling and proving reserves, by varying the production of a certain volume of hydrocarbons with given technology at a given price or by acquisitioning companies with proved reserves in their books. Bookable reserves create expectations for future revenues on the one hand and allow to add capital expenditures to the company's financial balance sheets on the other hand. Thus, net changes in booked

reserves became essential for an oil company's future prospect, what puts oil companies under pressure indeed. Subsequently, production growth became a major priority.

The third strand of the previous BM, is reducing costs, which has indeed always been an issue for any industry. The difference is that the IOC's seeking for greater efficiency has characterized the oil player landscape essentially. In the 1970's academics argue that outsourcing was an effective measure for reducing company internal expenditures. Consequently, numerous oil companies specified on their core competencies, while outsourcing service activities, with the aim, that the resulting competition among service companies would lower costs. Given the complex value and supply chain in the O&G business, the vertically integrated IOC's have in this connection a broad range of opportunities for outsourcing. (Stevens, International Oil Companies: The Death of the Old Business Model, 2016)

The Schlumberger CEO Paal Kibsgaard described the "old" BM, which arose during the 1990's with the procurement driven commercial model, which today represents an obstacle for the necessary performance progress. The described procurement-driven approach is characterized by full decision-making power on the operator side, where the full technical project scope and technical design for hydrocarbon development is executed by technical teams of the E&P operator. Later on the broad technical scope is split into a host of small elements and put out for tender by the downstream purchasing departments. The focus for those tenders is to seek for the lowest price for each element, while expecting a high value for the project (Kibsgaard, Morgan Stanley E&P and Oil Services Conference, 2016).

Kibsgaard's viewpoint on the level of involvement in O&G projects is committed in my interviews as well. The BH representative claims: *"The large IOCs of this world, the Exxon Mobil's, the BPs, the Shells, Total, ENI and so on and so forth. Ultimately, they have a lot of strong reservoir capabilities in-house. They determine how they're going to drill the wells, they determine how they're going to complete the wells and they will consult with us. We could work with them. Ultimately, that probably will stay as a transactional relationship, potentially."*

The Technip-FMC representative says: *"We would like to promote an early engagement during the cooperation with the client and move away from this very strict separation between the decision gates and try to provide an integrated approach, so that we walk together with the client from the very early stage. And at the early stage we can offer them and optimize them cost-efficient solutions."*

The fundamental principle behind the procurement driven model is backed by two characteristics. On the one hand, service providers are not expected to deliver fit-for-purpose designed planning, and are hence involved too late in the project design to have a significant impact on the operational and financial performance. On the other hand suppliers are assumed to be equal as long as they meet the minimum qualification requirements.

The procurement-driven approach is accompanied with the following consequences (Kibsgaard, Morgan Stanley E&P and Oil Services Conference, 2016):

1. The service supplier has no intrinsic motivation to streamline operations, because operators don't provide any incentives for performance differentiation.
2. A procurement approach where different elements are purchased fragmented, impede the innovation and optimization of technological solutions, because a common data platform is missing.
3. A lacking collaboration between operators and suppliers in the project design phase impacts project costs and performance sub-optimally.

Based on this, new BM's are required, which integrate technology, stakeholders and revenue models in order to deliver more efficient technical solutions and operational as well as financial performance and finally to cope with the current market dynamics. Approaches for such business models will be presented in chapter 4.3 based on primary data from my interviews and secondary data from professional literature.

4.1.2 Reasons for the failure of the old BM's

There is a number of reasons, why the BM's described in the previous chapter don't work in the current O&G industry anymore. They can be traced to the trends from chapter 1.1 and their consequences. This chapter presents the most outstanding reasons for the old BM's failure.

Firstly, the problem with CAPM turned out to underprice risk, because exploratory drilling in unproven areas with no historic production record is of nearly unpredictable risk. Fama and French (2004, S. 41) argue in this context, that "the market portfolio at the heart of the model is theoretically and empirically elusive." As a result, "corporate executives and investment bankers routinely fudge their CAPM estimates [...] because experience and intuition tell them the model produces inappropriate discount rates (McNulty, Yeh, Schulze, & Lubatkin, 2002)."

One major reason for the failure of the old BM's is the IOC's inability to grow reserves, which used to be one of the core features of the IOC's BM's, as booking reserves increases the value of a company. Within the course of the resource nationalization in the 1970's, IOC's have lost

the access to a broad extent. Moreover NOC's and independents have increasingly engaged in upstream activities outside their own country (Stevens, Kooroshy, Lahn, & Lee, 2013). According to the 2015 BP statistical review of world energy (British Petroleum, 2015), by end of 2014, when the oil price started to fall drastically, 63,4 percent of proved oil reserves worldwide, are possessed by six countries, namely Venezuela, Saudi Arabia, Iran, Iraq, the Russian Federation and Kuwait.

Venezuela is considered to be a risky subject for investments, as there is experience, that it's government has made unilateral modifications in its earlier contracts. Saudi Arabia is closed to upstream investments from IOC's. Iran was being imposed to economic sanctions, so there was no access to the market no matter under what terms. Iraq was open to upstream investments, however under non-promising perspectives. The Iraqi host government provided production sharing agreements, in which the foreign partners could engage as service providers. For IOC's, however, this approach hasn't been beneficial. Kuwait used to be an open market, however it is for the government of major priority to prosper their own NOC. With Russia it is a similar case as with Kuwait. IOC's are allowed to step in JV's with Russian operators, while the Russian party hold the majority share.

Due to the impeded access to easy extractable conventional fossil resources and the imperative to fall back on unconventional approaches for oil production, the "upstream costs in the oil industry have risen threefold since 2000, but output is up just 14 percent (Evans-Pritchard, 2014)". However, a cyclical recoverable oil price allowed operators to still achieve profits, because "oil prices rose faster than the costs of exploration and production. (Kaletsky, 2014)" The current oil price scenario, however, doesn't plan such a scenario anymore.

Moreover IOC's have missed the chance to make a use from small scaled oil fields, as they preferred mega projects in order to profit from economy of scale in the course of the cost cutting initiative. The entirety of the small sized upstream projects could have collectively increased the bookable reserves of IOC's.

Further on risk sharing in connection with production sharing agreements influences share prices negatively. When the oil price was weakening in the 1990's, numerous governments stepped into production-sharing agreements with IOC's. Against the background of a threatening fall in oil prices, which eventually took place in 1998, IOC's insisted on more protection against low oil prices during the negotiations over fiscal terms with national governments. National governments accommodated the IOC's needs under the consideration

of the oil price, which was actual in the times of negotiations. “Typically revenues from early production were allocated first to recover costs, according to a formula and then the balance went to the government of that particular oil exporting country” (Stevens, 2016, p. 17). So, IOC’s transferred upside risk to governments in the event of rising oil prices. As a result IOC’s missed the chance to make a profit from rising oil prices, which took place from 2002, because they were bound to the production sharing agreements and rising oil prices did not result in rising share prices.

Another reason for failing the old business model is as already mentioned with the outsourcing of service companies. As a consequence in-house technological competencies in terms of innovations got neglected, as with the outsourcing of service activities research and development has been ceded as well. IOC’s have felt the effects of when they entered the shale business in North America, when they massively overpaid for assets (Young, 2015).

Last but not least, the 2014 oil price collapse declared a final milestone for the old BM. Oil commodities used to be subject to a commodity super cycle. Thus, a fall in oil prices is nothing new in nature. Within the last decades oil companies were sheer waiting for price recovery, what took place, indeed, sooner or later. However it is unlikely to be the case after the 2014 oil price collapse, because climate issues and a rising competition based on industrial restructuring as well as threats by substitute products, lower the rise for a global demand for oil.

The increasing failures of IOC’s, shifted NOC’s and independents in cooperation with OFS to new levels, which characterizes the “new” BM’s significantly. In order to maintain economic viability under a “lower for longer” oil price, it requires business to act more flexible and integrate all kind of tangible and intangible resources stronger to another. Such measures addressing BM’s under dynamic market conditions are being presented in chapter 4.3.

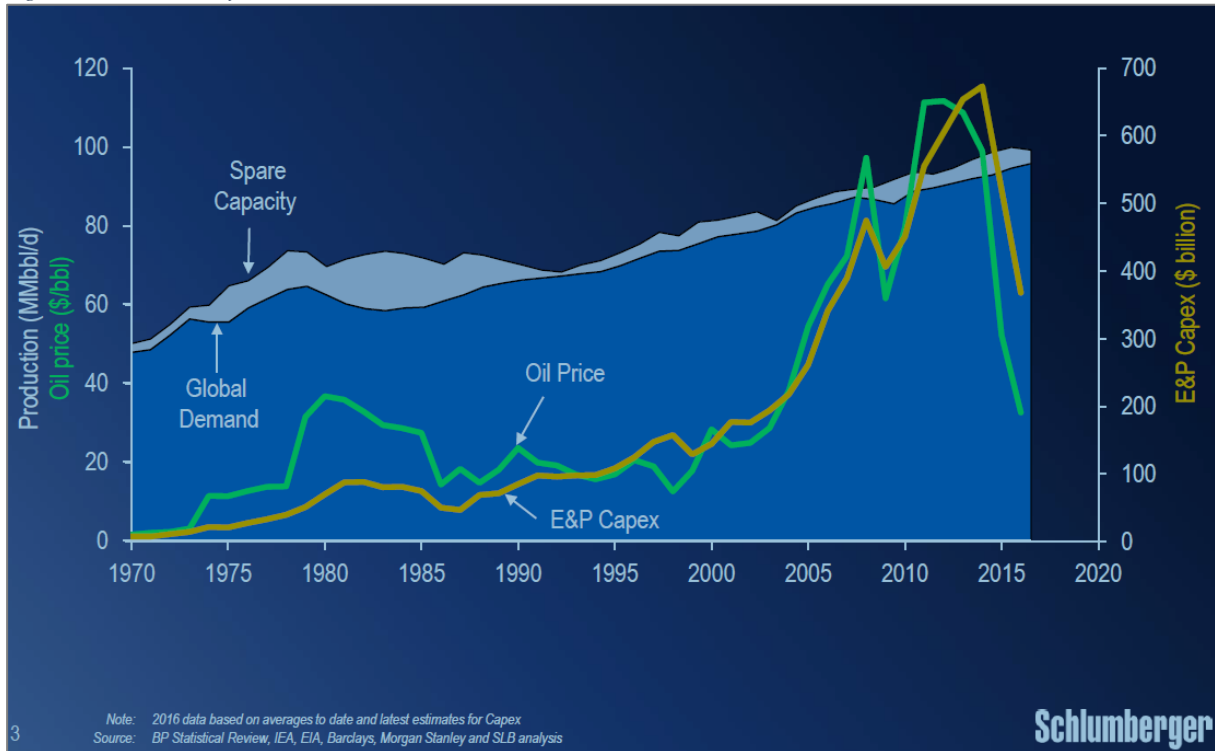
4.2 Investment Development from E&P companies

The following chapter presents some figures, which stand in connection with the industry downturn and signify the imperative for revising the way of doing business.

4.2.1 CAPEX

The global Capex from operators towards their suppliers have been falling from around \$700 bln in 2014 by almost 50% to around \$350 bln in 2017, as presented in the following graph, which is based on data from institutions referenced at the bottom of the graph:

Figure 12 E&P Industry Macro

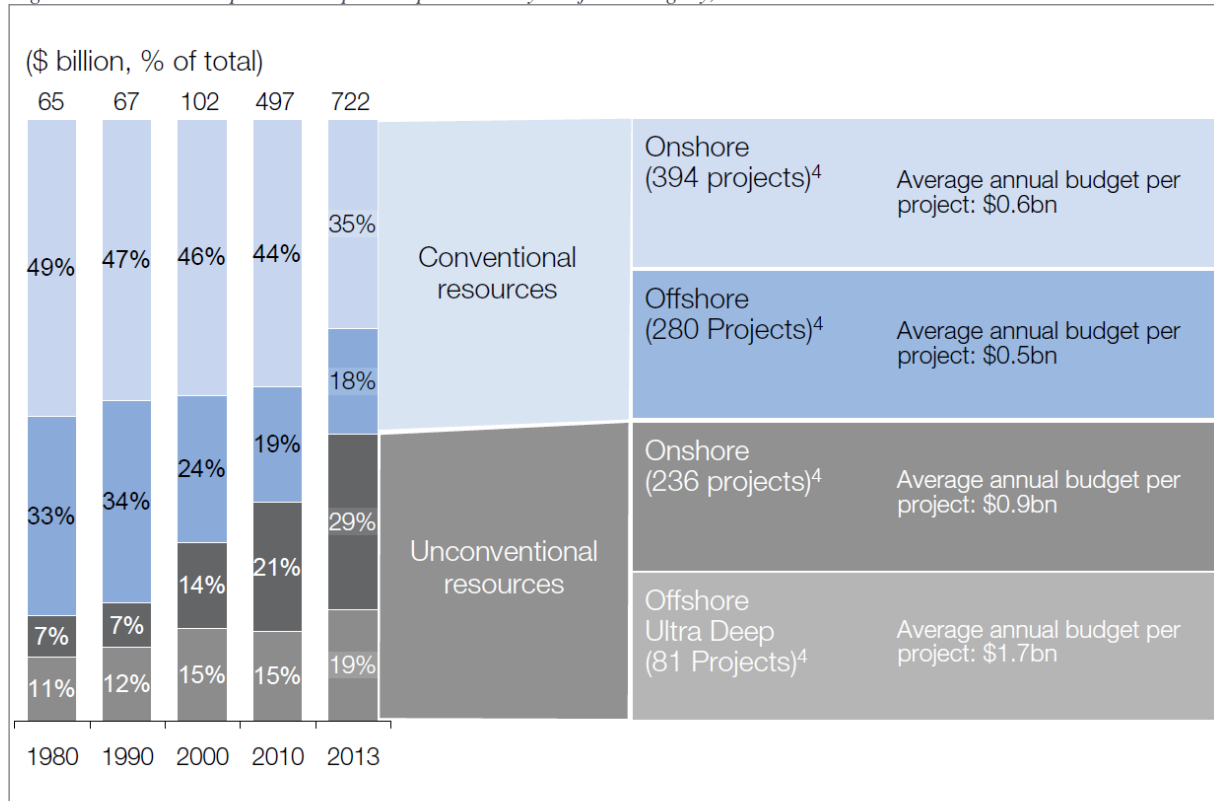


Source: Kibsgaard, Morgan Stanley E&P and Oil Services Conference, 2016

The majority of upstream operators is largely dependent on contractors to supply services and equipment, as up to 95% of operators' Capex are assigned to them. Such massive investment cuts indicate for suppliers appropriate deficits in product and service quality. In regard of the fact, that operators used "keeping costs down through tightly managed competitive-bid processes and holding contractors accountable for their performance" there is low probability, that contractors could maintain efficient business operations as they have been partially facing pricing pressure already, when the oil price and Capex were over \$100 per barrel (Groves & Melville, 2015).

My interview partners have confirmed this downturn, by stating a lower productivity and the cancellation of employees and contractors. The representative from FMC-Technip, claimed a drop in Capex from the customer of around 40%, resulting in "fewer projects to be shared between initially the same number of vessels, number of plants, factories, people". The BH Houston representative also committed to downturn by putting an emphasis on negative results in financial statements and the layoff of ten thousands of people.

Figure 13 Historical Upstream Capital Expenditure by Project Category, 1980-2013



Source: The World Economic Forum in Cooperation with A.T. Kearney, 2014

Despite all the trends, which soften the demand growth for crude oil, described in chapter 1.1, the U.S. has not slowed down production from shale fields. U.S. crude oil production supply has less than 0.7 bln barrels per day in January 2010 to almost 4 bln barrels per day in November 2014. As prices have dropped and the economies of production have changed, shale producers have moved rig around to the most profitable sites. So, while rig count has reduces, production has stayed stable. Also as crude oil can't be exported currently, North-American producers must process that tight oil. These factors are contributing to a global imbalance, which is feeding this supply glut.

Conventional sources are still an essential part of the business, however there arises the question how prospects of unconventional differs from conventional resources. In conventional sources a well is drilled and the production lifetime can last more than 20 years, while in hydraulic fracturing a well's lifetime moves between several months and several years. This fluctuation in production lifetime makes operators more often moving from site to site for exploring new production wells. Consequently projects with hydraulic fracturing are very Capex intensive, which can be retraced in figure 12, if you compare the production output and rise in Capex between 2010 and 2014.

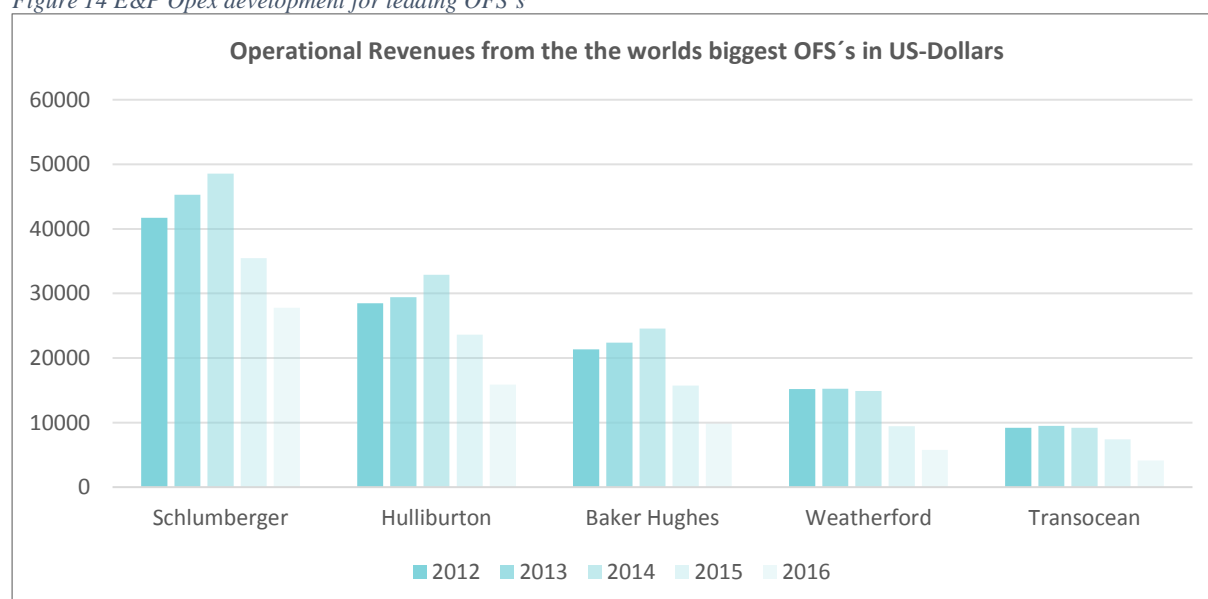
4.2.2 OPEX

In the course of pricing pressure, which operators have transmitted to suppliers, Opex have also been drastically reduced in accordance with Capex. Unfortunately it was not possible to me, to organize figures on E&P Opex, which cover the whole industry, as they are presented for Capex in chapter 4.2.1. However, the development of decreasing Opex is supported by the statements of various industry experts. Stuart White, the director of transaction advisory services at Ernst and Young, stated: *“There is evidence already of turnaround in certain operational indicators. Following the record investment levels of recent years and increased focus on production efficiency, the long term decline in UK production has begun to reverse. Similarly, unit operating expenditure per barrel has started to reduce after many years of increases (Ernst and Young, 2016).”* As O&G is a global industry, besides the UK, different parts of market were affected at different times and in different ways by Opex reductions.

Jon Knudsen the Vice President in Aker Solutions claimed, that his company was *“massively hit from the start, starting with the Opex, which was the quickest what they [the operators] could do something with. It is very difficult to stop a project that you have invested billions into. So the slow-down of Capex did not materialized immediately, while the slow-down of Opex materialized immediately into our maintenance and modification business. Of all in all, I would assume that close to 5000 employees and contractors were affected during the initial phases.”*

In order to illustrate this circumstances, I have illustrated the trend of the top five globally leading OFS’s operational revenues for the last five years in figure 15. Their operational revenues consist of income from services and sales of equipment.

Figure 14 E&P Opex development for leading OFS’s



Source: own illustration based on figures, retrieved from corporates annual reports

4.2.3 Renting market

The O&G business is characterized by high risk and high reward or failure in turn. Even though the industry is challenged by substitute products and environmental hurdles, the world energy demand is rising, and by 2040 fossil fuels will still be the energy source, which covers around 80% of global energy demand, depending on what sources you read (ExxonMobil, 2016). That's why drilling activities are going to be continued and extended in the near future. The oil price however, is unlikely going to recover to levels above \$100 a barrel. Thus, in order to diminish risk of operating activities, operators increasingly move away from buying or manufacturing oilfield equipment towards renting it. It enables the operator to reduce overall capital costs and the liability for equipment performance is so transferred to the appropriate OEM, thus enabling more operational and financial flexibility for the operator.

According to *MarketsandMarkets* Research Private Ltd “the oilfield equipment rental (OER) market will grow from an estimated \$26.8 billion in 2014 to \$53.7 billion by 2019 with a compound annual growth rate (CAGR) of 14.9% from 2014 to 2019. (MarketsandMarkets, 2014)” Those figures can, however, deviate from findings of other research, as different researchers use different sample groups and consider a different basic population in terms of O&G operations. Thereby the North American market dominates OER, which is likely to be traced to advances in drilling technologies, in particular horizontal drilling paired with hydraulic fracturing (Research and Markets, 2017).

The OER is present in both, the onshore and the offshore segment, whereby it is dominated by onshore and this trend is expected to be the case for the next four years. The concentration of E&P activities in the onshore segment will drive the growth of OER. This will be the case predominantly in the shale fields of northern USA and conventional fields in the Middle East (OGN, 2017). From 2014 eight new oil and gas fields were found in Saudi Arabia, four new oil fields in Kuwait by Saudi Aramco and the Kuwait Oil Company, which are considered to be followed by development and production (Research and Markets, 2017). Moreover, there are some offshore gas fields, considered to be operated in Arabiyah and Hasbah in Saudia Arabia by Saudi Aramco (Saudi Aramco, 2016) and in the East Nile Delta in Egypt by BP (British Petroleum, 2017). All this projects are considered to contribute to the growth of the OER.

In connection with OER I got to know in my interview with the Rosneft representative, that Rosneft is using drilling rigs on a daily rate. Moreover the biggest Russian oil producer procures drill bits from service companies, which are bought back from the service company for a lower price than the purchasing price after usage. Aker Solutions is also active in OER in the segment

of pumping and boosting for enhanced oil recovery. Marc Mathessius from BH Celle told, that with the falling oil price there were cases, when equipment wasn't produced in Celle and shipped to the production site anymore, but it was leased from local manufacturers, in order to avoid production and logistics costs.

4.2.4 Influence of investment cuts on the O&G Supply Industry

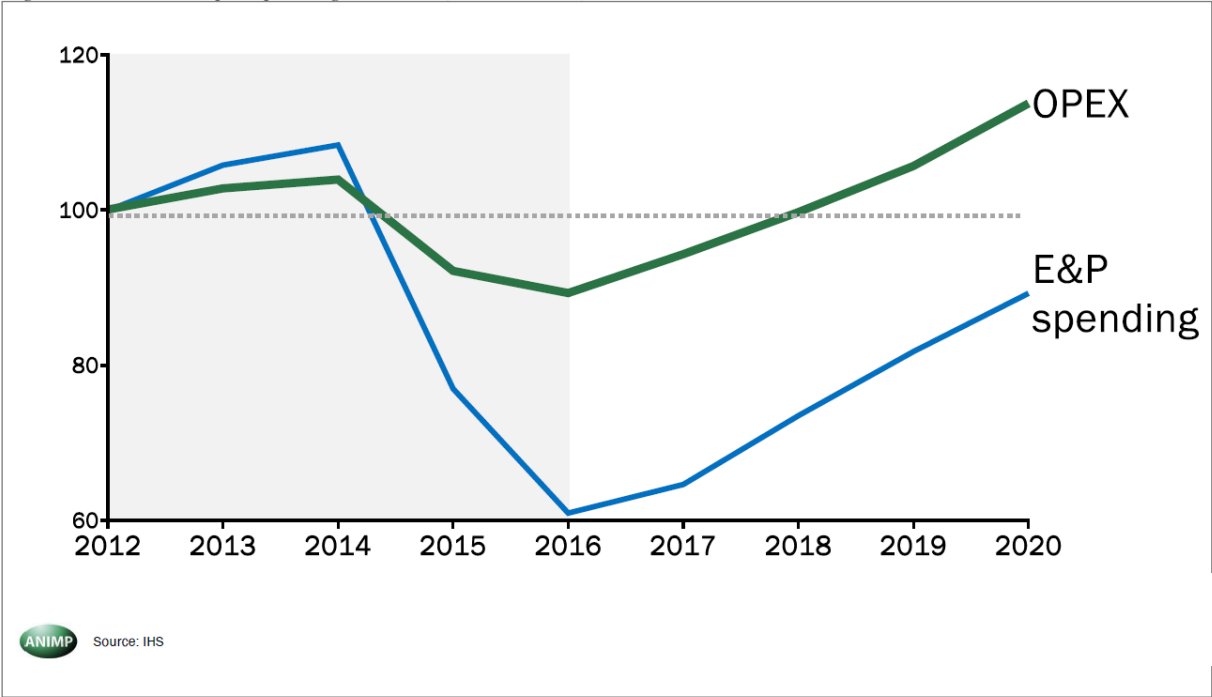
IHS Energy has analyzed the correlation between the market development of Opex and Capex, which are called E&P spending in figure 16. It shows clearly, that the trend in Opex and Capex moves in the same direction at the same time, whereby the Capex have been significantly more reduced than Opex. If we look at the growth of OER market, we can observe that against the background of the E&P Capex-Opex allocation from 2014, operators tend to shift their investments away from Capex intensive projects more towards Opex oriented project operations.

Such a development has a certain impact on the value chain, at least in the short term. To get back on the example of Marc Matthesius, Baker Hughes had to reduce its cost by 20 – 30 percent. In order to achieve such cost reductions, the production of certain equipment was stopped, and substitute equipment was sourced – to the extent possible and reasonable – in the local area of the appropriate production site. Therefore Baker Hughes sources drilling tools regionally, which are compatible with their own ones. As it is necessary to reduce Capex in the short-term, the service and product quality is reduced compared to own production correspondingly. Moreover it is additional effort for the procurement to manage new vendors, which causes additional transaction costs, described in chapter 2.1.2. The pricing pressure made BH to reduce logistics expenditures, shut down certain production facilities and procure equipment, which was used to be produced in house.

The operator's investment reductions has an overall influence on the whole supply industry, which results in a significant reduction of headcount along the whole supply chain. EPC's face a fall in FEED awards and new contracts. OEM's face cost pressure, which are transferred again to sub-suppliers. Production facilities were partially shut down, and materials and equipment bought from third parties instead of produced in-house, as depicted on the Baker Hughes example of Matthesius. OFS companies are even more directly impacted by the falling oil prices. Operators shut down or postponed a number of projects in the expectation of better conditions, like lower costs or higher oil prices. The global rig count fell from 3736 in February 2014 to 1405 in May 2016, to represent the minimum and maximum rig counts of the recent

years in connection with the 2014 oil price collapse. (Baker Hughes, 2017) In May 2017 global rig count is stated with 1935, as the business starts to recover.

Figure 15 E&P and Opex spending evolution (indexed 2012)



Source: ANIMP, 2016

Basically the investments reductions pushed the supplier landscape for a more advanced Capex efficiency and reducing Opex through lean organization and processes. Jon Knudsen admits that the pricing pressure forced Aker Solutions to completely re-shift and rethink approaches for green field and brownfield sites. This includes questions addressing firstly cost perspectives and on a later stage materializing new business models. Besides all those negative impacts, however, the positive sign for the industry is a natural drive towards operational efficiency. The next chapter provides some major approaches for new BM’s leading to cost efficiency.

4.3 Trends impacting BM’s

There is a broad variety of strategies impacting a company’s BM. Their implementation depends on the region and its complexity in terms of the break-even price, its geological condition, and political and legal requirements. The trends presented in the following chapter 4.3 are however generally applicable for the whole industry, whereby the priorities between them might be different for every participant along the O&G value chain. The described strategies are predominantly retrieved from my interview partners’ statements. Although their statements offered me an insight, such strategies have to be customized to every businesses’ individual company structure, as the level of an enterprise’s integration and the field of activity has different requirements. For instance standardization might be more important for OEM’s

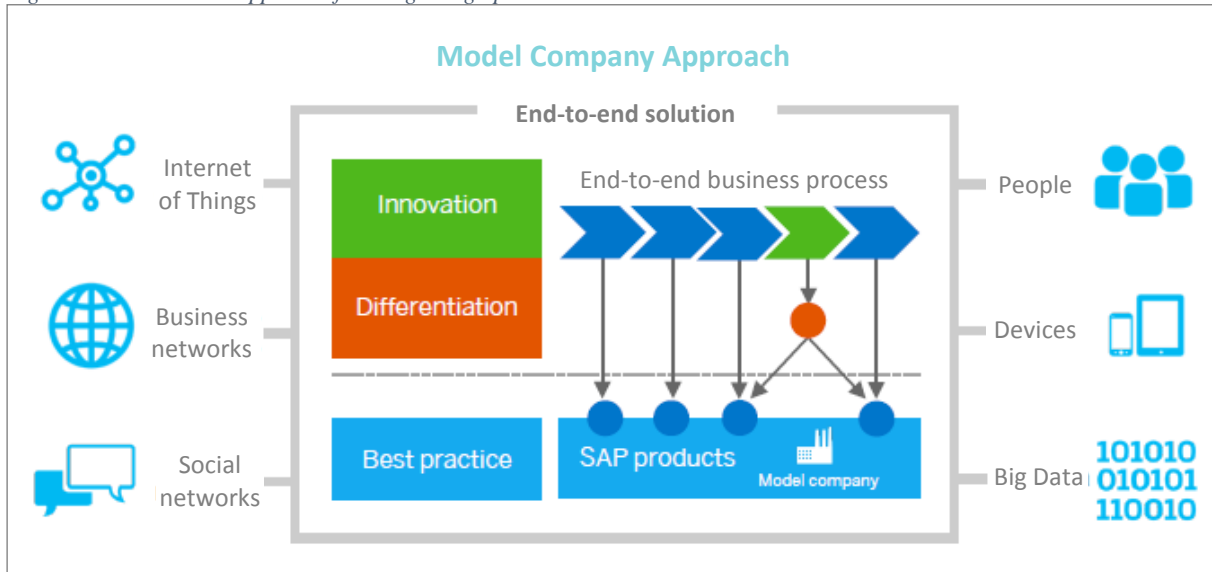
than for OFS's and vertically integrated E&P's have less need to collaborate with certain OFS's than the non-integrates ones.

4.3.1 Integration

Integration is a strategy, which covers from a superficial point of view all subordinated strategies addressed in the subsection of chapter 4.3. More precisely, integration in terms of BM's in industry 4.0 is the integration of technological innovation, standardization and cooperation. The BM's are based on the pillars of technology and the cooperation with all company internal and external supply chain partners. Technological integration includes predominantly drilling and production systems, which are completely digitally enabled and foster the business and collaborative models to expand and strengthen. Moreover integration challenge existing ways of working and actively fosters insight and learning from best practices from other technology-based industries. That measures deliver performance improvements, and consequently an improved financial performance.

One of the main drivers for integration is digitalized solutions. For this reason, many software companies have actively started to engage in the O&G business. SAP is the leading provider of enterprise resource planning software. On the one side the company describes how processes, people and systems interact on the basis of a collaborative business support. On the other side, it constantly develops operating models, which describe how they can be streamlined in order to achieve operational efficiency. The silo design architecture integrates functions and geographies in order to promote processes and technologies. The selection of the appropriate BM with the required level of integrated planning, tightly managed Opex and Capex and innovative engineering solutions, turns out to be crucial for developing hydrocarbons under the consideration of volatile oil prices and break-even costs in different regions.

Figure 16 SAP's model approach for integrating operational models



Source: SAP, 2017

One major item is to connect discrete technologies to one completely digitally enabled technology system. Such integrated technology systems reduce the cost per barrel of hydrocarbon extractions, through software control paired with big data analytics and innovative hardware products underpinned with constant machine learning. The world's biggest O&G company Schlumberger presents a role model in integrated operative models as it provides a broad diversified service scope (Kibsgaard, Scotia Howard Weil 2017 Energy Conference):

- integrated services management
- integrated drilling services
- integrated production services
- production management

In that connection Schlumberger operates increasingly with customers, who are looking for BM's, which are focused on further technical collaboration and closer commercial alignment. Therefore Schlumberger pushes for more productive business relationships with E&P operators, which start basically with integration offering and the appropriate risk based BM's.

The first level of integration offering is Integrated Services Management, which involves specifically at Schlumberger trained project managers, providing scheduling planning and activity coordination for different product lines, which are involved in customer projects. The advantage is a simplification of interface management between service provider and E&P operator and drive of safety quality and efficiency in project operations.

The second and third level are Integrated Drilling Services and Integrated Production Services, where Schlumberger houses engineering design and technical optimization capabilities to perform at the customers production sites. All three levels leverage collaboration, where joint teams from OFS and E&P develop “fit-for purpose solutions” (Kibsgaard, Scotia Howard Weil 2017 Energy Conference), which potentially improve the cost base per barrel. The highest level of cooperation and commercial alignment, however, comes from Schlumberger Production Management, where the service provider takes over responsibility for the full field, using the whole range of in-house capabilities, consisting of products and services.

Moreover Schlumberger demonstrates its openness to innovative alignment models publically. Therefore the company has created a special venture for fund offering, which is a new way for project investments in collaboration with the whole potential customer range. Besides closer cooperation and alignment with customers, this avenue helps to achieve more E&P investments, which can also be regarded as Capex for service and equipment providers. In addition it secures preferred agreements with suppliers for the appropriate activities for both discrete services and integrated service packages, as the supply chain partners have more transparency over the project and its potential outcome, where they engage in.

The venture fund enables Schlumberger to expand the company’s offering from technical support to financial support. The new business relationships have proved to be successful on the examples of projects like Fortuna, which is operated in collaboration with Ophir and OneLNG (World Oil, 2016), or the Tendrara project in cooperation with Sound Energy (Schlumberger, 2016; World Oil, 2017), or Schlumberger’s investment in Borr Drilling (Offshore Energy Today, 2017).

4.3.2 Digitalization of operations

To refer to my interview partner’s statements and secondary data, from all approaches towards new business models for O&G, addressed in the sub-chapters of 4.3, digitalization is the most important one. The key idea behind digitalization in the oil and gas business is to collect data with digital technologies from multiple sources and aggregate it together. The information from the extracted data is subject to be analyzed in order to make the right decisions for efficient operations. The identification of further optimization targets maximizing uptime and minimizing downtime.

For capital projects the industry has long been challenged with delivering projects on time and on budget. Thus a number of industry leaders believe, that digital technologies will set the pace

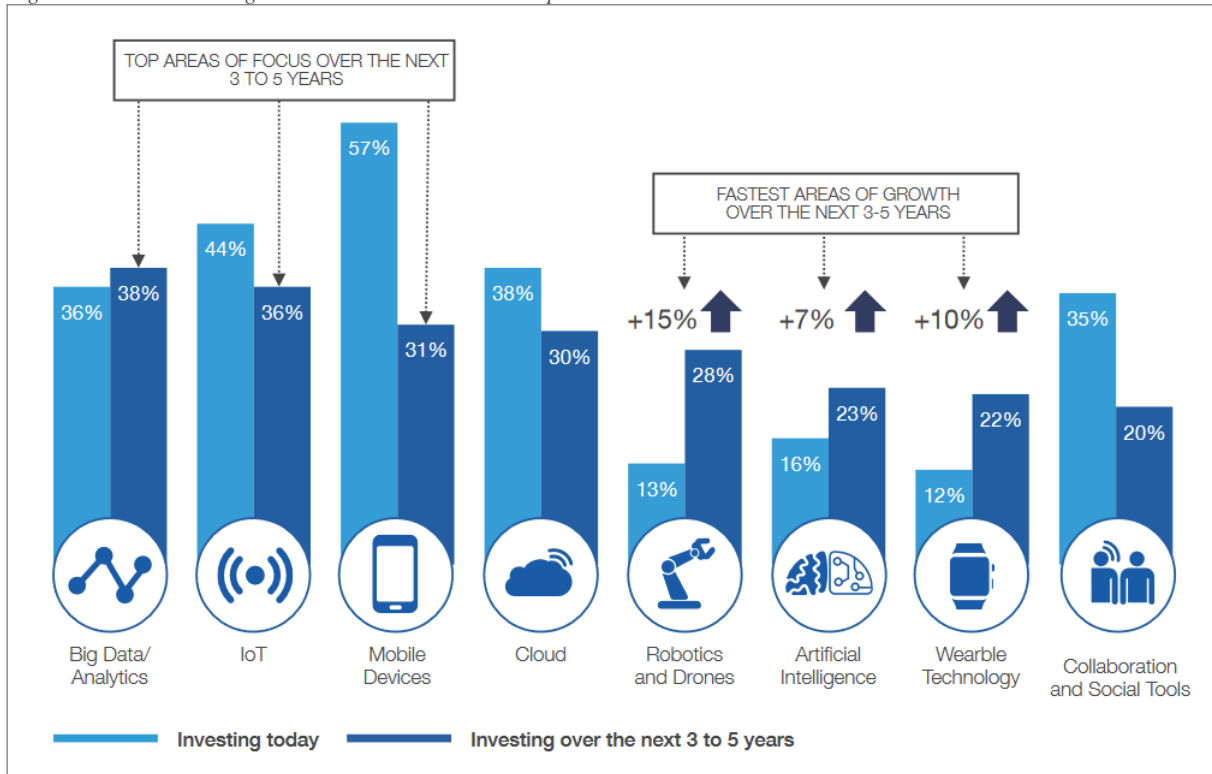
for sustainability in a dynamic O&G market. Jon Knudsen claimed: *“We [Aker Solutions] have massive amounts of energy, putting to our digitalization agenda, working closely with the operators, who see digitalization as a catalyst to efficiency gains, especially in areas such as, what we call digital project execution. Looking five years ahead, our service side will, probably have half of our income as outcome based. So we have quite ambitious targets towards moving our service side to a completely different game, than what we are going in today in terms of business models. I think in our stories you will find a lot of similarities that many of the other OFS’s companies have.”*

Knudsen summarized the drivers for digitalization as following:

1. *“The first formal driver is to become more effective and more efficient. So the Aker solutions agenda is all about improving efficiency in the way we work, the way we work towards our clients and to deliver more with less. I think that’s the main direction offshore term in order to cope with the fact that we need to help our clients realize their projects.*
2. *The second agenda is to use the digitalization to investments that we do in order to create more value. It’s saving costs and creating more value. And then we are looking at how for instance can we capture, and store, and analyze data that will enable our clients to run their subsea equipment in a better way, which can enable them to get more oil out of their reservoirs. So another models and technology that can enable more value creation for our clients.”*

In 2016 Accenture publishes in cooperation with Microsoft the “2016 Upstream Oil and Gas Digital Trends Survey”, which included all the target groups of my research, namely IOC’s, NOC’s, independents and OFS’s. The survey reveals the most significant trends among the respondents in regard of digitized technologies for their O&G upstream activities.

Figure 17 2016 O&G Digital Trends – Investments in Upstream



Source: Accenture, Microsoft & World Economic Forum, 2016, p. 9

4.3.2.1 Analytics and Big Data

The key concept of digitalized technologies, which helps to create value through retrieving appropriate information from a given data set is the so-called “Internet of Things” (IoT). This machine-to-machine communication concept considers all kinds of physical assets to be equipped with sensors and with them to be interconnected with each other in order to transmit digital information. It generates constantly vast volumes of data, which is transmitted in real time and in varying formats to technical devices. That real time data can be received by site workers and to by remotely located control centers, where support engineers are concentrated and guide on site workers via communicating with mobile devices and wearable technologies. Besides recording and communicating of field data, mobile devices allow to track and trace workers and coordinate employment of labor more efficient.

Advanced analytics of Big Data provide algorithms, from which certain insights and predictions can be retrieved and visualized. On the basis the shared data the O&G industry as a whole is subject to revolutionize the BM’s, because operations get more transparent and predictive for stakeholders with the support of digitalized technologies. Thus the value of executed services can be determined more precisely as well as E&P Capex and Opex, what actually drives the shift of BM’s.

The representative from Technip-FMC emphasized, that within the framework of digitalization, monitoring and control of specific parameters have significantly gained importance. Technip-FMC attempts to integrate all equipment, all processes into one single model for subsea equipment. That *“implies a need for some advanced technology, heating technology, use of special materials and so forth and also a durational control, of how you control the flow of oil and gas from the well to your facilities. [...] And at the other hand, the level of technology is such that in the past it was impossible to imagine that you can monitor, let's say, all components. You would typically try to monitor the most risk-prone and critical parameters of your system and limit the number of monitoring devices. But now, technology developed at a level as such that you can expand it into a very, very broad, wide range of devices and that suddenly discover quality of improvement results. We are around the corner where we would be able to deliver full field development solutions, which will integrate a lot of monitoring system, a lot of real life analysis systems. Which will allow clients to great day fields in a much smarter way compared to how it is done now.”*

A more precise case of how oil companies engage in data analytics and IoT can be showed on the instance of BP applying a software solution from GE, which is customized for O&G operations. *“BP gravitates toward new technologies, especially digital, and that makes working with them particularly exciting,”* says Lorenzo Simonelli, president and CEO, GE Oil & Gas. *“We are taking a big step forward together during this time of digital transformation, deploying what we've co-created over the past year to drive the kind of productivity improvements that the oil and gas industry needs. The global deployment is expected to be the largest-scale deployment of GE's Predix-powered asset performance management technology to date. (World Oil, 2016)”* Predix is “platform-as-a-service” data and analytics tool for O&G operations, which can capture and analyze machine data of high volume and variety in an industrial cloud environment.

Another initiative of technological collaboration has been signed between GE Oil & Gas and Paradigm in order to deliver Reservoir Driven Production Optimization. Paradigm develops software for the O&G industry, specializing on reservoir modelling and petro technical services. Reservoir Driven Production Optimization is powered by Predix, and it provides an upstream solution for optimizing field-level production by combining Paradigm's subsurface knowledge with GE's production capabilities. Paradigm's chief executive Arshad Matin claims: *“Today, production engineers often rely on single-well analysis to make production decisions*

that have field-wide impact. Partnering with GE, we can now provide a unified view of both production and reservoir data for optimal decision making. (GE, 2016)”

So the essential value of the digital energy revolution is “Big Data” and it results in a more resilient network, which connects all workers, suppliers, customers and assets. In this context Sundararajan, chief technology officer at GE Oil & Gas, puts an emphasis at this point: *“We have also had to upgrade other work management and systems so the integration is more seamless and efficient. That has been a benefit but also a labor challenge to pool resources and get all systems to work together. (Blake, 2016)”*

4.3.2.2 Know-How Management

In corporate centers digitalized technologies transfer the way of doing operations, such as finance, human resource management (HRM), supply chain, marketing and procurement. For example IT embraces cloud to get better agility and to reduce their cost. Finance is embracing analytics to look for hidden sources of value. HRM is looking at social analytics for recruiting and retention. So the operations landscape is fundamentally changing based on digitalization.

Firuz Butaev from Rosneft gave me an insight on such issues, which are based on integrated software: *“We use software, designated to knowledge sharing, which is called ‘I know’. It manages the experience of specialists and their statements on the first page of this resource. That means, that we have numerous types of production activities in any kind of business stream, starting from drilling, completing the well, oil refining, intensification of energy efficiency, chemical processes, and everything actually. If you klick on it, you have the special article with examples and statements from experts, which can provide you with any detail information upon best practice. It’s one of a best practice examples, and we try to spread it over the whole country of the Russian Federation in our subsidiaries.”*

“Also we work with specialized knowledge bases for drilling for example. We have a special information managing resource, about the capital construction activities in drilling, called ‘Upstream Capex’. This program collects the data from all activities in drilling and capital construction from all the subsidiaries. It shows us the plans, the actual data and special integrated reports. In the following you can extract certain data and technical parameters. And you can use it for your own needs, for instance to prepare highly detailed analyses, draw comparisons and other things.”

“The clue is to integrate all types of information in one business data management information system. We try to put all utilized software programs into one mega software and to let all our colleagues over our whole company work with this data in very easy ways. That’s the target.”

4.3.2.3 Drones and Robotics

Further on, drones and smart robots along with video analytics and artificial intelligence are inspecting pipelines and other hazardous areas, which are not safe for humans. Automation eliminates unnecessary work through optimizing labor deployment and unifying operational technologies with information technologies.

In this connection the US IOC Chevron launched an initiative, which develops drone technology for detecting and producing new reserves while considering certain levels of safety. Ken Lewis, who is the R&D Project Lead of Chevron’s Upstream Workflow Transformation teams, explains: *“The focus is to collect high resolution imagery, thermal infrared radiation data, as well as digital point clouds in order to create digital elevation maps. This information can be used to create new base maps for all our fields, along with being able to, for the first time, create thermal image maps across all our fields as well—especially in those areas where we are doing steam flooding or any other type of steam distribution systems.”* Tony Latham, a production and thermal operations supervisor of Chevron’s Coalinga oilfield adds, that the usage of drone technology for O&G operations enables deep technological possibilities: *“We could look at anything from pipeline inspection processes to real-time leak detection and monitoring.”* (senseFly, 2016)

In addition to drones, the trend of robotics is rising more and more. Automated technologies have been in O&G already long time existing. However the automatization of operational technologies is gaining importance as it is expected that a significant share of industry professionals will retire within the next years at the one side. At the other side with the progress of technological development, automated solutions become cheaper, while wages for human workforce rise. The General Manager of GE Oil & Gas – Portable Non-Destructive Testing, Tim Humphrey states in this connection the following at the 2017 Pittsburgh Technology council: *“It will be by 2020, \$1.7 trillion of spending on the IoT. [...] The last ten years the cost of robotics has dropped by 50%, where the cost of labor has increased by 80%. So it’s easy to see why automation becomes the solution.”*

The 2014 oil price collapse has accelerated the imperative for automated solutions, in particular robotics. Automated operations “take humans out of the most repetitive, dangerous, and time-

consuming parts of oil field work” like drilling for instance (Wethe, 2012). Besides of that especially in the subsea solutions business, ROV’s represent an essential success factor for subsea operations, because subsea installations can’t be executed by divers due to the depth. Safety will be increased with the improved use of robotic technologies, particularly in hazardous areas.

4.3.2.4 Wearable Technologies

Another trend for digitized technologies is wearable technologies, as already mentioned before. Maersk Oil company is a pioneer in integrating wearable technologies. Troels Albrechtsen, the head of corporate technology and projects at Maersk Oil explained this in an interview, on the example of the Culzean gas project in the UK North Sea. Culzean is expected to start production in 2019, and is considered to be a digitized flagship in terms of featuring augmented reality (AR). (worldexpro, 2016)

AR enables workers in remote O&G fields to receive real-time information on equipment via mobile devices like tablets, and helmets or glasses with integrated smart devices like the Google Glass-type for instance. *“This infrastructure will enable a front-line worker to approach a piece of equipment, and immediately have available to him all the data and drawings that are relevant to it. He’ll know how it should operate; he will have its records available to him just by being where he is on the site.”* (Lo, 2016)

In the control centers, staff is enabled to support and guide repairs and maintenance via live video feeds. *“If he [worker] sees a problem or anomaly, he’ll be able to call up experts in an onshore support facility. They can be in his ear, seeing a live video stream of what he sees, and provide him with live feedback on how to best tackle the issue. If that is not enough, they can call up an industry expert sitting in, say, Houston, who will be able to come in at a moment’s notice to take part in managing a situation or inspection.”* (Lo, 2016)

In particular for new projects Maersk Oil is optimistic about introducing AR into the design, because it enables them to design, plan and implement on-site workers. *“For retrofitting into existing installations, the remaining lifetime of the facility will be what decides whether those investments can be made. If you can make good use of this over a five or ten-year period, it makes a lot of sense. The number of helicopter trips you could save from people going offshore, for example, is a tangible, bankable saving.”* (Lo, 2016)

4.3.2.5 Additive Manufacturing – 3D-Printing

An additional trend which is now also applied increasingly by OFS companies is additive manufacturing. Marc Matthesius from Baker Hughes states that Baker Hughes attempts to replace mechanic processes in equipment manufacturing, executed by human manpower through additive manufacturing. Baker Hughes manufactures micro components through 3D-printing. While the mechanic processing was used to be executed by turning and milling, 3D-printing enables more precision with a lower error rate. Additive manufacturing is subjected by higher initiation costs compared to the conventional production procedures.

However those costs can be reduced through economies of scale, because manufacturing machines don't need to be supported by one person continuously anymore. Instead numerous machines are merely equipped with material by one worker and then they work automatically. So if one worker can support five manufacturing machines by means of 3D-printing, then the expenditures for four workers can be saved. However additive manufacturing is still moving at a very early stage. The results of first test runs in terms of vibration tests, heat tests, etc. are significant for further decisions regarding, whether to continue the production process of additive manufacturing or not.

4.3.3 Revenue models

As the usage of digitized technologies provides more transparency about upstream operations, the outcome of operations becomes significantly more measurable and predictable. Against this background especially in times of such dynamic markets, where E&P Capex are strongly correlated with current oil prices, which are as a rule very volatile, there is a clear trend towards new revenue models. As already mentioned in chapter 4.2.4 there is an industry wide orientation in E&P spending from Capex to Opex. Vince Vasquez, the CEO of crowdstory published an article on how IoT solutions can improve business. In that article he outlined three BM's, which hardware companies can follow currently (Vasquez, 2017):

- **Service and Support Contracts:** manufacturer sells equipment bundled with warranty and in-house service.
- **Assisted Services:** equipment is connected to the manufacturer's control centers in order to provide advice for machine performance.
- **Machine-as-a-Service:** While the customer uses the equipment, it remains being owned by the manufacturer, who is fully responsible for maintenance on payment of a recurring charge.

In particular the latter BM is subject to be taken over by a number of E&P operators, because it enables OFS's to "...shift from selling products to selling services based on those products; this model can transform large Capex into pay-by-usage Opex. (Vasquez, 2017)" The services are usually measured and charged in entities like time or performance outcome. Equipment is charged according to variables like per "meters drilled" for drilling equipment, "hours used" for blowout preventers (BOP's) or "barrels produced" for pumping equipment.

In the year 2012 Kjell Hausken from the University of Stavanger publishes a research paper on fixed price contracts (FPC) versus incentive based contracts (IBC) in the O&G industry. The author compares under what conditions operations and service providers prefer FPC's and IBC's. FPC's focus on time in form of a fixed payment rate per day, while IBC's consider the relationship between quality and time via coupling incentives to performance or better said the outcome of the performance. IBC's apply reward and punishment, grounded on performance measurement in terms of certain targets like schedule and quality in consideration of a certain budget and time frame. A typical incentive is material reward in the form of financial bonuses for instance. If the service provider does not meet the performance agreed on, the reward decreases or might even turn out negatively, what presents a risk for the service provider in case of not performing as specified.

From a mutual welfare viewpoint, the advantage of IBC's for managing completion of O&G projects lies in the level of how deep a service provider is involved in the project planning phase. This motivates actors, who are due to their strategic capabilities more suitable to deliver an appropriate solution to the project than the operator, who holds the formal ownership to get deeper involved in the project design and planning. The license holder's strict guidelines might affect productivity negatively with a FPC, because IBC's push for decreasing the time to complete a project.

In his 2012 research paper Hausken (2012, p. 380) claims, that O&G relationships between operators and contractors on the Norwegian continental shelf are regulated by FPC's, where service providers are payed on a day-rate. IBC's are uncommon at the Norwegian continental shelf, however they are on their rise. Sund (2010) argues, that ICB increases value of drilling for all actors involved, because aspects like productivity and cost efficiency are critically questioned. The application of an IBC, is grounded on a payment to the service provider, which increases or decreases depending on the actual time effort compared to the estimated time.

In contrast to FPC's, IBC's are characterized by decreased costs of monitoring and coordination, because contractors are motivated to engage actively in the operator's project design, as they get deeper involved in the planning and get more motivated to complete the project in a shorter time. The involvement of operators and service providers on certain key performance indicators, may result in a more efficient resource allocation. However processes like drilling present a trade-off between quality and time. A number of factors impacting drilling are time critical, however too high drilling speed can lead to failure of the drill rod and cause delays (Osmundsen, Sørensen, & Toft, 2008).

The findings of Hausken's study show, how time usage is effected differently by the two contract types. FPC doesn't deliver incentives to the supplier to complete a project before the estimated time, because profit can't be maximized. The more days a drilling contractor requires to complete a drill on a fixed day rate, the higher profit will be, as long agreed on estimated time is not exceeded. On the other side, if the service provider is motivated to increase its profit per day on the basis of an IBC, the service provider prefers to deliver project completion as early as possible.

A practical example on incentive based contracting can be illustrated on the case of Halliburton, constructing a well in the Rumalia oil field in southern Iraq in cooperation with the Rumalia Operating Organization. The challenge was to construct a well within naturally vuggy and fractured formations and drilling highly reactive shale sequences within an estimated time of 40 days. Through a logically structured project organization, which involved applying knowledge from previous projects and a thoughtful collaboration with third parties, the OFS provider managed to complete an S-shaped well safely within 31,5 days instead of 40 days (Halliburton, 2017). Considering the fact, that a drillship costs approximately between \$520.000 (2014) and \$200.000 (2017) per day and a standard jackup approximately between \$60.000 (2017) and \$170.000 (2014) per day (IHS Markit, 2017), 8,5 days of time saving results in a significant cost saving.

Another example what IBC drive is production sharing agreements. In 2015 Halliburton got into an agreement with BlackRock, a leading global financial services organization. Blackrock helps Halliburton to fund new drilling program, which targets existing onshore shale wells in North America. The funding of \$500 million will accelerate Halliburton's refracturing operations. Christopher Robart, the managing director of unconventional resources at IHS Energy states: *"What refracturing needs now is a new innovator to step up, invest capital, and*

take risks to refine the technologies and lower costs.” (Shale Gas International, 2015) In turn Black Rock approaches the customer base and requires the services to be paid on the production of hydrocarbons, after BlackRock has paid and delivered the services, which were developed and refracted by Hulliburton. The BH Houston representative beliefs, that such services will characterize O&G business as a rule in the future: *“There was a bit of it before 2014, but as some of the customer base in the E&P world has become more cash-constrained and dead later, those kind of business models have become more common, certainly by the largest service companies.”*

A similar example on production sharing has already been mentioned in chapter 4.3.1 with the case of Schlumberger funding the Fortuna gas field, which is operated by Ophir and OneLNG. The OFS funds the operator’s asset initially and acquires a share of it. In turn Schlumberger will generate revenues from the gas production. Since Opex are highly variable and depend on “product mix, water depth, distance from the shore, facility size and configuration”, there is a trend in the context of outcome based revenue models, that E&P operators pay service providers “fee based on the volume of oil or gas, costs are measure by \$/Mcf or MMbtu or \$/bbl” (U.S. Energy Information Administration, 2016)

4.3.4 Collaboration

As already taken up in the previous chapter, O&G players increasingly interact with each other. After the 2014 oil price collapse there was an industry-wide movement towards strategic alliances observed. The former Deputy Managing Director from Kuwait Petroleum Corporation and chairman of Aref Energy stated: *“Most NOCs would love to see these guys [OFS’s] more because they do everything in one contract. And this is something good for somebody who is tied up with a long chain of local government tender procedures. So you talk to someone like Schlumberger and they can bring you your breakfast to the derrick, as well as huge equipment under contract. The Schlumberger philosophy is propagating while small companies push to be able to offer more services.* (KPMG, 2016)” OFS’s have recognized that trend and imperative, and step increasingly into alliances with horizontally or vertically related companies in order to create bundled complementary capabilities, which address customer related challenges and can’t be developed separately from each other.

Garcia et al. (2014) explores six sets of challenges of technical and institutional nature, that O&G firms face, which are however subject to differ in their complexity. One challenge of those, which was also addressed by Knudsen is “extreme environments and reservoirs, which by and large represent primarily technical challenges (Garcia, Lessard, & Singh, 2014, p. 24).”

In regard of that point, Jon Knudsen emphasized that Aker Solutions doesn't only step into partnerships in order to drive the company's product differentiation, but also to enhance project management abilities: *"In my view there are two aspects of it [strategic partnering]. It's either cooperating, because we want to develop new technologies, that will create value for our clients, like we have done with ABB for instance. Our long step out technology is an example of this, which enables oil companies to connect facilities far away from their existing infrastructure to their current infrastructure, like Arctic waters for instance. And then we have partnerships, which is about project realization. An example of this is, the SURF space. Here we have a strategic alliance with Saipem, to access for instance installation vessels across the world, enabling us to install equipment in a more efficient way in the big institution projects. So that's the two allies that we are following."*

To get back to the point of bundling services, the findings of my primary research turn out to be consistent with my secondary research. There is an increased trend into both vertical and horizontal integration. The most outstanding example in this context is the merger of Technip, a leading EPC company, and FMC Technology, a leading subsea solutions provider. My interview partner from Technip-FMC claimed: *"Technip had merged with FMC just three months ago. Meaning that this process exemplifies exactly, the way two technology leaders, one in Sub Sea Production Systems –FMC– and Technip was a leader in Sub Sea Pipelines and Video calls Installation Operations and so forth. Normally we would have operated completely independently from each other, meaning that such independence created significant risks for our clients in regards to interface, conflicts and so forth. But now since we merged, we are integrating two different technologies into one business model, meaning that we are committed to resolve interfaces between different equipment packages with **no additional charge to the client** and that's the reason why this merger was integrated. We are basically taking more risk, more responsibility, but we are doing that in order to get competitive advantage. We are so big now, that we cover almost 99% range of whole Sub Sea Technologies, that as such we do not need to talk to Schlumberger, Siemens or GE. We are competing with them and we ensured that we are fully prepared for this drive towards cooperation and integration, by merging two companies together. [...] now we are not going to discuss anything with our competition, we are going to out-compete them because we have this tremendous advantage now after the merger."*

Another mega deal which was signed is the merger between GE and Baker Hughes last year, which is valued \$32 billion of combined revenue (General Electric, 2016). It combines in

particular GE's data analytic and IoT capabilities with Baker Hughes' drilling capabilities. Although both companies have a broad product and service portfolio, according to my interview partner from BH in Houston, the merger will directly react to the most outstanding market trend and foster innovations in the digital solutions business: *"Digitalization and Baker Hughes hasn't really had an impact yet. [...] At Baker Hughes, we've not experienced it yet, but I suspect with the GE merger, one of the anticipated outcomes of that relationship is that we will be able to leverage their digital capabilities to better improve our business and, ultimately, improve economics for our customer base."*

To move on further along the supply chain towards an operator point of view, the representative of the biggest Russian NOC Butaev, claims that vertical integration is an essential matter of Rosneft's strategy: *"We try to diversify our business in each possible way. Diversify our presence, diversify the number of our products, diversify the number of markets where we are presented in. [...] Starting with preparing the detail engineering phase and ending with M&A of OEM's. For big vertical integrated companies it's very important to be diversified. [...] The business model of Rosneft is very close to the type of the big EPC companies. We're not integrated with EPC companies for sure. But we have special subsidiaries, called company designing institutes. They have a special department, which are dealing with the engineering and preparing the special forms of documents, which helps you to make the procurement activities in the right way on the next phase. We also consolidate all our procurement needs in one center. It's called company procurement service. It's a huge department, and there is only one of them. Then we have the construction activities. [...] the so called upstream construction department and this department, our colleagues are trying to do the same things regarding the construction activities in each subsidiary in each region. Successful approaches are spread as best practices in each subsidiary. [...] It's not a natural EPC company. It's divided more into the certain fields of EPC activities. As I said we have certain centers for each type of activity. For detail engineering, for procurement and for construction. So it's not an EPC."*

Despite the fact, that operators like the NOC Rosneft are eager about diversifying their product and service portfolio, this trend is also observed for classical OFS's who go beyond their classical scope in terms of activities. Knudsen notes a trend, where OFS's, amongst others also Aker Solutions engage increasingly in the E&P business: *"I think our work with BP stands for the fact, that our owner - the Aker Group - has bought into the Norwegian part of BP and formed a separate company. In that what we see with this kind of having an in-house oil company, the fact is that you can try out new collaborative models. It is customers wanting to*

have, to arrange for maybe two or three competitive lifts for a frame agreement and then joining two competitors into a collaborative mode, where we realize projects, based on a target price regime, within an upside and downside bid based on how much work you do in the project. So those deliberative is something that we are certainly seeing more emphasis from both, medium-sized companies as well as smaller companies. That's why we move away from the typical vendor oil-company approach but more a joint approach to deliver a project."

Another challenge, taken up by Garcia et al. (2014, p. 24) is: "Enhanced local economic and social engagement in new regions that present primarily institutional challenges." The representative from the Russian NOC states: *"In some regions we have the obligations imposed by the regional government. They require us to provide them with jobs, to maintain the infrastructure, they to provide them with electricity for their towns and on the country side. Another thing is, that we are helping them with the recovery of field needs in petroleum. [...] Moreover we have a partnership with the Gubkin University. In that programs students are educated for technical professions after which they are employed in our company."*

4.3.5 Standardization

Another important driver which stands in close connection with the previously described market trends is standardization. This applies on the one side for technological solutions, on the other side also for business processes. Tore Halvorsen, who used to be the senior vice president of subsea technologies at FMC Technologies until the merger with Technip, outlined new collaboration models, and technologies with a lean design time and standardization as the major approaches for cost reduction (Halvorsen, 2015). Standardization reduces the costs of project inception to the first oil production. Halvorsen (2015) supports this statement with the example of FMC Technologies signing agreements with IOC's like BP, Shell and ConocoPhillips to develop standardized and modular based equipment for application in high-pressure deep-water fields.

Knudsen says, that *"standardization has been on the agenda for many years, it picked up speed lately. But it's always been a struggle until the downturn to get acceptance from the client, that this is the standardized solution. You're not getting a custom-made solution for your project. And I think this is one of the areas, where we have made much progress during the last 1,5 years, because the customers are actually now starting to accept, that if they want a cost-efficient solution, actually asking for a custom-type of delivery every time. It's not going to be beneficial for them."* The representative from FMC Technologies expects a stronger engaged initiative from operators to standardization: *"We would love to standardize just absolutely*

everything and we see some ridiculous examples, but, I think the drive here should come from oil and gas companies.”

To get back to the point of digitalized technologies, cloud based applications play an essential role for standardization as well. Oil companies engage actively in big data analytics and IoT, integrates sensing, communication and analytics of data in O&G operations. Statoil spokesperson Ola Anders tells in an interview with Rigzone: *“Each plant has thousands of measuring points that are read continuously. The measuring points form the basis for key decisions to understand and analyze what has happened, and to optimize and improve plant operations. By introducing one standard solution for storing and presenting process data, Statoil will achieve considerable cost savings and simplification.”* Robert Golightly, the senior product marketing manager for AspenTech adds to the Rigzone interview: *“The measuring points are the basis of understanding and analyzing what has happened, so that important decisions can be made to optimize and improve plant operations.”* AspenTech provides the Information Manufacturing Systems technology standard for Statoil.

But as mentioned in the introduction of this chapter, standardization is not only strived for on the technological side, but also in business process management. Butaev claims: *“We [Rosneft] are in the process of standardization of our procurement needs. Also we are trying to standardize our production intensification programs. That’s the second think. Thirdly, we are trying to define the standards for the drilling programs for certain types of wells, horizontal wells, vertical wells, sub-horizontal wells and other types of wells.”* In terms of standardizing procurement, Butaev emphasized the imperative to orientate more towards a solution based approach rather than to a supplier relationship oriented approach: *“We are trying to get rid of special technical parameters, which leads us to certain suppliers. That’s why we prepare this procurement documentation, where it won’t find the connections to certain suppliers. We try to put the technical parameters in the way, looking at which you won’t find the connection with the certain supplier. We try to get rid of the connection with certain suppliers with documentation standards.”* To refer to the concept of network strategy, this fact described in the actual quotations, opens opportunities to OEM’s to establish new business relationships with the biggest Russian oil producer. According to Butaev the mentioned documentation standards *“help OEM’s to understand Rosneft’s needs more detailed and more specifically”* and enables the NOC to understand which approach does not allow Rosneft to change their demand and their technical parameters. That’s beneficial for both parties, because it reduces

transactional effort, in particular arrangement and adaption costs, and consequently the price, which stands in connection with such coordination activities.

4.4 Summary

The investment development as well as the industry trends have already been addressed several times in the introduction part of this research paper. Thus I compare the “old” and “new” BM’s of the O&G industry in this chapter. The old BM’s refers up to 2014 and the new BM’s from 2014, when the “lower for longer” oil price collapse took place. At this point it is worth mentioning, that I describe the absolute opposite pols of BM’s for the whole industry in general, in order to illustrate it understandable. There have already been signs of the new BM before the 2014 oil price collapse. However, all my interview partners have admitted, that 2014 has strengthened the leading companies attitude in engaging seriously into new BM’s, as market forces make it necessary. There are also companies still following the old BM’s, however they are likely not be sustainable in long term.

Table 8 "Old" vs. "new" BM

	“old” BM’s	“new” BM’s
O&G player landscape consisting predominantly of	IOC’s	NOC’s, IOC’s, independents, OFS’s
Business target	Increase shareholder value	Increase shareholder value
Strategy	Maximizing bookable reserves and minimizing costs through outsourcing of OFS	Operating existing mature fields and minimizing costs through usage of advanced technology and collaboration
Preferred segment	Conventional	Unconventional

Source: Own illustration

The previous industry BM, which emerged predominantly in the 1990’s was characterized by an O&G player landscape, dominated by IOC’s. Their main target was to maximize revenues by acquiring continuously new oilfields and maximize bookable reserves. In order to save costs the IOC’s outsourced their internal OFS departments. Thus in the 1980’s the big OFS were established. Thereby IOC’s focused predominantly on easy accessible hydrocarbons, which could be extracted by conventional methods, like onshore oilfields with light and sweet oil in the Middle East. As the oil price used be at a level high enough to maintain economic viability such a BM was followed until the economic super cycle in 2014.

In the context of the new BM, governments of resource rich countries start from the 1970’s to nationalize hydrocarbons located at their territory. Due to a lack of competencies they allow OFS’s and independents to step into partnerships with their NOC’s in order to build up joint production. IOC’s, on the other hand, get increasingly active in the unconventional segment in

OECD countries. In particular in the U.S. and Canada they develop together with independent oil companies hydrocarbons with horizontal drilling and hydraulic fracturing. On the basis of this development the O&G player landscape becomes more variegated and competition intensive. With the sharp fall of the 2014 oil price companies are facing harsh pricing pressure from the supplier side, resulting in Capex and Opex reductions by almost 50 percent. This circumstance forces the whole industry to work more efficient, as the oil price is expected to stay “lower for longer”. Therefore key players step into strategic partnerships and work on technological innovations in order to streamline operations, which hadn’t been done before to such an extent, as has been from the harsh economic downturn. The new technical possibilities offer new revenue models on a performance basis.

5.0 Analysis

All collected findings in this research are presented in the empirical results. This chapter will focus on the opportunities and challenges, which arise for OEM’s from the approaches towards new BM’s. In addition I analyze and discuss my findings in line with the presented theories. The first two sub-tasks of my research question were answered in the empirical part, the third sub-task is answered in the analysis part in chapter 5.1 and 5.2.

5.1 Opportunities for OEM’s

5.1.1 Integration of digitalization, standardization and strategic partnering

The three major trends, described in chapter 4.3, which consist of digitalization, collaboration and standardization are interdependent from each other and result interconnected together in new performance based business models. The concept of IoT is based on real time data exchange, which helps take the right decisions for upstream operations. Therefore all E&P equipment is attached with sensors, which exchange data over a cloud based software and visualize that data on mobile devices at the production site and at the control center. The Technip-FMC representative outlines: *“The level of technology is such that in the past it was impossible to imagine that you can monitor, let's say, all components. You would typically try to monitor the most risk-prone and critical parameters of your system and limit the number of monitoring devices. But now, technology developed at a level as such that you can expand it into a very, very broad, wide range of devices and that suddenly discover quality of improvement results.”* There are different variables used for measuring and communicating the data. For drilling activities that variables are temperature and speed of rotation and penetration rate of drilling for instance. For pumping equipment the level of intake and discharge pressure, motor and fluid temperature, current leakage and vibration are critical variables. The monitored

values provide a basis for decision making, what measures should be taken in order to avoid downtime and maximize uptime of the production facility. Such measures imply for instance the injection of chemicals or steam into a well, or adjusting the optimal vacuum pressure under the given conditions. Generally speaking that the retrieved and analyzed data enables predictive maintenance, as maintenance intervals can be measured by specific variables. The process flow can be improved through the monitoring of potential changes in the operating conditions. Consequently the accident frequency is reduced through real time monitoring.

As already described in chapter 4.3.5 on the example of Statoil, process data is stored and more E&P operators accept modular design solutions, as underpinned by my interview partner from Knudsen: *“It’s always been a struggle until the downturn to get acceptance from the client, that this is the standardized solution. [...]this is one of the areas, where we have made much progress during the last 1,5 years, because the customers are actually now starting to accept, that if they want a cost-efficient solution, actually asking for a custom-type of delivery every time, it’s not going to be beneficial for them.”* There is a number of companies active in that field, which has been described on various examples in the subchapters of 4.3. In order to make a use of digitalized technologies and standardized solutions. Service suppliers tend to get involved in the design and planning of E&P projects from the very early beginning, as they possess the competencies to find more suitable solutions, than the procurement engineers of operators do.

The interplay of the described three factors results in new revenue models, which are leaned on performance or incentives based contracting like described in chapter 4.3.3. On the basis of new and closer connected business networks, which involve a deeper collaboration between contractor and client, OFS’s cover a site’s partial or entire production management, suppliers fund upstream projects upfront, acquire client assets or leverage own technology. The revenue will be outcome based, as already mentioned. A new consequence and market trend, evolving from the described development is vertical integration along the O&G supply chain.

An outstanding pioneer for this development is the merger between GE and BH stepping into the E&P business. GE is a leading OEM in artificial lift as well as in sensor supported software solutions and Baker Hughes is after Schlumberger the biggest OFS for drilling and well completion. The merger, in which GE is the major shareholder with 62,5 percent (GE, 2016) shares has shifted the venture to a new market position as illustrated in figure 12. Considering the fact, that GE entered the artificial pump market segment only in 2010, when the market was

already saturated with well-established OFS's, which are listed in figure 12, and achieved such a market position, the engagement in IoT technologies presents a driver for new market dynamics. The merger with BH will expand the ventures portfolio differentiation and consequently increase market power appropriately. To come back to the point of vertical integration, where OFS's increasingly enter the E&P business, there is a number of successful ventures. To take up again the example of GE-Baker Hughes an OEM-OFS merger funding the development of the Ogo field in OPL310, which is operated by the Nigerian E&P company Lekoil. If the result of the appraisal well will be positive and meet the necessary requirements GE and Lekoil's funding partners will fund the Capex for the full field development. GE Oil & Gas is expected to receive a percentage of LEKOIL's future cash flows from the Ogo Field, as well as the ability to supply its products and provide technical expertise throughout the life of the project.“ (Lekoil, 2017)

A further example on vertical integration with a new – performance based – revenue model can be stated on the example of GE providing Diamond Offshore drilling company with BOP's. Briefly summarized, Diamond Offshore sold four BOP's back to GE, after having them used, thus pushing a rental model for key drilling equipment. Oil service and completion equipment has been used to be possessed by OFS's, while drilling package has been used to be owned by operators. However circumstances are changing. The repair of subsea equipment causes the biggest equipment related downtime on the rig. This causes manufacturers to rethink the innovation of equipment and customer satisfaction. Thus, GE has to ensure product reliability even beyond the point of sale, as the payment is offset performance based, where the drilling company will be charged per hour performing the BOP. Therefore GE has bought back BOP's installed aboard Diamond Offshore's drill ships. Moreover a 10-year maintenance service contract was signed in order to shift responsibility for equipment performance. The new agreement, in which pressure control is charged by hour, considers Diamond Offshore to pay GE only for the time, the BOP is available. GE O&G will provide staff, the management of parts and maintenance, data monitoring, ongoing certification and change management for pressure control equipment. In addition Diamond Offshore will apply GE's Predix software solution in order to monitor and analyze data. (Triepeke, 2016)

There is a similar case with Indian Oil and Natural Gas Corp (ONGC), reviving depleting fields with the support of OFS's. The world's biggest supplier for OFS Schlumberger has stepped into a temporary agreement with ONGC to explore the production potential for the maturing ONGC field in Assam. The contract considers Schlumberger to invest capital upfront, deliver services

and technology and generate revenue based on the share of incremental production. The onshore director of ONGC Ved Prakash Mahawar says: *“The two companies would agree in advance on the cost per incremental barrel that Schlumberger can take. Schlumberger will get the cash equivalent of its share in the incremental production, not oil, and if there is no incremental production following the investment, the loss will be entirely the service provider’s.”* (Choudhary, 2016) In the following he adds that Hulliburton and other OFS’s are engaging increasingly in such BM’s. This statement is also supported by my BH interview partner and Jon Knudsen from Aker Solutions, which used to follow similar approaches.

At this point I want outline, that digitalization plays a key role for integration and generating value add for the customer. Mikhailov, my interview partner, who has been working for BP and Bashneft highlights the importance of *“computer-led analysis of big data and predictive modeling. While the use of neural networks and machine learning in O&G may be said to be in its infancy, it undoubtedly holds keys to successful competition in the future in all areas from finding oil to predicting consumer preferences.”*

5.1.2 Revenue models

As production outcome and operations become more predictive through coupling hardware with software via IoT, OEM’s can profit from commercial models if they drive with the current trend, where they switch to renting models and other performance based approaches, which are measured on flexible performance parameters. Using such measures, suppliers are motivated to deliver the best possible product and service quality, because on an incentive base they hold the risk for operations outcome and consequently their return on investment (ROI). With the following statement Angela Durkin, Chief Operating Officer at Maersk Drilling supports the importance of performance based contracting. *“I compare our situation to that of service companies about 15 years ago. They were also being compensated on day rates, but when they developed more efficient tools, all of a sudden they were drilling the same section in half the time. While the day rate increased for the new tools, it didn’t double. So if they were drilling in half of the time, they were getting maybe two thirds of the revenue they used to get. That didn’t make sense, and you see that models have been changed on the service side where compensation is now measured in, for example, meters drilled or other performance metrics. That’s the kind of thinking that we need to look into as drilling contractors.”* (Hsieh, 2017)

5.1.3 Segments

According to my findings there are two three segments, on which OEM’s should keep a wary eye on. On the one side, it’s well established mature fields, which are to a large extend depleted.

Those are predominantly operated by small and middle sized E&P operators, who are mostly active in the north-American unconventional onshore segment and are characterized primarily by insufficient financial resources and allow suppliers to engage more and deeper already at an early stage of project design and planning.

The second and third segment are high volume reservoirs for green field projects, which were shut-down, sold or postponed as a consequence of the fallen oil price, because at that time they hadn't been economically viable in consideration of the given oil price. Such high volume reservoirs consider both onshore and offshore fields. In terms of offshore the North Sea has a big potential. As the majority of Norwegian O&G production sites have been active in the North Sea for many decades, they are going to shut-down their fields in the near future due to maturity and start operating fresh developed conventional fields. *“With Brent crude declining by more than 60 percent from mid-2014, North Sea oil producers have slashed spending, scrapped projects and are looking to sell off assets. (Cunningham, 2016)”* Applying new technologies, which shape innovative BM's such projects could become economically viable again.

Another prospective market is the Russian onshore and offshore segment, which in contrast to OECD based O&G companies hold competitive advantage due to a combination of tax measures, the Rubel/Dollar exchange rate and comparatively low cost production. In fact, against the global trend, according Barclays E&P report 2017 and the central Bank of Russia, Russian E&P companies have increased their Capex from around \$33 bln in 2014 to around \$46 bln in 2016. In addition, under the U.S. government, which came into power in 2017, the economic sanctions are more likely to be abandoned. Mikhailov supports this aspect: *“I believe that Russian oil companies will continue to dominate the industry in more or less their present state, protected by the government. Their evolution will accelerate when sanctions are lifted, but the power structure will remain the same. [...] Swings in oil prices had no sizeable effect on either the direction or the size of investment programs. Owing partly to the cushioning of the companies' financial results by the Dollar/Rubel exchange rate and governmental subsidies, most Russian oil companies have steadily increased their Capex, not curbed it.”* Backed with China as a major customer, a rising global energy demand and not yet developed immense hydrocarbon reserves in the Russian Arctic, I see potential for OEM's to engage in R&D towards technologies, which are capable to work in harsh Russian and Arctic conditions.

To get back to my first finding in terms of prioritizing small and middle sized businesses, Jon Knudsen from Aker Solutions emphasizes, that for Aker Solutions: *“It's the smaller companies*

who is driving this change. The smaller companies really mind about three things. It's either cash constraints, meaning that they either don't want to borrow or they cannot borrow in the open market. They need to plan the solutions or they are driven by risk constraints, that they have troubles or bad experiences with. In particular new technology or subsea technology, where they want to share risks through payment per performance type."

The BH representative supports the importance of small and middle-sized companies, emphasizing the drive of digitalization through independent's: *"I think you will see different customers adopting at a different pace and some won't adopt at all. You already see independent oil and gas companies in North American land, US unconventional, already starting to adopt, or at least explore, digitalization of digital approaches. [...] Some of the much, much smaller companies, they don't have that capability. [...] These processes will be very rapid. I suspect you'll start to see, over the next two to three years, a big leap forward. US land unconventional moves very, very far. The technology window in US land unconventional is 18 months until the next technology takes over. It's very fast. [...]. I suspect you will start to see some changes. It can be as soon as the end of this year, probably the next 18 to 36 months."*

In terms of relevant technologies for U.S. unconventional field he adds: *"Half of our business is the interventions business and, really, we would need to adjust to selling tools and services and probably consulting fees, where we are really maximizing those reservoirs and those wells that are already in production, maximizing their productivity. On the longer term, we need to actually focus less on drilling new wells, as to maximizing the wells that are already out there and that would be very advantageous for the E&P companies because they have to then spend less money on the Capex. We haven't seen an impact yet, but it [drive from Capex to Opex] is something that we are considering and we may need to adjust to it, in terms of the offerings of our products and services going forward."*

The chief technology officer at GE Oil & Gas Sundararajan, carries the previous statement forward: *"Today in a conventional oil reserve we are able to extract about 35% of the oil. If we can increase that by just 1 % by understanding more about what is happening about the whole operation that means three more years of oil production, or it means I have 80 billion barrels of oil equivalent of reserves in excess. Either of them turns to value for the company."* (Blake, 2016)

5.1.4 Technologies

As clearly outlined in this paper, the U.S. oil market is the biggest growing market globally and it caused the global O&G market to change fundamentally. According to a publication from the society of Petroleum Engineers, 96 percent of oil wells in the U.S. are operated with artificial lift, as pressure in the well is insufficient for natural extraction. According to the Society of Petroleum engineers, in the U.S. around 80 percent of oil wells are stripper wells, predominately produced with means of sucker-rod pumps, which produce less than 10 barrels per day.

The more productive non-stripper are 52 percent gas lifted and 27 percent rod pumped. The remaining 21 percent consist are dominated by electric submersible pumps (ESP's) and hydraulic pumps. In these statistics rod pumping is mainly representative in the onshore segment and the more efficient ESP's and gas lift in offshore and higher rate wells. (Benavidez, 2015) According to a report on the artificial lift market by *Research and Markets*, where the five major O&G producing regions in the world have been analyzed, North America is expected to be the leader in artificial lift, as the shale gas production and number of mature oil fields carry weight. Moreover the report outlines the dominance of the onshore segment as the biggest growth driver for artificial lift, which is also attributable to shale production in North America (Markets and Markets, 2016). Basically this statement is also supported by my interview partner from BH Houston.

The following table presents a comparison of the technical parameters of the most established methods of artificial lift for horizontal drilling and hydraulic fracturing. The data is published by petroleum engineers, however it can vary from publications of other specialists. According to Muster et al. (2013) ESP's can produce up to 40.000 barrels per day and jet pumps can go down to 16.000 feet. With continuous R&D these technologies enhance or disappear, what emphasized the importance of dynamic capabilities. The comparison shows clearly, that in terms of production efficiency, there is a huge potential for OEM's to engage in ESP, as they deliver the highest production outcome and are representative with a low market share in the artificial lift. If such hardware is coupled with software solutions, it can lead to competitive advantage, as shown on the example of GE O&G.

Table 9 Artificial lift comparison

Lift Mechanism	Deviation Applicability	Lift Efficiency	Volume Lifted Per Day (bbl/d)	Solids Tolerance	Gas Tolerance	Comments
Beam Lift (sucker rods & pump)	Vertical Section	Not usually deviated	Limit around 1.000 bbl/d	Poor	Requires Separation	Deviation limited by rod wear
Gas lift	Can be run to any position	Poor in horizontal	Varies with gas used	Excellent	Excellent	High gas rates required to lift

ESP	Full horizontal	Excellent (if gas shielded)	>20.000 bbl/d	Poor	Requires separation	Requires constant flow & straight landing point
Jet pump	Full horizontal	Moderate	Tubular & depth limited	Moderate to poor	Limited	Requires flow path for power fluid
Plunger	To about 20°	Not used	10 to = 50 bbl/d	Poor	Good	Low rate liquid removal
Progressing cavity pump (PCP)	Full horizontal	Good, but rate limited	Varies, usually low	Excellent	Moderate	Requires straight landing point: protect bearings
Chamber lift	Best in vertical	Unknown	Low	Good	Good	Slugging flow

Source: Presley, 2012

Even if parameters differ with different publication, it can be extracted, that ESP's, jet pumps and gas lift have the most growth Potential, for both conventional and unconventional fields. The CEO of PumpWell Solutions considers the physical mechanics of different artificial lift methods to be subordinate against the rising IoT applications: *“With the cost of sensors going down, we are starting to see clients increase the number of sensors they use to gather and protect the data. That is rally one of the biggest shifts, along with maturing analytics and ubiquitous Internet access. We are certainly on the verge of seeing a sudden jump in the number of machine-to-machine devices out there. (Haydu, 2015)”*

Another technological emerging technological trend, where OEM's can achieve success, is unmanned robotics and drones coupled with sensing in order to monitor and control operations and log reservoirs. Besides of that AR represents an upcoming trend, which helps to visualize and ease IoT based solutions. In this context I want to outline in particular the wearable technologies. To get back to the interview in with Troels Albrechtsen, the head of corporate technology and projects at Maersk Oil in chapter 4.3.2.4, answers as following to the question, what devices are the most valuable ones for offshore in terms of data displaying: *“The issue is around field-proofing, and of course it has to work every time and it has to be explosion-proof so it doesn't interfere with our operations. I think the tablet devices are the ones that, at this point in time, have the least risk associated with them. We know that they work. Personally, I think we've only seen the beginning and there will be an evolution, and we need to make sure we're ready to also do the Google Glass type of approach. But of course there are practical issues with those – battery life and so on.”* Moreover he adds to the question of the upcoming more complex applications of AR in O&G that it can help to save training costs: *“For training of staff, instead of sending them for training on the facilities themselves, you train them with AR equipment using models of the plants that you want them to operate. They can do that on their own or as part of teams. That will, again, increase safety and efficiency.”*

5.1.5 Related industries

As already mentioned there are certain players, who adapt their business towards modular design and standardized solutions. In addition there are some O&G and E&P companies open minded toward moving in a familiar business with a similar supply chain. Olesen (2015, p. 26) compares the value chain of offshore O&G operations and offshore wind plants and outlines certain similarities. For offshore wind farms the five major steps of the value chain are the same as for O&G. Moreover Olesen outlines turbine manufacturers, which are of essential relevance for development, production and operation, as main actors in the value chain for offshore wind farms. OEM's like Siemens for instance hold leading positions in such market segments. In addition, in such related businesses IoT based solutions, as well as robotics, ROV's and drones are also applicable.

Besides the equipment, there are also services from the O&G sector which can be adopted from O&G to renewables, as confirmed by Knudsen from Aker Solutions: *“Now most of our clients are moving to renewables. If you once install for instance a wind turbine offshore, you need the same type of expertise that we offer today in terms of approving other equipment offshore. So we certainly have a lot of offer in that certain base we are looking into. [...] That's one of our core products. We have learned a lot about harsh environment types of setups and deliver products towards harsh environments. When it comes to big capital projects that stay offshore, we have people that can go and maintain it. We have people that run offshore operations. We have people that can install and decide. So we have all the business pieces, needed in order to realize these types of projects.”*

5.2 Challenges

5.2.1 Cyber threat

As described in chapter 4.3.1 digitalization drives growth in O&G. According to *MarketsandMarkets* the market for digital oilfield technologies rose from \$18,7 bln in 2011 to \$24,6 bln in 2014 and is expected to rise up to \$33,3 bln in 2022 with a CAGR of 9.6 percent (Sperzani). Besides efficiency advantages like field modeling, preventive maintenance and supply chain planning analytics digitalization is also subject to vulnerability by cyber-attacks, which can cause technical and financial damage. The most common types are Malware and Phishing. While Malware indicates viruses and other harmful software, damaging IT data infrastructure, Phishing represents a type of social engineering, which includes deceit and tampering in order to aim at data assets. According to a research, conducted by Allied Business Intelligence (ABI), by 2018 there will be \$1,87 billion invested into cyber security (Sperzani).

With an appropriate risk management, however, digitalization will continue to drive operations efficiency in O&G.

5.2.2 Resistance from established competitors

The following statement of the BH Houston representative, refers to both optimism and doubts regarding vertical integration between generalized OEM's and OFS's. *"I'm expecting in the next years to everyone to have a relatively good relationship, as the market seems to be on the way up and profits should increase. Manufacturers could potentially be seen as a risk to the service companies, if they wanted to start providing the service companies, as well as manufacturing certain equipment. There are some manufacturers out there, who have started to compete against their customers, quite frankly. We have people who supply us, who have then gone and acquired other services or other products, and, although not directly, competing directly against us, they could be seen as a competitive threat in the future. [...] So the enemies of this world are probably manufacturers. The negativity is they wish to become a competitor to the service companies."* This refers directly to the competition, which can arise within networks. As I described in chapter 2.1.3 interaction relationships can restrict space of action and consequently cause opportunistic behavior and loss of trust (Wurche, 1994, p. 144). The BH representative supports this theoretical assumption with the relationship to certain fresh arising competitors, who used to be suppliers in a strategic alliance before.

If OEM's follow an aggressive market penetration when integrating in the service sector, as described by the BH representative, than an early integration in project design and product planning will be impeded. This is subject to result in the deployment of non-optimal solutions and inefficient production outcomes, resulting in a loss of competition. If we refer this circumstance to the BMC, which has been described in chapter 2.2.2, a weak relationship between supply chain partners might influence in particular the value proposition and revenue streams negatively, as services and equipment may not be optimally compatible to each other due to a lack of collaboration.

5.2.3 Lack of young engineers

Another challenge, which applies for the O&G industry in particular is the maturity of industry standards, which have been characterized predominantly by those people who started their careers in O&G when the "old" BM's have been dominating the industry. Those industry professionals will retire in short-term, while there is little young professionals with comparable O&G skills and experience. In addition the O&G industry is charged by the difficulties, described in chapter 1.1, which makes the industry as a whole less attractive for young talents.

This has been confirmed by several sources of my secondary and primary data: *“Essentially, there is a significant gap in experience. We have a lot of people [...] working in the '80s and '90s and the early 2000s in the O&G industry, who are likely or already have retired. All of these cyclical downturns just meant that we haven't attracted as much talent to the oil and gas industry as we would have liked to. There is a significant gap in experience, which poses a challenge for the service companies, in terms of having qualified people to run the jobs. The oil and gas service industry has traditionally been very people-dependent. We need to go through an exercise, from a technological innovation perspective [...] which is using less people to drill for wells and less people to complete wells and produce them. We ideally would like that to be more automated and less people-dependent.”*

Technical competencies impact a maintenance provider’s capability to serve a client in the case of an unexpected downtime. Such cases present a worst case scenario for an operator, thus it is of essential importance to complete a failure as quickly as possible. For this reason, maintenance providers need to be able to offer staff and facilities in short term. (Proeger, 2017) In terms of innovation and automatization there has been already put a lot of effort into, and this development is going to continue. In terms of talent gaps for young professionals, however, OEM’s could take a model into account, which is followed by Rosneft. As introduced in chapter 4.3.4 Rosneft has a strategic partnership with the Gubkin State University, where young professionals work part time besides of their studies at the university. After graduation they are guaranteed a job, as they have both company internal competencies and theoretical competencies from the O&G University. However, such a strategy might be more accepted in countries like Russia, whose economy is strongly dependent on O&G.

5.3 Theoretical analysis and discussion of findings

As pointed out in chapter 2.2.8 a sheer business model doesn’t present a strategy, while its insistent change does. According to my theoretical framework a sheer BM can be worked out with the help of the BM Ontology. As I consider the O&G supply industry as whole and not a single supplier, I can’t go much deeper into its individual components at this point, because this tool is usually used on a company level, not on industry level. However I can point out, that the major customer segments in form of operators were determining a suppliers key activities – producing and selling equipment – to a wide extent, as suppliers haven’t been used to involve in solutions at an early project stage. The value proposition under the “old” BM is dominated by a high level of customization and a high support and service level. An oil price, which was far above the operators break even costs per barrel enabled operators to demand customized

solutions from their equipment suppliers. For OEM's this inflexibility resulted in an expensive cost structure, but correspondingly also in high revenue streams. This was the case until the oil price collapse as an external market force and the customer's pricing pressure as an industry force haven't initiated an industry downturn.

5.3.1 External challenges influencing the old BM

The problem about the BMC is, that it considers only internal influencing factors. In order to address this issue, Osterwalder et al. (Osterwalder & Pigneur, Business Model Generation, 2010) define four interdependent key external forces, influencing BM's. The industry forces, illustrated in figure 7 indicate in the following case the shale revolution as a competitive and substitute product to the existing conventional market segments. The key trend in terms of technology, carrying weight, is horizontal drilling coupled with hydraulic fracturing in this context. From this a new market segment in form of unconventional hydrocarbons exert pressure on the established conventional segments, causing demand and supply imbalance on the global oil market. This imbalance has caused oil prices to collapse, in following of what E&P operators are forced to transfer their pricing pressure towards their suppliers, causing investment cuts in Capex and Opex.

5.3.2 St. Gallen BMN: Magic Triangle of O&G supplier

Gassmann et al. (2013a) develops on the basis of Osterwalder's achievements the St. Gallen BMN. This tool, illustrated with the magic triangle in figure 8, basically focuses on four questions, which are again interdependent with each other:

- 1.) What is offered to the customer?
- 2.) How is the value proposition created and delivered to the customer?
- 3.) Who is the target customer segment?
- 4.) Why is the business profitable?

The first question addresses the value proposition, which indicates technological solutions enabling to develop and produce hydrocarbons at a "lower for longer" oil price, while still maintaining HSSE standards and other stakeholder interests like a minimum amount of appraisal wells for instance. Moreover profit will be generated, because integration will help to produce under break-even costs.

The second question covers the methods and approaches, which have been described in chapter 4.3 and 5.2. Basically the integration of digitalized and standardized technologies coupled with

an intense collaboration between supply chain partners makes operations at all stages of the value chain more efficient and more predictive.

As there is an industry wide concentration of networks or vertical integration the customer segment is variable. Under consideration of the “old” BM, E&P companies presented mostly the customers for OEM’s. Under the new BM, when supply chain partners involve each other much deeper into their project design, the customer may change. To refer back to the case of example of GE providing Diamond Offshore with BOP’s under a new revenue model. In this case GE’s customer is the drilling company, so an OFS and not an E&P. Through the collaboration and bundling of services and equipment, the customer base is changing along the supply chain for the OEM in order to enhance the operator’s value proposition.

The fourth question addresses the revenue models. Innovative technologies offer the opportunity to predict operations and production outcome. While the industry used to work with fixed price contracts, like a day rate for drilling activities the new BM’s consider an incentive based charge, where operators are charged per meter drilled instead. This gives the OFS company an incentive to optimize performance and the operator postpones the financial risk from operations to its supplier. To refer to Osterwalder and Pigneur (2010, pp. 31-33) new revenue models apply dynamic pricing in the form of performance based contracting instead of fixed pricing, as it was mostly done before the industry downturn.

If there are aspects in at least two of those four questions in the magic triangle, which are subject to be enhanced, then we can talk about business model innovation Gassmann et al. (2013a, p. 9). In the case of the post 2014 O&G supply industry there is innovation in every of those four questions.

5.3.3 Developing innovative BM’s for OEM’s

Figure 10 shows a systematic approach, which has been defined by Gassmann et al. (2013a) for developing a BM.

- The first stage indicates initiation, which involves an analysis of the ecosystem. Porter’s five forces framework and the key external forces, illustrated in figure 7, provide a useful tool in order to get to know all relevant players and influencing factors. The analysis of the ecosystem can be retrieved from the introduction part of this paper and my empirical results. Briefly speaking the whole O&G player landscape needs to revive its BM’s, due to an industrywide pricing pressure

- The second stage, which is ideation, includes the collection of potential business ideas, whereby potential future demands are also considered. In the case of this study such potential ideas for BM's are predominantly about digitalized technologies, as they are deliver the biggest growth potential in terms of operations efficiency and the digital market is subject to gain market volume as confirmed from primary and secondary data.
- In the third stage potential ideas are integrated in a BM, whereby internal and external consistency should be achieved. Internal consistency requires the four questions from that magic triangle, addressed in the previous chapter. External consistency aims at bringing the ecosystem in accordance with the BM. The ecosystem is in our case the operator. A business model which includes IoT solutions and incentive based contracting does fulfill the end-customer's needs in this sense.
- The last stage, which is implementation, indicates realizing the plan. Gassmann et al. argue the complexity with opposition from the market, from partners and from own employees. This has been committed during my interviews, as stated by the BH representative in chapter 5.2.2, regarding suppliers as a threat.

5.3.4 *Recombination of BM patterns relevant for OEM's*

Gassmann et al. (2013a) outline copying, combining and replicating as the three major strategies for defining business models on the basis of 55 different branch independent BM's. In the following, several BM's from other industries are listed, which are relevant for the O&G supply industry. Combining them with each other in order to utilize benefits from all of them will help to achieve competitive advantage and increase complexity as well as barriers for imitation:

Trend, outlined by myself:	BM's captured by Gassmann et al. (2013a)
Integration	Integrator: Added value through integration Solution provider: everything from one single source provider
Digitalization	Digitalization: Digitizing physical products
New Revenue Models	Pay per use: Use-dependent payments Revenue sharing: Symbiotic profit participation Rent instead of buy: Temporary usage right against payment (from the viewpoint of OEM's it's rent out instead of sell)
Collaboration	Fractionalized Ownership: efficient usage through partial ownership Open BM: Leverage effects through collaborative value creation
Standardization	No results found

Own illustration

The BM's in the right column, captured by Gassmann et al. (2013a) are compliant to the appropriate approaches for a new integrated O&G supplier BM in the left column, retrieved by myself from my research. As they have been already elaborated in this paper, I won't go into the details at this point. The combination of the listed patterns has a potential for several benefits from the viewpoint of network theory, transactional theory and institutional theory, because human failure in terms of Williamson's (1975) organizational failure framework will be mitigated, due to new technological opportunities.

5.3.5 Synergies through networking and reductions of transaction costs

In chapter 4.3.3 the differences between FPC's and IBC's are outlined and referred to the old and new BM's. The integration of IoT supported technology, collaboration between supply chain partners and IBC helps the E&P company to reduce transaction costs. For instance when Schlumberger takes over the whole production management for the operator from the very early stage of a project and involves strategic and dynamic capabilities as shown of the example in chapter 5.1.1 on the example of the Schlumberger – ONGC venture, the operator can avoid several types of transaction costs. As it is an IBC, where Schlumberger will be payed a share of incremental production outcome, the service company takes a high share of the risk of the venture. Thus it has intrinsic motivation to engage its best possible dynamic capabilities in order to achieve production outcome. Due to that intrinsic motivation the operator doesn't need to monitor operations and can so save monitoring costs. Moreover Schlumberger supplies own equipment or procure or rent appropriate equipment by third party OEM's. So the operator can save initiation and arrangement costs for oilfield equipment, as it will be supplied with bundled services and equipment by a vertically and horizontally integrated supplier. Moreover IBC displace adaption costs, because payment is agreed on in advance on determined performance or incentive based outcome parameters. The same synergy effects apply for other ventures, maintained by networking and intra-organizational relationships that were described in this paper, for instance the GE-Diamond Offshore venture or the GE-Lekoil venture, described in chapter 5.1.1. It is worth mentioning at this point, that such flexible and innovative BM's are heavily based on networking, as leading industry players merge their best strategic and dynamic capabilities and increase value for the customer in terms of operations efficiency and HSSE maintenance.

6.0 Conclusion

This chapter provides a summary of my findings related BMI in the oil and gas supply industry and suggest what strategies should be followed in order to introduce competitive BM's in a dynamic and volatile market environment. The conclusion itself embraces my research question from different viewpoints:

How are O&G spending and business models changing in a dynamic oil and gas market environment and what impact does it have on the oil and gas supplier landscape?

My main conclusions are:

- 1.) The commodity super cycle for O&G is experiencing the fourth industrial revolution with new BM's over the whole industry as serious as never before.
- 2.) The oil price is expected to stay "lower for longer", while easy accessible conventional hydrocarbon reserves get scarce for various reasons. This emphasizes the imperative for an industry wide BMI, as the ROI trend has tended to decrease year by year, especially when the oil price collapsed in 2014.
- 3.) Those industry participants, who follow the market trends of the fourth industrial revolution will come out stronger from the downturn. Those who don't, will get out weaker and loose competitiveness, as it did the once market leader mobile phones Nokia when it failed to go along with the rise of smartphones in time.
- 4.) The success key for overcoming economic hurdles is integration of digitalization, standardization and collaboration, resulting in new incentive based BM's.
- 5.) The fusion of information technologies and operational technologies will drive BMI in O&G.
- 6.) With IBC E&P spending, Capex shift increasingly to Opex. On the one side this makes operations for E&P's more flexible, in case of a necessary shut down of an ongoing project due to an unprofitable oil price, because losses will be charged only on a performance base. Thus the risk over production is shifted from the operator more towards the supplier.

6.1 Summary

In the following I highlight my findings regarding approaches for BMI in a market environment, which is characterized by a volatile oil price. Based upon suppliers I have conducted four expert interviews with representatives from leading OFS's and a leading EPC company, namely Baker Hughes, Aker Solutions and the merger of FMC Technologies and Technip. In addition I have conducted an interview with the biggest Russian oil producer Rosneft, an integrated NOC, in order to get different viewpoints on the relationship and the cooperation with OEM's. Also I have interviewed an O&G company consultant, who has worked before for BP and Bashneft in marketing strategy. Moreover I have collected relevant secondary data in form of

- interviews from industry representatives, with whose companies I couldn't get in touch,

- annual reports and investor relations presentations from leading suppliers
- publications like reports, articles and presentations with O&G expert perspectives

All figures retrieved from secondary data are based on publications from recognized market research institutes like IHS Energy or Rystad Energy.

In order to answer the research question, I have defined the following three sub-tasks and elaborated them structurally.

- 1.) To evaluate the reallocation between Capex and Opex in oil and gas projects and its influence on OEM's, EPC's, OFS's.
- 2.) To outline the O&G player landscape with the corresponding business models and their drivers in consideration of the 2014 "lower for longer" turnaround point.
- 3.) To analyze findings of primary and secondary research from previous subtasks and identify opportunities and challenges for OEM's.

Sub-task 1: As illustrated in figure 17, E&P's spending in terms of Capex and Opex rises from 2012 until 2014, when the stock prices for oil collapse. Figure 12 "E&P Industry Macro" presents the correlation between E&P spending and the actual oil price. The correlation can be traced back to the fact, that E&P companies are the connective links between hydrocarbon reserves and retailers or end-consumers. As the E&P company's revenue base decreases with a falling oil price, they transfer that pricing pressure in form of reduced Capex and Opex to their supplier base. Figure 15 "E&P and Opex spending evolution" shows in this connection that the relatively measured Capex reductions were much stronger than Opex reductions. Capex fell from around \$700 in 2014 approximately by 50 percent to around \$350 in 2016. Opex fell industry wide by around 20 percent from the maximum point in 2014 to the minimum point in 2016. In this context figure 14 shows the fall of operational revenues from the five globally leading OFS's. The strong fall in Capex is predominantly caused by the shut-down of planned or ongoing O&G projects. The fall in OPEX can be traced a sharp reduction of headcount throughout the whole supply industry.

The operator's investment reductions had an overall influence on the whole supply industry, which resulted in a significant reduction of headcount with hundred thousands of employees along the whole supply chain. EPC's faced a fall in FEED awards and new contracts. OEM's faced cost pressure, which was transferred again to sub-suppliers. Production facilities were partially shut down, and materials and equipment bought from third parties instead of produced in-house, as depicted on the BH example of Matthesius. OFS companies are even more directly

impacted by the falling oil prices than OEM's. Operators shut down or postponed a number of projects in the expectation of better conditions, like lower costs or higher oil prices. The global rig count fell from 3736 in February 2014 to 1405 in May 2016, to represent the minimum and maximum rig counts of the recent years in connection with the 2014 oil price collapse. (Baker Hughes, 2017)

Subtask 2: Generally speaking the oil and gas player landscape consists of E&P operators and suppliers. In this paper I divide operators into IOC's, NOC's and independents. Suppliers are categorized in EPC's, OFS's, OFS's, and in generalized and specialized OEM's. The industry's BM's used to be characterized by vertically integrated oil companies. Up to the 1970's the O&G market was dominated by IOC's. From that time NOC's arose due to the nationalization of hydrocarbon reserves located at their state territory. IOC's tend to maximize shareholder value through maximizing bookable reserves. In the 1980's IOC's outsource their integrated service departments with the intention to achieve lower costs due to the increasing competition between the establishing service companies. With the nationalization of resources governments influence the growth of NOC's and independent oil companies. As service companies are independent, they are consequently increasingly contracted by NOC's and independents in order to enhance performance. In terms of technological innovations the O&G industry hasn't kept pace with other industries, like automotive for instance. In fact up to 95 percent of operators' Capex are assigned to OFS's. Due to an ongoing oil-price, which used to exceed break-even price, the industry was still able to maintain profitability. So the "old" BM can generally be summarized as maximizing shareholder through maximizing bookable reserves, where operators determine project design and hire those external service providers, who offer the cheapest costs per tender.

As the 2014 oil price collapse is expected to be "lower for longer", the industry is forced to increase operational efficiency, so that hydrocarbons can be produced economically viable under the given oil price, while maintaining HSSE requirements. There are several market trends, which influence the "new" BM's. Generally speaking the new BM consists of the integration of standardized and digitalized technologies, and collaboration or vertical integration between supply chain partners. On the basis of technological innovation the operations and their outcomes are predictable. For that reason, suppliers are increasingly engaging in operator's project design from a very early stage, as through an early involvement and profound consultancy operations performance can be essentially optimized. The range of integration, changes revenue models for suppliers, which become more flexible and more risky

for suppliers. There is a clear trend that suppliers manage production to such an extent, that besides coordinating operations, they fund equipment, installation and maintenance works upfront. In turn they get paid on a performance basis, for instance per meters drilled and per barrel oil produces. Such a revenue model shifts the risk for production outcome from the operator to the service provider and generates incentive to deliver the best possible performance.

Subtask 3: On the basis of the previous findings there I have derived challenges and opportunities for OEM's. IoT drives digitalized technologies, which means that all kind of equipment is attached with sensors, which collect operational data and exchange them via cloud based software application platforms in real time. That data is visualized on mobile devices, thus providing staff at site and control center a basis for further decision making. According to all my interview partners and my extracts from secondary data this trend will take over O&G operations. As this movement is still in its beginning, there is growth potential for OEM's to engage in that kind of technologies. Besides IoT based production equipment, IoT based drones and robotics as well as modular based hardware solutions offer potential for increasing value through efficiency boost. As OEM's are the most remote suppliers along the O&G supply chain, OEM's must invest considerable resources into networking in order to enhance business relationships and get the best possible value from strategic and dynamic capabilities from network partners. Therefore, state of the art solutions are essential to bring networking forward, which can have various forms. Under the precondition of well integrated digitalized technologies and strategic partnerships, revenue models are able to be enhanced to performance based contracting. In this context operators increasingly tend to commercial models, where OEM's remain owners of the equipment and take over responsibility about technical reliability. In this direction, renting and leasing models are increasingly gaining market share in O&G.

Gassmann et al. (2013a) develops on the basis of Osterwalder's BMC the St. Gallen BMN. This tool, illustrated with the magic triangle in figure 8, basically focuses on four questions, which are interdependent with each other:

- 1.) What is offered to the customer?
- 2.) How is the value proposition created and delivered to the customer?
- 3.) Who is the target customer segment?
- 4.) Why is the business profitable?

If there are aspects in at least two of those four questions in the magic triangle, which are subject to be enhanced, then we can talk about BMI. In the case of the post 2014 O&G supply industry there is innovation in every of those four questions.

6.2 My contribution to research

The actual thesis has formalized knowledge and evidence related to the combination of innovative approaches in order to achieve BMI in a highly dynamic industry. Before the 2014 oil price collapse the O&G industry had not seriously faced the imperative of efficient business operations, because the oil price used to be high enough to generate profit. As this is not the case anymore, especially for OEM's there is the question, whether it's worth it to keep being active in O&G or not. My finding is that there is huge potential for prosperity, thus OEM's should stay in O&G, if they are willing to innovate their BM's. This research paper has addressed this question, backed by in-depth interviews with industry representatives and the relevant theory. I'm confident, that my research can back up OEM's in their decision making, as the topic is very actual and of great importance for one of the biggest industries worldwide.

6.3 Suggestions for further research

As BMI in the O&G supply industry is still at its beginning, there might be potential to improve relevant strategies or work from best practices from other industries. In fact strategic realignments are very resource intensive and thus difficult to implement. From this viewpoint an approach of how do get BMI successfully started, could be questioned. Therefore a comparison with more automated and more digitalized industries, like automotive for instances, could be conducted. An additional issue is how OEM's can get increasingly involved in O&G projects already at an early stage of the project design. Given the fact, that OFS's participate in project designs increasingly, they are the main contractor, while OEM's are located along the value chain still more far away than the main contractor. Therefore I can suggest the following two research question for further research:

- How can entry barriers for BMI in the O&G supply industry be overcome? Comparison with the automotive industry?
- How can interaction-oriented network theory help to merge main contractor's and sub-contractor's BM's in a value add for O&G projects?

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List of appendixes

Appendix 1

Mintzberg's five P's of strategy (Mintzberg, 1987):

Henry Mintzberg, one of the major thought leaders of the concept of strategy, introduced the five P's of Strategy, which stands for strategy as a plan, ploy, pattern, position and perspective. The framework is designated both to practitioners and to researchers in order to navigate more confident in a field, where different forms of strategy interfere with each other in different ways (Mintzberg, 1987).

- **Strategy as a plan:** The plan is the theoretical background of the strategy and its “mental” expression. It is made in advance and developed consciously and purposefully.
- **Strategy as a ploy:** From the concept of the plan follows the concept of ploy. In this sense, strategy is used to gain an advantage over competitors.
- **Strategy as a pattern:** It outlines the practical part of the strategy, the result that we strive for. It is an algorithm, a sequence of actions aimed at achieving a certain goal.



- **Strategy as a position:** The position denotes our place in the market (physical location, market segment, industry, target customers, etc.). Everything, related to the external environment refers to the position. It delineates the niche, which a company strives for, in order to achieve success.
- **Strategy as a perspective:** Perspective is a mission, a collective mind, a world view. Here it's worth mentioning, that all strategies are abstract concepts. They can't be seen or touched. They exist only in the minds of the concerned participants. Moreover the corporate culture can also be referred here.

The entrenched nature of strategy grapples with the most fundamental matters about organizations as instruments, whose actions are perceived collectively in a certain way. Strategy as position and perspective can, but doesn't have to be compatible with strategy as a plan and/or pattern. The five different definitions of strategy may help to remove confusion about the term and help to comprehend the processes and backgrounds, from which strategies form. Finally, strategy is more than merely the necessity of how to deal with competitors or a market, as it was posed in literature in the beginnings of research on business strategy.

Appendix 2

Frequently cited definitions of the term “Business Model”

Author	Definition
Timmers (1998, p. 4)	<ul style="list-style-type: none"> • An architecture for the product, service and information flows, including a description of the various business actors and their roles. • A description of the potential benefits for the various business actors. • A description of the sources of revenues.
Afuah and Tucci (2001, p. 4)	<p>The method by which a firm build and uses its resources to offer its customers better value than its competitors and to make money doing so. It details how a firm makes money now and how it plans tot do so in the long term. The model is what enables a firm to have a sustainable competitive advantage, to perform better than its rivals in the long term. A business model can be conecptualized as a systemthat is made up of components, linkages between the components and dynamics.</p>
Osterwalder: (2004, p. 15)	<p>“A business model is a conceptual tool that contains a set of elements and their relationships and allows expressing a company's logic of earning money. It is a description of the value a company offers to one or several segments of customers and the architecture of the firm and its network of partners for creating, marketing and delivering this value and relationship capital, in order to generate profitable and sustainable revenue streams.”</p>
Allen, Morris and Schindehutte and (2005, p. 727)	<p>„A business model is a concise representation of how an interrelated set of decision variables in the areas of venture strategy, architecture, and economics are addressed to create sustainable competitive advantage in defined markets”</p>
Al-Debei, El-Haddadeh and Avison (2008, pp. 8-9)	<p>“The business model is an abstract representation of an organization, be it conceptual, textual, and/or graphical, of all core interrelated architectural, co-operational, and financial arrangements designed and developed by and organization presently and in the future, as well as all core products and/or services the organization offers, or will offer, based on these arrangements that are needed to achieve its strategic goals and objectives.”</p>
Afuah and Tucci (2001, p. 4)	<p>The method by which a firm build and uses its resources to offer its customers better value than its competitors and to make money doing so. It details how a firm makes money now and how it plans tot do so in the long term. The model is what enables a firm to have a sustainable competitive advantage, to perform better than its rivals in the long term. A business model can be conecptualized as a systemthat is made up of components, linkages between the components and dynamics.</p>

Interview Guide

1. Question about the interviewee:

- Could you please briefly introduce yourself and tell about your background in the O&G business?
- What business model shifts have you experienced in connection with the 2014 oil price collapse?

2. Questions regarding the allocation of CAPEX and OPEX:

- How are Capex and Opex for upstream O&G projects allocated in your company?
- How does the drive from Capex to Opex apply for your company?
- What influence does this development have on the BM of your company?

3. Questions regarding BM's:

- What kind of BM's does your company use? How do you use them and why?
- Has the BM's changed after 2014? If yes, how? Has your company taken specific measures in order to cope with the challenging market dynamics?
- What measures has your company introduced?
- Why do you use them?
- Which ones are the most important?

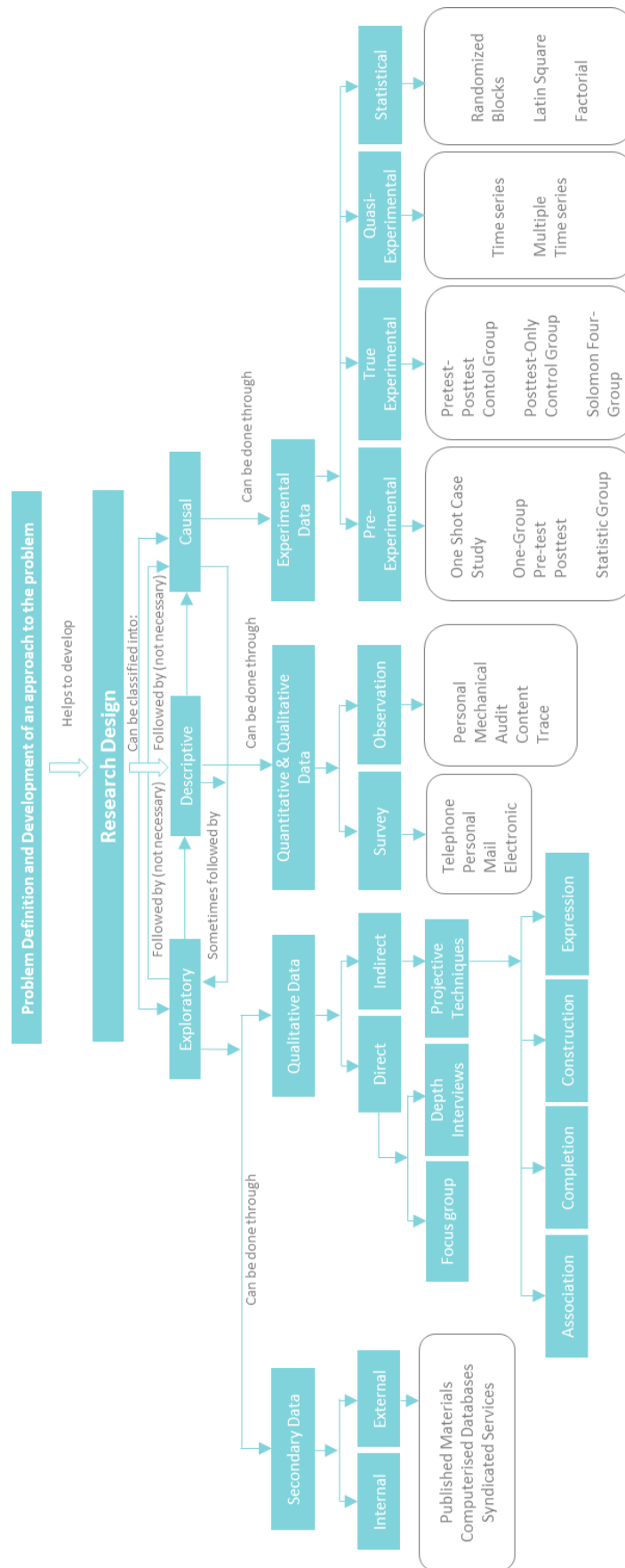
4. Questions regarding recommended actions for OEM's:

- How important is a close cooperation with OEM's for your company? Is it a matter of priority for your company to create a BM, which offers a win-win situation with the OEM's? Or is your company intending to get more independent from suppliers?
- What are you expecting from OEM's, that you are missing now? What do you expect for the future regarding the cooperation with your

5. Open general questions (if they haven't been already answered in the course of the conversation) in order to conclude the interview:

- How is digitalization driving your business? What is the most important aspect about it?
- To what extent is your company engaged in changing its revenue models?
- How important is vertical integration for your company? Why? What is the most important reason for it?
- How far is your company engaging in standardization?
- How do you see the future of your company? Do you think your company could exit the O&G business and move to another business for example to renewables?

The three characteristics of research design:



Source: Sreejesh, Mohapatra, & Anusree, 2013