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# A qualitative study of Norwegian firms diversifying into the emerging offshore wind industry

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# PROBLEM DESCRIPTION

This thesis aims to develop new insights regarding the process of related diversification into an emerging industry, from a firm perspective. We utilise a qualitative, multilevel analysis to couple industry observations with empirical evidence from eight Norwegian case firms that have diversified into the offshore oil industry. The study finds that the unpredictable nature of emerging industries is not always adequately addressed by diversifying entrants. Consequently, this thesis presents a framework which highlights the importance and hazards of related competencies and the pace of technological evolution.

# PREFACE

This Master's thesis is associated with the Department of Industrial Economics and Technology Management at the Norwegian University of Science and Technology (NTNU). The authors Nina Sakshaug Hovd and Thea Marie Sitek are both specialising within the academic field of Strategy and International Business Development.

The study is associated with a research programme named Internationalisation of Norwegian Offshore Wind Capabilities (InNOWiC), which is a four-year competency project funded through the EnergyX-programme of the Norwegian Research Council.

We would like to thank our academic supervisor Arild Aspelund and support supervisor Øyvind Bjørgum for their help and guidance throughout the research period. We would also like to thank all interviewees for their time and contribution to this thesis. They have made it possible to conduct a comprehensive and interesting study.

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# ABSTRACT

Diversification endeavours into emerging industries is one of the riskiest and yet most promising strategic actions firms can take. In spite of this compelling nature, we identify a research gap concerning diversification in the emerging industry context. By conducting a qualitative, multilevel analysis of eight Norwegian firms diversifying into the emerging offshore wind industry, we contribute to the diversification research stream by applying concepts from emerging industry theory.

First, we address two different approaches to timing of entry, based on whether a firm has a long-term or short-term ambition for their industry presence. Secondly, the prerequisite of a proven track record is addressed, furthering the importance of, but also surprising challenges, associated with competency relatedness between a firm's established industries and the targeted emerging industry. Lastly, we identify three different paces of technological evolution that a firm can encounter after industry entry. The thesis contributes to the extant diversification literature by introducing a framework that illustrates the relationship between timing of entry, level of competency relatedness and pace of technological evolution, when diversifying into an emerging industry.

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# Part I

# INTRODUCTION

# 1 INTRODUCTION

Diversification is one of the riskiest, yet most important, strategic actions a firm can take. Decades of research has been devoted to creating a better understanding of diversification and the challenges it poses to the firm. While this research addresses important aspects of the simultaneous departure from existing products and markets, which is the definition of diversification, the importance of the context the firms diversify into, is less regarded. Diversification literature focuses primarily on the influence diversification has on firm performance (Palich et al. 2000), the role of relatedness (Neffke and Henning 2013) or which synergistic benefits it might bring (Kim et al. 2013), and not the particular challenges imposed by industry characteristics.

For firms diversifying into emerging industries, general diversification theory may not be sufficient to cover the particularly challenging context an emerging industry imposes. Research on emerging industries has become increasingly popular, but this literature focuses on the emergence itself (Agarwal and Bayus 2004), identification of different stages (Phaal et al. 2011), or the timing of entry (Mitchell 1989; Suarez et al. 2015). When emerging industry literature addresses diversification, it is merely assessed as one of several possible entry modes (Helfat and Lieberman 2002). Hence, we identify a research gap for diversification into emerging industries, as the coupling is not covered sufficiently by either research stream. Thus, the theoretical contribution of this thesis is an extension of diversification literature, by introducing considerations from emerging industry research, and illustrating important relationships.

In practice, diversification endeavours into emerging industries is well illustrated by the energy transition from fossil fuels to renewable energy. The Norwegian context in particular may shed light on this issue. For nearly half a century, the Norwegian economy and identity has been dominated by the oil industry (Ryggvik 2017). A significant number of Norwegian firms are heavily invested in oil oriented industries, and the Norwegian government depends on oil related revenues to the extent that the Norwegian currency is in large a derivative of the oil price (Bernhardsen and Røisland 2000). The emergence of the offshore wind industry has appeared to be tailor-made for Norwegian firms rooted in the maritime and offshore oil and gas industries, to diversify into. Both the offshore wind and the petro-maritime industries are based on complex, technological, offshore operations, but are inversely affected by the shift from carbon-intensive to renewable energy. This *relatedness* may influence firms to think that related diversification into this particular industry is well motivated.

Based on the theoretical and practical importance of diversification into emerging industries, we identify an interesting research area for this thesis.

**Research questions**

In this thesis, we begin by addressing the fundamental question of what drives a firm to diversify into an emerging industry *before* the industry has stabilised and becomes more predictable. In accordance with extant diversification literature, we hypothesise that established firms are reluctant to invest before they can identify a viable business case, but are intrigued by the opportunity to position themselves for potential future growth. Thus, the first research question (RQ) concerns the firm's internal ambitions, and why firms see early entry as appealing, in contrast to the advantages of waiting.

**RQ 1** | What motivates a firm to diversify into an emerging industry at *an early stage?*

Following the strategic focus provided by RQ 1, we further explore what the prerequisites are, for diversifying entrants to be able to actually enter the emerging industry. Ambition in isolation has no corporate value, an thus we address the entry barriers a firm is faced with when attempting an act of related diversification into an emerging industry. Our hypothesis, in accordance with extant diversification literature, is that competency relatedness is an important asset. We thus investigate how crucial the existing competencies of a firm is, to manage an act of related diversification into an emerging industry. Industry entry is defined as when a firm manages to obtain its first contract.

Given the established focus on early emerging industry characteristics and the importance of existing competencies, we look

**RQ 2** | What role does the *existing competencies* of a firm play, to successfully diversify into an emerging industry?

at how the *timing* and *relatedness* parameters change as the industry transitions towards maturity. How are the early diversifiers affected by the dynamic nature of emerging industries? We hypothesise that the rapid development seen in the emerging offshore wind industry has forced the early entrants to innovate in order to remain in the industry, and address this by the following research question:

**RQ 3** | How does the transition towards maturity influence the early diversifiers?

These research questions are designed to make a theoretical contributions at the intersect between diversification and emerging industry research. In particular, the timing of when to enter an emerging industry is coupled with the importance of technological relatedness. This link should contribute to new insight of incentives for related diversification into an emerging industry.

This thesis follows the structure that is presented in figure 1.

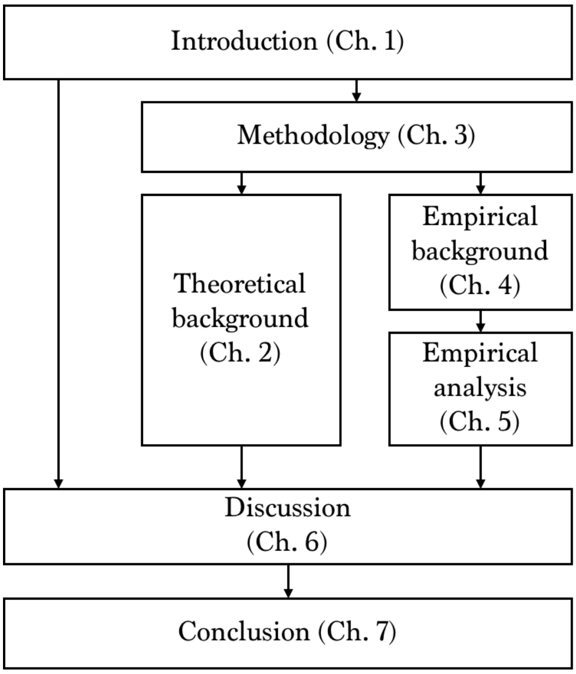


Figure 1: Thesis structure

# Part II

# THEORETICAL BACKGROUND AND METHOD

# 2 THEORETICAL BACKGROUND

In this chapter, the theoretical foundation for diversification into emerging industries is presented. First, the emerging industry research stream is outlined. Second, extant diversification literature is presented. Then, the two areas of research are coupled together using theory which is relevant with regards to both research streams. This is preceded by the identification of potential research gaps. Finally, a summary is given in section 2.4.

*Growth is important because companies create shareholder value through profitable growth. Yet there is powerful evidence that once a company's core business has matured, the pursuit of new platforms for growth entails daunting risks — Christensen (2003)*

The imperative for firm growth has permeated business strategy research for decades (Ansoff 1957; Porter 1980; Kaplan and Norton 2004). As a consequence, a range of different growth strategies and frameworks for firm growth has emerged.

One way of pursuing firm growth is to grasp opportunities that present itself, for instance by entering an emerging industry. This would be the outside-in strategy of pursuing firm growth. From an inside-out perspective, firms may actively pursue growth by developing strategies based on their core competencies (Teece et al. 1997), for example through related diversification. This thesis aims to make a theoretical contribution by addressing the intersection between corporate diversification literature and emerging industry literature.

## 2.1 EMERGING INDUSTRIES

One way to achieve business growth is by entering new markets or new industries (Christensen 2003; Kaplan and Norton 2004). New industries represent an opportunity for firms to tap into new sources of revenue, expand the existing business portfolio, and thereby create economies of scope and scale. When these new industries are still emerging, they are not yet at equilibrium. According to Porter (1980), "it will rarely pay to enter an industry in equilibrium" (p. 344), which strengthens the relative attractiveness of emerging industries.

Since the emergence of new industries is of importance to most firms, either as an opportunity or a threat, the research field has been given much attention over the past decades (Porter

1980; Lieberman and Montgomery 1988; Anderson and Tushman 1990). In more recent years, renewed attention has been given to this academic field, partly because the frequency of new industry emergence has increased following the catalysing effect of the internet-related industries (Gustafsson et al. 2016). This increase, together with the inherent importance of emerging industries for all firms, makes this academic field compelling.

### 2.1.1 *What is an emerging industry?*

Before conceptualising what an emerging industry is, a clear definition of *industry* is needed. A traditional view of the term is that an industry is a group of firms that produce products that are close substitutes for each other (Porter 1980). Van de Ven and Garud (1989) argue that this is too narrow a definition, and propose viewing an industry as a social system where other actors and institutions are included. As this study includes only firms that are actively involved in an emerging industry, our definition in this thesis is aligned with that of Porter (1980). This definition does not mean that we consider actors and institutions an irrelevant part of emerging industries, but rather helps create a clearer scope for this study.

The terms *emerging markets* and *emerging industries* are sometimes used interchangeably in extant literature (Sarasvathy 2001). Since *emerging markets* often refers to developing countries and emerging economies (Hitt et al. 2000; Khanna and Rivkin 2001; Khanna et al. 2005), we use the term *emerging industry* distinctively, since we are considering a global, emerging industry.

An *emerging industry* can be defined as an industry that is built around disruptive technology, and can be identified by an increasing number of technical solutions, an increasing number of competing actors, or both (Kirkwood and Srai 2011). Porter (1980) defines *emerging industries* as "newly formed or re-formed industries that have been created by technological innovations, shifts in relative cost relationships, emergence of new consumer needs, or other economic and sociological changes that elevate a new product or service to the level of a potentially viable business opportunity" (p. 215). In this study, an emerging industry is defined in accordance with Porter's definition because this definition is more specific than that of Kirkwood and Srai (2011).

### 2.1.2 *Emerging industry characteristics*

To differentiate emerging industries from other industries, some key characteristics are in order. Virany and Tushman (1986) describe emerging industries as industries dominated by turbulent change. According to Porter (1980), an essential characteristic of emerging industries is that there are no rules of the game. Part of the challenge for firms entering an emerging industry is that these rules need to be defined (Porter 1980; Virany and Tushman 1986).

Porter (1980) defines a set of emerging industry characteristics. More recently, Kirkwood and Srai (2011) reintroduce these with slight alterations. These characteristics are:

- **Technological uncertainty**
  There is a high level of uncertainty tied to which technology will end up being adhered to.

- **Strategic uncertainty**
  Since the industry is yet to be defined, there is a high level of uncertainty tied to the strategic decisions made by firms in emerging industries.

- **High initial costs but steep cost reduction**
  The costs associated with investing in emerging industries are often high, but as the industry takes form, dramatic cost reductions can be achieved.

- **Many embryonic companies and spin-offs**
  To begin with, there are a lot of small start-ups and visionary firms present in the emerging industry.

- **First-time uninformed buyers**
  Buyers are inherently first-time buyers and must be educated about the functionality and be convinced that the risk is sufficiently low.

- **Short time horizon**
  In emerging industries, the pressure for development may be so high that decisions can be made expediently instead of being based on an analysis of future conditions.

- **State intervention (legislation or subsidy)**
  Many emerging industries depend on governmental initi-

atives that give regulatory benefits or subsidies to get the industry going.

The extent to which these characteristics are prevalent may vary from industry to industry. Identifying which characteristics are most predominant for a given emerging industry can help a firms assess the opportunities and threats of that industry.

When presenting these industry characteristics, it is also natural to address the classical barriers for firms to enter emerging industries. These barriers to entry can also help explain the characteristics that emerging industries have, e.g. the prevalence of many embryonic companies. According to Porter (1980), these barriers are:

- Proprietary technology
- Access to distribution channels
- Access to raw materials and other inputs
- Cost advantages due to experience
- Risk raising the effective opportunity cost of capital

Out of these entry barriers, proprietary technology, access to distribution and cost advantages due to experience, are expected to decline in emerging industries as they evolve.

### 2.1.3 *Emerging industry stages*

In emerging industry literature there is an ongoing discussion on how to separate different stages from one another and how to determine which stage an industry is in (Agarwal and Bayus 2004; Phaal et al. 2011; Gustafsson et al. 2016). The process of accurately describing emerging industries is further complicated by the fact that different parts of the industry may have developed to different extents (Phaal et al. 2011). Still, there are different proposals on how to distinguish the different stages from one another.

Porter (1980) uses the product life cycle as a basis for describing industry evolution, namely the industry life cycle model. This model is based on the assumption that industry follows an S-shaped diffusion curve. It divides industry evolution into four stages; introduction, growth, maturity and decline (Kotler 1997). The model has been criticised for its underlying assumption that industry evolution is solely defined by the diffusion of products, not taking into account the complexity of the industry as a whole.

When creating a framework for mapping industry emergence, Phaal et al. (2011) identify the different stages of emerging industries as six phases and three particular transitions between the earliest phases, c.f. figure 2. First, the precursor and embryonic phases constitute the scientific and technological development, respectively. In the next phase, the nurture phase, the commercial potential is demonstrated through different applications. This phase is then superseded by the market growth phase once there are applications that give sufficient performance at a reasonable price. When this growth slows down, the mature phase is reached, which will be followed by either a decline or a renewal of the industry.

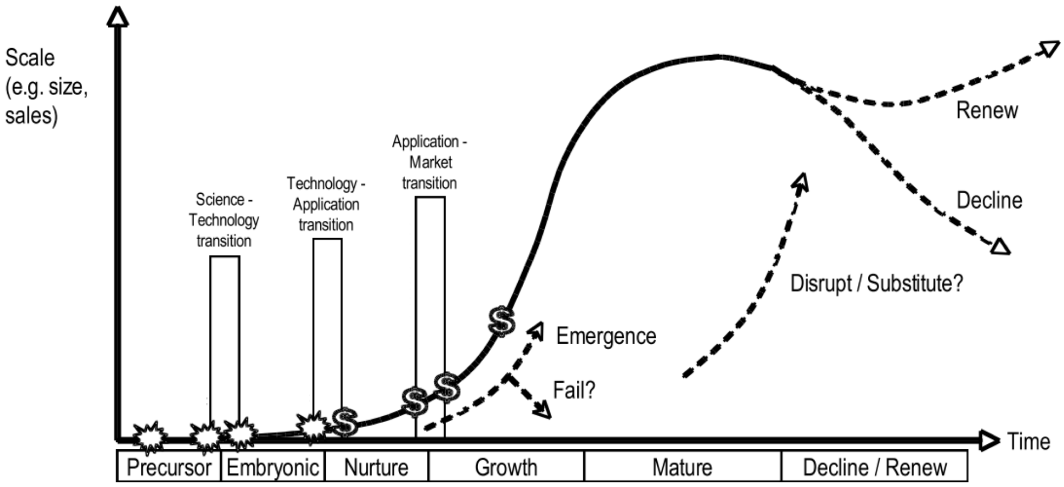


Figure 2: Emerging industry stages (Phaal et al. 2011)

In a recent literature review on the emergence of industries, Gustafsson et al. (2016) find that there is a consensus among scholars regarding the existence of three distinct stages in the industry emergence process; *the initial stage*, *co-evolutionary stage* and *growth stage*. The properties of these stages are presented below.

**The initial stage**

Gustafsson et al. (2016) define the very first stage of industry emergence as *the initial stage*. It is equivalent to the precursor and embryonic phase (Phaal et al. 2011), cf. figure 2. The initial stage is characterised by inventions and innovations causing a new field to distinguish itself from existing technology, products and services. It can be caused by scientific or technological developments (Phaal et al. 2011), socio-economic changes (Sine and Lee 2009) or shifts in demand (Agarwal and Bayus 2004). In the initial stage there are different technological design categories and industry identities and no industry boundaries. This stage is dominated by research and development, visionary start-ups and corporations with a highly deliberate ambition to shape the industry from its inception (Gustafsson et al. 2016).

**The co-evolutionary stage**
The transition from the initial stage to the co-evolutionary stage is indicated by the shift from a technological and scientific focus, to proving the potential as an industry. It is the stage in which the emergence of organisational, technical, product and service innovations takes place, while contagion and imitation speeds up the emergence of the industry. Furthermore, firms start to evolve in the same direction (Gustafsson et al. 2016). It is what Phaal et al. (2011) refer to as the nurture phase, where the focus lies on improving price and performance. In other words, the co-evolutionary stage is the stage in which the commercial prospects of the industry is demonstrated.

**The growth stage**
Quite intuitively, the growth stage is identified by growing sales, i. e. sales take off (Agarwal and Bayus 2004), leading to sustainable industrial growth (Phaal et al. 2011). The shift to the growth stage is marked by the emergence of a dominant design[1] (Utterback 1994; Markides and Geroski 2005). This enables firms to shift the focus from designing different technological solutions to how processes can become more cost-efficient. According to Gustafsson et al. (2016), the early growth stage is often when the market leader position is established.

### 2.1.4 *Timing of entry*

A critical aspect for firms considering an entry into an emerging industry is *timing*. To enter at an early stage means facing a wide range of market uncertainties, with the risk that high investments might not secure any real value to the firm. On the other hand, if a firm enters an industry after the market growth has started, the chances of becoming a market leader

1 A *dominant design* is the design that wins the allegiance of a marketplace, which competitors and innovators must adhere to (Utterback 1994).

may be slim (Markides and Geroski 2005). Helfat and Lieberman (2002) find that the ideal time of entry depends on the resources required to enter a new market. In other words, the time of entry should be based on the qualities of the firm's resource base.

York and Lenox (2013) look at the entry time differences between entrepreneurial entrants and diversified entrants in emerging industries, and find that established firms are more likely to diversify into emerging industries if the economic and regulatory prospects are positive. The rationale is that managers of diversifying firms need to legitimise new activities to existing stakeholders, where the economic incentives may justify the risks associated with diversification processes (York and Lenox 2013).

Porter (1980) finds that the low entry barriers associated with early entry may provide large returns, yet he also presents a set of circumstances where an early entry may be particularly risky. He argues that an early entry into emerging industries is especially risky when (1) the competition and market segmentation is formed on a different basis than in the later development, (2) costs of opening the industry are great, but cannot be made proprietary to the firm, (3) competing with smaller firms is costly and (4) technological change makes investments obsolete and later entrants can have an advantage by having newer products and processes. These are in large the same issues that are addressed by Markides and Geroski (2005). According to Markides and Geroski (2005), established firms should wait to enter until just before the dominant design is set to avoid these risky circumstances.

Within the population ecology research stream on the emergence of industries, Suarez et al. (2015) contribute to the timing aspect by presenting a theoretical framework, cf. figure 3. The framework introduces the concept of dominant categories, which is set before the dominant design. First, there is a number of different categories before one dominant category emerges. Then, even more firms enter, which further refine this dominant category into a dominant design. Finally, the dominant design is set, pushing several firms to exit as they acknowledge that they are not in a favourable position to compete based on what has become the dominant design. Consequently, Suarez et al. (2015) identify a *window of opportunity* for firms to enter: between the emergence of a dominant category and the emergence of a dominant design.

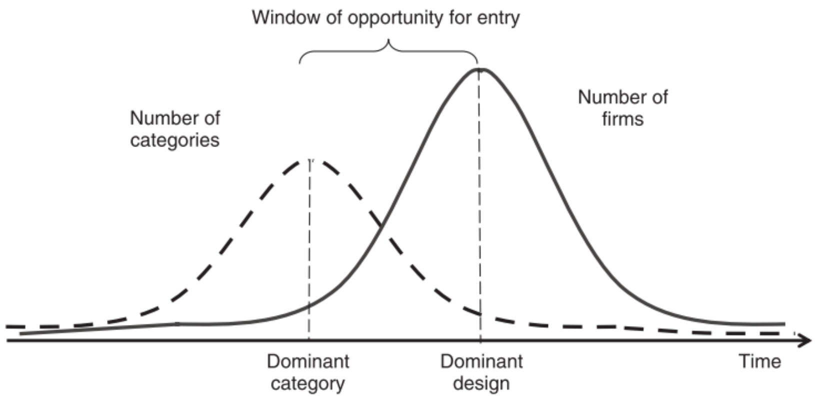


Figure 3: The window of opportunity (Suarez et al. 2015)

By entering within this window of opportunity, firms do not waste energy on developing designs that might not be within the dominant category, while still being able to position favourably before the industry grows.

### 2.1.5 *Transition to maturity*

Once an industry's growth rate starts to decline, the industry is transitioning towards maturity (Porter 1980; Kotler 1997). The industry is no longer said to be emerging, but rather a mature one. According to Phaal et al. (2011), the maturing phase is characterised by the refining of established applications, business models and production processes. Since firms are selling to more experienced buyers and the industry growth slows down, the competition to sustain market share increases and the focus is often shifted towards cost and service.

## 2.2 DIVERSIFICATION

A well-known strategy for entering new industries is *diversification*. The term 'diversification' is widely used in academic literature. It is found within a range of different fields, such as business strategy, finance, biology, ecology and archaeology. All these genres of diversification ultimately describe the same effect: expanding a portfolio, gene pool or business line. For purposes of this thesis, we will address only the corporate strategy field of diversification.

A formal definition of the concept of corporate diversification can be traced back to 1957, when it is defined as one of four business growth strategies by Ansoff (1957). Ansoff (1957) acknowledges that diversification as a term is frequently interchanged with other types of adjustments in the market-product structure, and therefore strictly defines diversification as *"a simultaneous departure from the present product line and the present market structure"*. The strategy should be seen in contrast to market penetration, market development and product development, c.f. Figure 4. Later on, Rumelt (1974) strictly defines a *diversified firm* as one deriving less than 70 percent of its sales from a single line of business. A more common and conceptual definition is that a firm has to be present in more than one market or industry. The latter will be the definition of the term in this thesis.

| | | Products | |
|---|---|---|---|
| | | Existing | New |
| Markets | Existing | Market penetration | Product development |
| | New | Market development | Diversification |

Figure 4: Ansoff's growth matrix (Ansoff 1957)

According to Markides (1997), one of the toughest strategic questions managers face is whether a firm should diversify or not. In order to diversify, a company has to develop a new or altered product, while at the same time entering an unfamiliar market or industry. These simultaneous changes will almost always represent a distinct break with past business experience, which marks diversification as the growth strategy associated with the highest risk (Ansoff 1957) (p. 109).

The product and market dimensions described by Ansoff (1957) are still pillars for most diversification literature, but these pillars have evolved over the past decades. While some researchers choose to investigate both dimensions simultaneously (Hitt et al. 1997; Tongli et al. 2005), others focus on either the market expansion dimension (Fang et al. 2007) or the product development dimension (Luo 2002).

Research streams covering the market expansion associated with diversification have developed further into several directions. In particular, there is extensive research regarding international diversification, or more generally, *internationalisation* theory. In some cases, this research field tends to overlap what Ansoff (1957) terms market development. Within the product branch of the diversification research stream, the focus on *technological diversification* is gaining a lot of attention in recent literature (Breschi et al. 2003; Leten et al. 2007), and can to some extent overlap the growth strategy of product development.

In addition to these interpretations of diversification, new terms have also evolved, addressing acts of diversification from a defined perspective. Research on *upgrading* concerns the act of entering more skilled activities with higher entry barriers, from a cluster or value chain perspective (Humphrey and Schmitz 2002). And a research stream on *speciation* addresses technological diversification as an incremental adaptation emerging when existing technology is adapted to a new environment (Garnsey et al. 2008). The evolution of the diversification term is a natural development for such a mature and wide stream of research, and indicates that the principles of diversification are still relevant today.

### 2.2.1 *Motivation for diversification*

Penrose (1959) clusters motivation for diversification into three main categories:

1. Response to specific opportunities
2. Solution to specific problems
3. General policy for growth

Problems mentioned in (2), primarily refer to unfavourable changes in existing demand that are either temporary, seasonal or cyclical fluctuations, or permanent adverse changes. With reference to opportunity cost, the three motivation categories will always be intertwined. Thus, all three can often be used to reason a specific act of diversification (Penrose 1959). An interpretation of the categorisation can be that opportunities represent pull factors in other markets, while problems are push factors in the current market. And a general policy simply reflects that a firm is constantly looking for profitable markets to enter (Hollensen 2012).

Johnson et al. (2014) add another perspective to these motives for diversification by stating that there are both value-adding and value-destroying motives for diversification. Value-destroying motives for diversification are response to market decline, spreading risk and managerial ambition. Particularly the first of these, which essentially can be viewed as a solution to a problem (2), is highlighted by Johnson et al. (2014) as a negative driver for diversification.

### 2.2.2 *Resource-Based View (RBV)*

One of the cornerstones for assessing business strategy is through the *resource-based view (RBV)*. It is the notion of viewing a company's resource base as the foundation for sustained competitive advantage, a concept formulated by Penrose (1959).

The term *core competencies* is often used to describe a firm's most valuable resources. Core competencies are a harmonised combination of multiple resources and skills that are "difficult for competitors to imitate, can be leveraged in different businesses, and contribute to the benefits enjoyed by customers within each business". In addition, core competencies do not diminish, but increase, with use. Thus, patterns of diversification may be guided by a firm's core competencies (Prahalad and Hamel 1990). In competitive landscapes characterised by rapid and unpredictable change, the term *dynamic capabilities* is often used. It captures a firm's ability to integrate, build, and reconfigure its competencies in changing environments (Teece et al. 1997). Thus, both core competencies and dynamic capabilities may be used to explain a firm's resource-based conditions for diversification (Pehrsson 2006; Døving and Gooderham 2008).

Diversification decisions can be triggered by exogenous threats or opportunities, but are always based on the firm's endogenous resources. From its very definition, corporate diversification is about reallocating firm resources (Ansoff 1957; Barney 1991). The perspective is based on the idea that firms can create and sustain competitive advantage by focusing on the interchangeability of resources across domains. To best achieve this, the resources should be valuable and rare, as well as difficult to imitate or substitute. Still, all resources that can be utilised in value-adding activities to enhance firm performance are defined as part of the firm's resource base (Barney 1991; De Wit and Meyer 2014).

### 2.2.3 *Related diversification*

Inspired by Ansoff (1957)'s growth matrix, Noori et al. (2012) introduce a new matrix, solely focusing on different forms of business diversification. The distinction between new and existing markets is replaced by similar or different business lines. And instead of having a pure product focus like Ansoff (1957), Noori et al. (2012) look at the competency and supply relatedness required to produce such products. Based on this, three versions of diversification emerge; competency-related, market-related or unrelated diversification, c.f. figure 5.

| | | Competencies/Supply | |
|---|---|---|---|
| | | Similar | Different |
| Market/Demand | Similar | No diversification | Market-related diversification |
| | Different | Competency-related diversification | Unrelated diversification |

Figure 5: Business diversification matrix (Noori et al. 2012)

The extent to which the new market and product is related to existing business lines, denotes how related these industries are (Helfat and Lieberman 2002). The dimensions focus on the supply and demand, which Noori et al. (2012) argue can be viewed as the inside-out and outside-in perspectives respectively.

The first one to introduce a clear categorical differentiation between related and unrelated diversification was Rumelt (1974). The perks of *unrelated diversification* originates from portfolio theory. At a set level of justified market risk, a company aims to maximise expected return. Unrelated business diversification is thus to enter industries very different from those one currently operates within. If the company to a minimal degree can utilise its technology and insight when diversifying, it is defined as being unrelated (Rumelt 1974).

*Related diversification*, on the other hand, focuses on business units sharing key characteristics (Rumelt 1974; Helfat and Eisenhardt 2004). A key implication of shared characteristics is the potential for synergistic benefits. *Synergy effects* are often used as a synonym to *economics of scope*. These are efficiencies formed by variety, meaning that one can obtain a 2 + 2 = 5 effect, by utilising shared factors of production (Ansoff 1965). If resources are somewhat related, then bundling processes, products, marketing effects and so on can create mutually reinforcing effects between the business units (Barney 1991). However, market factors are imperfect, and sharing resources will at some point result in trade offs or requirements to purchase additional capacity (Teece 1982).

Rumelt (1974) examined whether related or unrelated diversification was the better strategy for increasing performance. He defined a carefully conceptualised model based on nine business structure categories, and aimed to demonstrate a linkage between each of these and performance. It became evident that performance varied greatly depending on a firm's diversification strategy. And the highest levels of profitability were exhibited by the firms that diversified primarily into areas which drew on some common core skill or resource, namely a related diversification strategy. The work of Rumelt (1974) has been the pillar for a *relatedness hypothesis*, stating that relatedness enhances performance. It has been reviewed numerous times (Christensen and Montgomery 1981; Levinthal and Wu 2010), with conflicting conclusions. But all in all, there is a common understanding that if one manages to obtain economics of scope from the related diversification, this will per definition contribute to more efficient operations than if two separate firms were to operate each business separately.

The relatedness hypothesis is extensively examined by Palich et al. (2000). After reviewing a significant amount of articles about the relationship between diversification and performance, they identify three different clusters of research that illustrate the most common models for explaining the nature of the diversification-performance relationship cf. figure 6. Palich et al. (2000) conclude by endorsing the inverted-U shaped model as the best representation, meaning that diversification enhances performance up to a certain level, favouring related diversification.

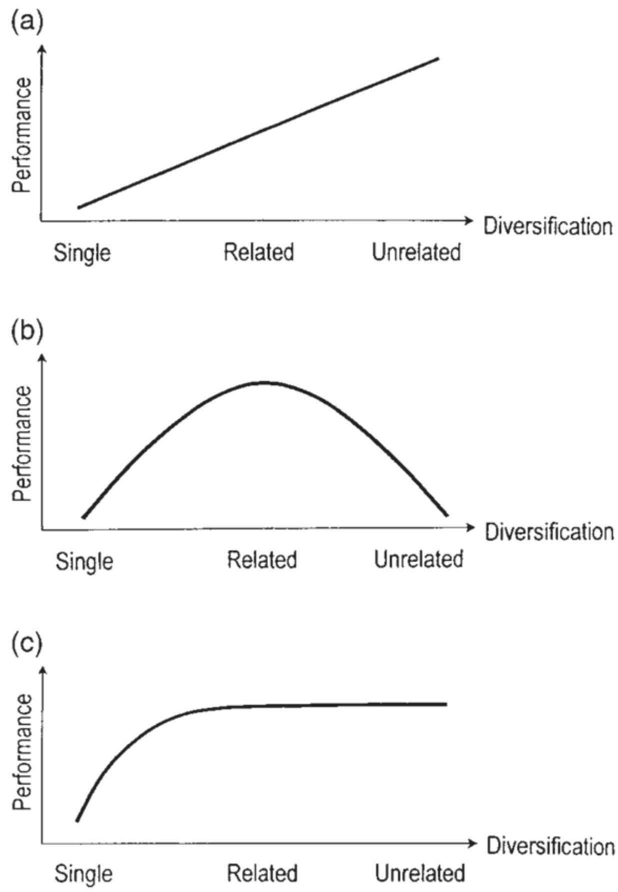


Figure 6: Models of diversification performance (Palich et al. 2000)
(a) The Linear Model, (b) The Inverted-U Model,
(c) The Intermediate Model

### 2.2.4 *Industry factors promoting diversification*

Porter (1987) develops what he called *the three tests of successful diversification*, which suggests that the following questions should be asked before entering an industry:

1. Attractiveness: How attractive is the industry? How strong is the profit potential?

2. Cost of entry: How much will it cost to enter the industry? Can these expenses be reimbursed by expected revenue?

3. Better off: Are there any synergy effects? Will the new unit, the firm or both be better off compared to being run as completely separate businesses?

Porter (1987) here underlines the impact the choice of industry has on successful diversification. This industrial perspective has been firmly advocated for by Schmalensee (1985), who concludes that, undoubtedly, the most important factor for diversification success is the industry effect. He finds that a firm's success in market A has no correlation with the same firm's success in a randomly selected market B. Hence, firm effects alone are not equivalent with successful diversification. Hence, performance is a function of the industry's overall performance (Schmalensee 1985). Furthermore, Christensen and Montgomery (1981) state that market structure variables could account for some, or even all, the differences other authors have observed when different diversification strategy effects on performance are analysed. They suggest that both performance and strategy is a result of the market, instead of performance being a result of strategy.

## 2.3 DIVERSIFICATION INTO EMERGING INDUSTRIES

### 2.3.1 *The chaos perspective*

When firms diversify into an emerging industry, they encounter a new, and not yet established context. According to Stacey (1993), the phenomenon of not knowing the long term future is a form of instability that can be described as *chaos*. Firms may to a certain extent always find themselves in chaos in the sense that they are always prone to external effects. However, for emerging industries, the future, even in shorter terms, is even more unpredictable (Agarwal and Bayus 2004). Hence, chaos is even more predominant in emerging industries.

More recent research on how firms tackle the unknown or unknowable, is the theory of *causation* and *effectuation* (Sarasvathy 2001). Effectuation is the entrepreneurial approach to the unknown that considers a set of means as given, and selects approach based on possible effects of these means. In contrast, causation takes the effect as given and considers different approaches to reach that effect. Sarasvathy (2001) argues that the effectuation approach gives control over an unpredictable future instead of a prediction of an uncertain future.

### 2.3.2 *Deliberateness*

In strategy formation theory, there is a tension between deliberate and emergent strategy formation. Mintzberg and Waters

(1985) were the first to focus on this tension explicitly. They argue that deliberate and emergent strategies are not contradictory, but complementary. Furthermore, Mintzberg and Waters (1985) find that strategies are a mix between deliberate strategy formation and strategy emergence.

De Wit and Meyer (2014) define *deliberateness* as the quality of acting intentionally, and according to Christensen (2003) it is conscious and analytic strategy-making. *Emergence*, on the other hand, is the process of becoming apparent (De Wit and Meyer 2014). It refers to processes where strategies are not intentionally formed, but pieced together along the way. It is important to note that emergent strategies are not simply an ad hoc approach where firms do whatever comes along. Rather, emergent strategies form a coherent pattern over time.

According to De Wit and Meyer (2014), the advantages of deliberate strategy formation are; sense of direction, commitment to a course of action, coordination of initiatives, optimisation of resource allocation and programming organisational activities. When diversifying into emerging industries, firms inherently follow a different course of action than before. The need for commitment and direction is therefore particularly important to make sure that the firm mobilises and takes action (Ghemawat 1991).

While deliberate strategies have a number of advantages, so do emergent strategies. Emergent strategies are shaped by an iterative process of thinking and acting (De Wit and Meyer 2014). The advantages of this strategy formation approach are; possibility of opportunism, increased flexibility, learning what works through trial, entrepreneurship within the firm and support among firm stakeholders. These attributes can be particularly important in the chaotic context of emerging industries. Deliberateness may be important for creating commitment to the strategy, while emergent strategies leave greater room for flexibility. Mintzberg and Waters (1985) conclude that "strategy formation walks on two feet, one deliberate and one emergent", and that "the relative emphasis may shift from time to time" (p. 271).

In emerging industries, there is a similar need for balancing the strategy formation. There a number of characteristics that distinguish emerging industries from other contexts firms operate under, cf. section 2.1.2. For example, an emerging industry gives an unpredictable context for entering firms. This means that firms need to be able to (1) adapt to the rapidly changing industry environment, and (2) create a sense of commitment to mobilise firm resources in the right direction. Consequently, firms entering emerging industries need to be both flexible and committed to their entry, i. e. both emergent and deliberate.

According to Markides (1997), the decision to diversify or not often happens in an atmosphere not appropriate for thoughtful deliberation. When comparing emerging industries relative to other industries, the main characteristic differentiating them is the comparatively high levels of uncertainty and risk. Thus, emerging industries may impose a greater need for emergent strategies than established ones.

### 2.3.3 *Timing*

When pursuing diversification strategies into emerging industries, an essential question is when to diversify. Especially in emerging industries, the timing can be decisive for the success of the diversification endeavour. Much research has been concerned with the timing of entry (Mitchell 1989; Lieberman and Montgomery 1988; Suarez et al. 2015), and the influence timing may have on the success of diversification (Luo 2002; Fang et al. 2007). According to Lieberman and Montgomery (1998), when firms are "faced with a decision about when to enter a new market, the optimal timing often depends upon the strengths and weaknesses of the firm's existing resource base" (p. 1113). However, the exact effect the resource base has on the timing of entry is still poorly understood (Lieberman and Montgomery 1998).

Mitchell (1989) finds that established firms, such as diversifying entrants, are more likely to enter into emerging industries if the firm's core product is threatened or it already has industry-specialised assets. On the other hand, this is what Johnson et al. (2014) refers to as a value-destroying driver to diversification, as it can be a sign of market decline, and conventional finance theory suggests that firm shareholders should be left with the diversification decision when core business is threatened.

Markides and Geroski (2005) categorise early entrants of emerging industries into *first-movers*, *fast-seconds* and *second-movers*. A first-mover strategy would involve getting fast to market and hoping that the introduced product becomes the dominant design. In contrast, second-movers wait until a dominant design emerges, and must therefore compete on price or find a way to shift the rules of the game in the industry. The golden mean between these two timing approaches is the fast-second approach. It entails entering the emergent industry just as the dominant design emerges. Markides and Geroski (2005) argue that fast-seconds arrive to market so fast after the first-movers that the first-movers cannot build up much competitive advantage over them. They state that "the optimal strategy for established firms contemplating entry into a new radical market is fast-second entry" (p.121). Fast-seconds are in other words firms that enter just before the window of opportunity closes. Thereby, Markides and Geroski (2005) have a similar understanding of timing of entry into emerging industries as that of Suarez et al. (2015).

### 2.3.4 *First-mover advantages*

The concept of *first-mover advantages* is the notion that being first to enter an emerging industry will bring advantages that can be attributed to the quality of being first. Lieberman and Montgomery (1988) define first-mover advantages as "the ability of pioneering firms to earn positive economic profits (i.e. profits in excess of the cost of capital)" (p. 41). According to Suarez and Lanzolla (2005), first-mover advantage is "a firm's ability to be better off than its competitors as a result of being first to market in a new product category" (p. 122). For purposes of this thesis, we define first-mover advantage as a firm's ability to be better off as a result of being an early entrant in an emerging industry.

The opportunity for first-mover advantages can be created when asymmetry arises between firms (Lieberman and Montgomery 1988). Once this opportunity for first-mover advantages is present, there are a set of mechanisms enabling firms to exploit their position and enhance the durability of the first mover advantages. These mechanisms can be divided into three types of mechanisms:

1. Technological leadership
2. Preemption of assets
3. Buyer switching costs

Lieberman and Montgomery (1988) refers to 'technological leadership' in terms of the experience, learning outcome and the potential R&D that can be obtained by first-movers. To be first to market gives the firm time to get a head start over competition by developing knowledge and know-how that can give further competitive advantage (Porter 1987; Lieberman and Montgomery 1988). 'Preemption of assets' is the possibility early entrants have to preempt input factors, locations and investments. Finally, the 'buyer switching costs' are the potential switching costs and lock-ins that can be created by first-movers. Especially under uncertainty, buyers tend to stick with the first satisfactory performing brand they encounter (Lieberman and Montgomery 1988). Makadok (1998) points to existing customers as a key resource that explains why first-mover advantages become sustainable. From a transaction cost perspective, Makadok (1998) may be right, since the cost of changing to unknown entrants is associated with a certain risk. Later entrants have the disadvantage that they must not only deliver a competitive product offer, but they also have to outweigh the transaction cost of changing supplier.

Even though the advantages of moving first into an emerging industry may be noticeable, there is no guarantee that the effect will result in a lasting strong position as the market evolves and matures (Lieberman and Montgomery 1998). Suarez and Lanzolla (2005) identify two factors that may influence the degree and durability of first-mover advantages. These two factors are the pace at which the technology of the product evolves, and the pace at which the market for that product evolves. In order to describe the relationship between first-mover advantages and these two factors, Suarez and Lanzolla (2005) develop a framework that divides the emerging industry context into four settings, cf. figure 7.

| | | Pace of market evolution | |
| --- | --- | --- | --- |
| | | Slow | Fast |
| Pace of technological evolution | Slow | Calm waters | The market leads |
| | Fast | The technology leads | Rough waters |

Figure 7: Technology-market matrix (Suarez and Lanzolla 2005)

According to Suarez and Lanzolla (2005), the likelihood of obtaining short-lived and durable first-mover advantages is contingent upon which one of the quadrants a firm operates within. Table 1 presents the mapping between the firm context and this likelihood. A quick observation shows that *short-lived* first-mover advantages are more likely the faster the market evolution and the slower the technological evolution. In contrast, *durable* first-mover advantages are more likely the slower both market and technological evolution are. Interestingly, both short-lived and durable first-mover advantages are negatively affected by the pace of technological evolution, and are unlikely when the technology leads, cf. figure 7. According to Suarez and Lanzolla (2005), this particular context demands strong R&D and deep pockets.

| | **First-mover advantages** | |
|---|---|---|
| **Firm context** | **Short-lived** | **Durable** |
| Calm waters | Unlikely | Very likely |
| The market leads | Very likely | Likely |
| The technology leads | Very unlikely | Unlikely |
| Rough waters | Likely | Very unlikely |

Table 1: Likelihood of first-mover advantages

There are several studies that have highlighted the importance of these two contextual factors, and especially the pace of technological evolution. Anderson and Tushman (1990) study how technological discontinuities initiate periods of strong technological variation and selection before a dominant design is set. Kessler and Chakrabarti (1996) study the innovation speed of firms, and similar to Suarez and Lanzolla (2005), they find that technological and market dynamism makes innovation speed more important. Hence, the pace of technological evolution may be an important factor of emerging industries.

In spite of much research being devoted to the importance and facets of first-mover advantages, the research stream has studies pointing in opposite directions as to whether first-mover advantages actually exist (Suarez and Lanzolla 2005). From a resource-based perspective, Barney (1991) argues that in order for there to exist first mover advantages, firms within the industry must be heterogeneous in terms of their resource bases.

In addition, the advantages of entering an emerging industry at an early stage may be outweighed by first-mover disadvantages (Lieberman and Montgomery 1988, 1998; Markides and Geroski 2005). According to Lieberman and Montgomery (1988), first-mover disadvantages are linked to the positive effects experienced by later entrants. These are (1) free-rider effects, (2) resolution of technological or market uncertainty, (3) technological discontinuities that give way for new entry and (4) incumbent inertia which makes it harder for incumbents to adapt to changes. Consequently, firms cannot look at the potential first-mover advantages without regarding the disadvantages an early entry entails.

## 2.4 SUMMARY

The theoretical foundation of this thesis reveals a lack of research connecting diversification to the emerging industry context. Emerging industry literature examines the emergence of industries itself, dividing the evolution into different stages, finds characteristics of such industries and discusses the timing of entry. In contrast, diversification literature addresses the foundation for entering new industries by looking at the firm's resource base and relatedness of existing competencies, but does not consider the industry context in particular.

In spite of emerging industry literature pointing to the notably challenging of such industries, diversification literature does not take in the importance of this context. Consequently, the purpose of this thesis is to develop new insights into the process of diversification into an emerging industry.

# 3 METHODOLOGY

This chapter presents the methodology of this thesis. After a short outline of the background of this thesis, the research design is presented. Second, the data collection process is described, before a presentation of the data analysis process. Finally, a reflection on the quality of research is given. Figure 8 illustrates the process of the thesis development, which this chapter gives a more in-depth presentation of.

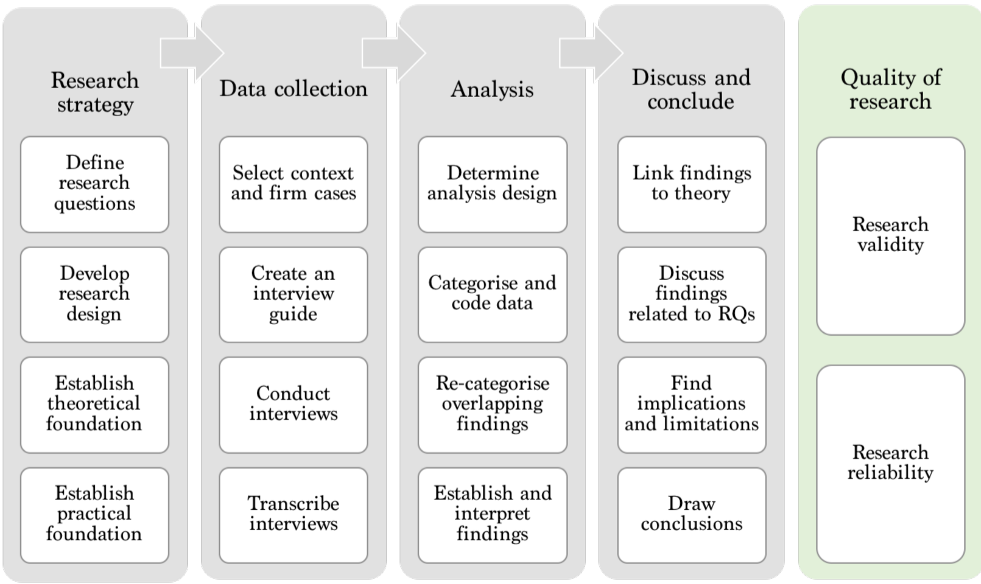


Figure 8: Research process

This thesis is associated with the research project InNOWiC - Internationalization of Norwegian Offshore Wind Capabilities. The project's overall ambition is to develop new knowledge about the opportunities and barriers for Norwegian firms to succeed in the offshore wind industry. Norwegian firms have a longstanding presence in the maritime and offshore oil and gas industries, and InNOWiC aims to explore how capabilities from these industries can be competitive in the emerging offshore wind industry. The InNOWiC project will last for four years, 2016-2020, and is funded by the Research Council of Norway. Although this thesis is motivated by this research project, the authors were free to develop their own research objective. We have however chosen to motivate our thesis in accordance with the project, and aim to generate *new knowledge about the opportunities and barriers for firms to succeed in an emerging industry*.

## 3.1 RESEARCH DESIGN

The purpose of this thesis is to develop new insights into the process of diversification into an emerging industry from a firm perspective. It will contribute to the research field of diversification, by introducing relevant concepts from the emerging industry literature. In order to achieve this, the chosen research design for this thesis is qualitative and inductive. This allows our research to have a more exploratory approach (Bryman 2012; Yin 2014).

### 3.1.1 *Multilevel analysis*

Since this study considers both diversifying firms and the emerging industry context they diversify into, a multilevel analysis design is chosen. The empirical foundation consists of a multiple-case study of the diversifying firms on one level, and a contextual analysis of the industry on another. These two dimensions combined defines our research method as a *multiple-case study* as part of a *dual-level analysis* (Yin 2014) (p. 226).

For the first level of empirical analysis, a case study design is chosen due to the favourable properties of qualitative case studies when aiming to generate new insights. By utilising multiple cases, the results of the study is strengthened (Yin 2014). Additionally, by building theory inductively, in accordance with grounded theory (Strauss 1987), we may generate more novel theory (Eisenhardt 1989). To cater for the grounded theory aspect, the data collection is in large based on interviews in a semi-structured and open-ended format. This leaves room for exploring interesting topics and grasping how research participants view the topic (Bryman 2012).

The second level of analysis, the industry context, is assessed empirically through documentation. Industry reports, seminars and conferences form the basis for this analysis.

### 3.1.2 *Defining research questions*

According to Bryman (2012), the first step in qualitative research is to develop general research questions. The degree to which these research questions are explicitly stated to begin with may vary. They can give a clear and distinct focus, or be more loosely defined versions, where the research question is embedded in a general statement. For purposes of this thesis and its inductive nature, the research questions were less formal to begin with, but with a clear focus area.

Our initial research questions were based on interesting aspects of the process established firms go through when entering emerging industries. "Why do firms diversify into an emerging industry?? How are they able to do so successfully? And ultimately, how do they handle the evolution of the emerging industry?" These questions served as a foundation for the three research questions of this thesis. They are quite similar to the final ones, presented in section 1, but with a slightly more open phrasing. Through the research process it became clear that for instance the timing element was interesting, and the first research question was thus adjusted to incorporate this aspect. Similar adjustments were made to the other two research questions.

### 3.1.3 *Theoretical and contextual foundation*

In the fall of 2016, we wrote a pre-thesis as preparation for this master's thesis. The pre-thesis was an extensive literature review of diversification literature, and more specifically of related diversification and the benefits thereof. As this thesis combines both diversification literature and emerging industry literature, we lacked a theoretical foundation on emerging industry literature. To account for this theoretical bias, a similar keyword search process for emerging literature has been conducted. This provided a thorough theoretical foundation for this thesis with respect to both research streams.

In order to establish the contextual, i. e. the industry-specific, foundation for this thesis, a number of industry reports were reviewed. These reports give insights into the developments of the offshore wind industry. Additionally, attending seminars and conferences, and conducting interviews with industry experts whom could provide a macroeconomic focus, helped create a better understanding of what the current discussions are, as well as in identifying important managerial implications of this study. A full list of interviews, seminars and conferences are found in appendix C.

## 3.2 DATA COLLECTION PROCESS

Inspired by the research questions and the preferred research design of a multilevel case study, we select a relevant industry and relevant firms within that industry.

### 3.2.1 *Selecting case industry*

The emerging offshore wind industry is a particularly interesting emerging industry case. Firstly, it supplements extant emerging industry research, which mainly regards software-based industries. Entering a long lived assets-industry increases the rigidity associated with the commitment of developing an industry-specific product or service. Research into such an industry can thus provide supplementing insight, to verify or challenge newer emerging industry literature.

Secondly, the offshore wind industry is currently high on the political agenda in many countries. This increases the relevance of the study for practical purposes, while at the same time easing the process to obtain relevant information for the industry level analysis. Accordingly, to ensure that we were able to conduct a through case firm analysis, the offshore wind industry is deemed as an attractive case industry since it is based on firms obtaining tangible contracts. This helped us to identify which firms have actually entered the industry, and identify a diverse range of interesting case firms.

### 3.2.2 *Selecting case firms*

Perhaps the most important task when conducting qualitative research is selecting which case(s) to investigate (Yin 2014). With that in mind, we create an qualitative basis for the case firm selection. In order to identify firms relevant to our research, we create an overview of the Norwegian firms and stakeholders in the offshore wind industry. This overview is based on the 4C Offshore (2017) database, which contains information regarding almost all stakeholders involved in offshore wind projects around the world. We analyse this database by selecting all Norwegian firms listed, and create a systematic overview of their offshore wind activities. We identify the number of projects each firm has been involved in (both realised an unrealised projects) and which segments they operate in. The results of this analysis can be found in appendix A.

To be a relevant case firm for our study, the firm must first and foremost meet the criteria set by our research questions. This means that selected firms must have (1) been an established firm in another industry prior to entry in the offshore wind industry, (2) entered the industry through diversification and (3) successfully obtained at least one contract in the emerging offshore wind industry at an early stage[1]. We only regard projects that have been realised or are still in the development phases. Projects that are cancelled, denied or dormant are not considered.

As a result of these requirements, we were left with a limited number of firms to choose from. Since this thesis aims to shed light on diversification into emerging industries in general, the sample should consist of different types of firms. This could generate results that to a greater extent are applicable to general theory. The desired sample was therefore a set of internally heterogeneous firms, while externally homogeneous in terms of fulfilling the requirements.

The final decision on which firms to contact was based on the combination of meeting the given requirements, having a fairly successful entry and being compatible with each other in terms of representing various parts of the offshore wind value chain. Potential bias for making the final decision can be discussions with our supervisors, attendance at seminars, and having read a recent report on which Norwegian firms were performing well in the industry (MAKE Consulting 2016). This left us with 8 desired case firms, upon which this thesis is based.

### 3.2.3 *Developing an interview guide*

An general interview guide was created to secure a gathering of compatible and comparable information from the eight case firms. The nature of semi-structured, open-ended interviews leaves room for exploring interesting topics when they come up in the conversation. Nevertheless, an interview guide helpes lead the interviews in the right direction and to ensure that all aspects of our research questions were covered.

The interview guide was formulated in a way that attempts to generate extensive answers to the research questions, by viewing them from different perspectives. Furthermore, the questions are relatively open and are formulated in a way that does

1 We define *an early stage* as entry before January 2017.

not lead the respondent to think there is a right or wrong answer.

The questions were clustered thematically, starting with the most open questions within each field; motivation, entry, network, deliberateness, sustainability, and financial and market considerations. For each of these subjects, a set of questions were asked, resulting in the general interview guide for this thesis. The interview guide was customised before each interview to enable the firm to reflect on their individual firm experiences within the offshore wind industry. The initial interview guide is found in appendix B.

Some of the interviews did take turns where other industry-related topics were discussed. Still, all eight firms answered all questions from the interview guide sufficiently.

### 3.2.4 *Format*

In total, eight semi-structured interviews were held to gather data for this thesis. Table 2 provides an overview over interviews and respondents from each case firm.

| **Firm** | **Name** | **Title** | **Date** | **Method** |
|---|---|---|---|---|
| Statoil | Tarald Gjerde | Head of Project Execution, Wind Business Development | 09.03.2017 | T |
| Kongsberg | Kristian Holm | VP Renewables & Utilities | 23.02.2017 | P |
| StormGeo | Jostein Mælan | VP Renewables | 20.03.2017 | P |
| Aibel | Lars Henrik Hosøy | Business Development Manager, Renewables | 01.03.2017 | P |
| Kværner | Kjell Eggen & | Former VP Business Development | 24.03.2017 | P |
| | Lars Minsaas | VP Business Development | | |
| Nexans | Morten Langnes | Sales Manager | 21.04.2017 | T |
| Fred. Olsen | Ketil Arvesen | Vice President | 27.03.2017 | P |
| Ulstein | Jon Olaf Brett | Deputy Managing Director | 24.02.2017 | T |

P = personal meeting, T = telephone interview.

Table 2: List of case firm respondents

Five of these interviews were conducted in personal meetings with the respondents, while three took place over by phone or video conference. The personal meetings took place in Trondheim, Oslo, Bergen and Verdal, and all the interviews were conducted in the time period from February to April 2017. All interviews were tape-recorded after having informed the respondents about the voluntary participation in our study, and having asked for permission to record. Most interviews lasted for an hour, with a few being a little shorter or longer.

The format of the industry analysis was dominated by reading industry reports. In addition, we attended two seminars organised by the research project, two conferences, and contacted two additional interviewees, as described in 3.1.3.

## 3.3 DATA ANALYSIS

In order to analyse the empirical data in a thorough and structured way, the data analysis is conducted in a way that creates as little researcher bias as possible. An outline of the data analysis process is given in figure 9.

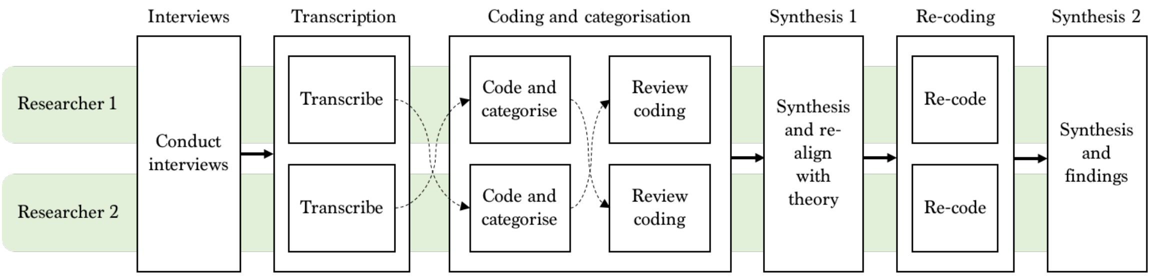


Figure 9: Data analysis process

After collecting data through interviews, the process of documenting the content begins. All interviews were recorded and documented though transcription.

The task of transcribing the interviews was divided between the authors. If one of the researcher was not present at an interview, this researcher was responsible for transcribing this interview. This ensures that both researchers know the content of each interview. Conversely, when coding the transcripts, the researcher that did not transcribe the interview was responsible for the coding process.

The coding and categorisation was conducted using web-based shared spreadsheets that enabled both researchers to work concurrently. The coding and categorisation was done by identifying interesting quotes, labelling them and clustering them based on the theoretical concepts that were discussed. One quote could be coded under multiple categories. To ensure that all coding was done in a similar manner, the first interview was coded by both authors together. In addition, the authors reviewed the coding of one another to ensure that nothing was forgotten or falsely categorised.

Following the coding and categorisation, the data analysis synthesis starts. Yin (2014) presents five techniques that can be used for analysing case studies; pattern matching, explanation building, time-series analysis, logic models and cross-case synthesis. The analysis method used in this thesis is a cross-case synthesis, which aims at deriving results from analysing multiple cases and the industry context. In order to do this thoroughly, both researchers do the synthesis together and match the results to extant literature. Based on the identified concepts, the quotes were re-coded to be clustered in more appropriately.

Finally, the ultimate synthesis of this thesis was conducted, resulting in the main discussion points and findings of this thesis.

The data analysis for the industry level analysis was less systematic. However, we deliberately targeted industry insight from a variety of sources, both supporting and sceptical toward the emergence and durability of the offshore wind industry.

## 3.4 QUALITY OF RESEARCH

Validity and reliability are important when it comes to establishing and assessing the quality of research (Bryman 2012).

### 3.4.1 *Validity*

Validity is the construct that the results of the study have integrity (Bryman 2012). It can be further distinguished into construct validity, internal validity and external validity (Yin 2014). This thesis aims at handling all these validity concerns.

*Construct validity* refers to the correct use of operational measures for the theoretical concepts that are studied. According to Yin (2014), it is particularly challenging to ensure in case study research. This thesis provides construct validity by data triangulation, meaning that multiple sources of data are used; documentation, interviews and reports. Construct validity is also addressed by making definitions of key concepts in the theory and discussion chapters of this thesis, to clarify what is actually meant by particular concepts and how they are identified by this study.

When assessing the *internal validity* of this study, the question is whether a conclusion that deals with causality really holds water (Bryman 2012).

To strengthen the internal validity of our findings, a preliminary thesis is distributed to the interviewees for respondent validation. According to Bryman (2012), respondent validation is particularly important in qualitative research to ensure that there is a good correspondence between the findings and the experience of the participants. Around four weeks before submitting the thesis, the interviewed candidates are given an account of our findings and have the opportunity to read through the findings yielding from their own company.

Throughout this process, the participants are also given the opportunity to refine or withdraw incorrect statements. This process lead to some clarifications of the quotes that are used, but the main content was not altered based on this feedback. This further strengthens the sense of validity of our interpretation of the interviews.

External validity relates to the generalising ability of the study. It is the extent to which the results and conclusions hold for other firms at other times. This property therefore be further discussed in the limitations of this study, cf. section 6.5.

### 3.4.2 *Reliability*

The *reliability* of a study refers to the property of being repeatable, meaning whether the results are consistent. It theory, it means that if another scientist were to repeat the same case study over again, it would yield the same results. In qualitative research, reliability is a property that is attained through the documentation of the procedures that have been followed (Yin 2014). We have approached this by developing a case study database that contains recordings, transcripts, encoding spreadsheets and general information about each case firm. This way, we secure that the the same study can be conducted again.

# Part III

# ANALYSIS

# 4 EMPIRICAL BACKGROUND

This chapter presents the empirical background from the two levels of analysis of this thesis. First, the chosen emerging industry context of offshore wind is presented. Sequentially, the background regarding our case firms is presented. The purpose of this chapter is to present the empirical background of this study as objectively as possible before analysing the empirical data in chapter 5.

## 4.1 THE OFFSHORE WIND INDUSTRY

The offshore wind industry has emerged to become one of the promising renewable energy sources of the future. In the bigger picture, renewable energy is an essential part of the transition towards a sustainable future for the planet, and the transition from fossil fuels to renewable energies has been placed on the political agenda in many countries over the past decades. The European Union's expressed goal of reducing greenhouse gas emissions to 20% below the levels emitted in 1990 by the year of 2020 (European Union 2017), has shown that there is political will and commitment to this transition. And on an international level, the Paris agreement has set reducing emissions on the global political agenda (United Nations 2017). For the offshore wind industry, this political backdrop provides an adequate security to trust that the shift is indeed coming, and that renewable energy sources will be important looking forward.

The announcements of these political goals have been vital milestones in the development of the offshore wind industry. Figure 10, on the following page, provides a timeline over several important milestones in the development of the industry. The timeline should be seen in conjunction with appendix D, which provides a list of selected offshore wind projects, since inception and until today, and thereby depicts the technological evolution of the early stages of the industry.

The offshore wind industry emerged in the 1990s as a natural sequel to the onshore wind industry. It started off much like other emergent industries with a focus on developing viable technologies and concepts. The technological development

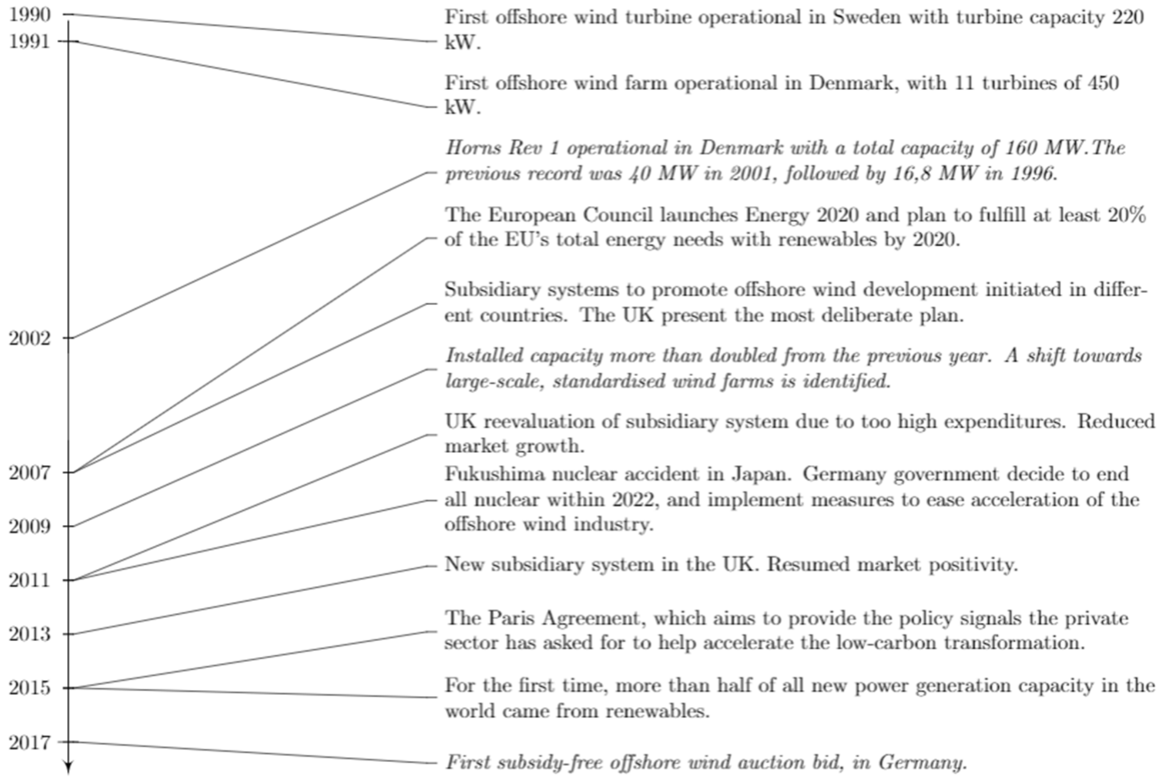


Figure 10: Offshore wind timeline

was based on knowledge from the onshore wind industry and petro-maritime industries; with wind mill competency from the first and offshore installation competency from the latter. Even though the offshore industry was based on technology derived from other industries, combining these technologies still proved to be challenging, and there was still a need for smaller test projects and further technological development to become viable industry, cf. appendix D.

According to Dedecca et al. (2016), the offshore wind industry was in its the initial phase from 1990–2001, the co-evolutionary phase from 2002–2008, and has been in the growth phase since 2009. The division made by Dedecca et al. (2016) is mainly based on the size of the wind farms, and that there may be other ways to identify when the industry has transitioned from one stage to another. In this thesis we address diversification into the offshore wind industry in the time span 2001 to 2016. Hence, we investigate some of the earlier entrants, as well as those who have postponed, but still entered before the industry is said to have reached maturity.

For some emerging industries, the sales volume never gets to a level where the industry is fully developed. The offshore wind industry, however, has grown to become a considerable renewable energy source. Even in times of economic recession, the industry has continued to grow, which shows the commitment to the projects once the investment decision has been made. Figure 11 shows the development in total installed capacity and annually added capacity of offshore wind. Even though offshore wind still accounts for a small portion of the renewable energy portfolio, the offshore wind industry has proven itself as a viable industry, with the European market at the forefront of the industry's evolution.

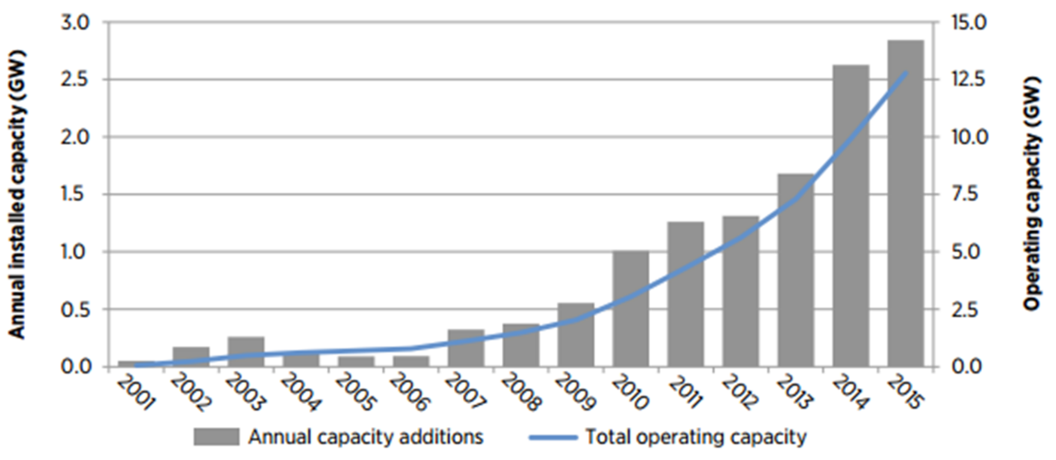


Figure 11: Global annual installed and operating capacity for offshore wind farms, 2001 - 2015 (Freeman et al. 2016)

The development of the offshore wind industry has in large been driven by technological development, which has given larger and more effective turbines that enhance electricity production for each installed mill. In addition, wind farms have gradually become larger, providing additional scale effect. From an economic perspective, the learning effects that create established methods and techniques, and the shift from tender to auction contracting, have reduced the costs across the industry line significantly. Not to mention the historically low interest rates in the financial market, which have reduced the opportunity cost of offshore wind investments notably.

### 4.1.1 *Offshore wind characteristics*

Based on industry reports (Freeman et al. 2016; MAKE Consulting 2016; IEA 2016) and topics addressed in seminars and conferences, we have identified some key properties, associated with the emerging offshore wind industry.

- **Capital-intensiveness**
  High cost of entry. Banks and insurance companies are important stakeholders.

- **Engineer-to-order and scale possibilities**
  Customisation necessary for each wind farm project. At the same time, there are mass production elements in the production once the customisation is done.

- **Industrial supply chain**
  High time to market. Typically 6 to 7 years from a tender is won to the offshore wind farm is commissioned.

- **Lack of established standards**
  Firms competing in the offshore wind industry are based in industries such as oil and infrastructure, with different contractual and cultural standards.

- **Politically regulated market**
  Tenders prevent natural market growth. Demand for offshore wind projects is higher than supply.

- **High pace of technological development**
  The industry growth is driven by technological development and cost reduction.

These characteristics show how the offshore wind industry differs from established industries, but also other emerging industries. When addressing context-related topics in this thesis, these specific offshore wind characteristics will be discussed in order to account for the particularities imposed by this specific industry context.

### 4.1.2 *Offshore wind outlooks*

The future of the offshore wind industry is contingent upon the qualities it demonstrates compared to other sources of energy. Wind is generally considered as an indigenous, competitive and sustainable renewable energy source. In spite of these traits, the development of *onshore wind* is often inhibited by concerns regarding noise, visual impact, bird life interference, and other environmental issues. These factors, combined with the scarcity of appropriate installation sites onshore, has lead to an increased interest in placing wind turbines offshore. Offshore production will to a greater extent eliminate the aforementioned issues associated with onshore wind energy production[1].

The availability of large-scale offshore sites combined with the opportunity to make each turbine larger and more powerful, makes offshore wind an attractive alternative for low-carbon electricity. The fact that winds offshore are both stronger and more stable than the ones onshore, further contributes to making offshore wind a natural choice as the next generation of wind power. Still, offshore wind plays a relatively small role in the renewable energy portfolio when compared to other renewable energy sources such as solar (PV) and onshore wind on a global scale, cf. figure 12 on the next page.

The main reason for this relatively small role has been the relatively high cost associated with the industry. Because the offshore wind industry is still a young industry, it is still costlier than many second generation energy technologies. However, the industry has already developed significantly since its inception, and the levelized cost of energy[2] is now much lower now than any forecast predicted (MAKE Consulting 2016).

From inception and until today, the cost curve for the offshore wind industry has decreased much more rapidly than initial industry forecasts expected. Originally, the estimated cost target of energy production in the offshore wind industry was EUR 80/MWh by 2025 (Garlick et al. 2016). Thus, the cost levels of the contracts won in late 2016 places the industry 9 more

1 There are some environmental concerns related to offshore wind installations as well, regarding how noise generated by wind turbines may affect whales and how too many turbines may obstruct the scenery. However, the environmental opposition against offshore wind in much less prominent than against onshore production.

2 Levelized cost of energy (LCOE) is a common measure in the utilities industry to assess the relative cost of electricity. It is the net present value of the unit-cost of electricity over the lifetime of a generating asset.

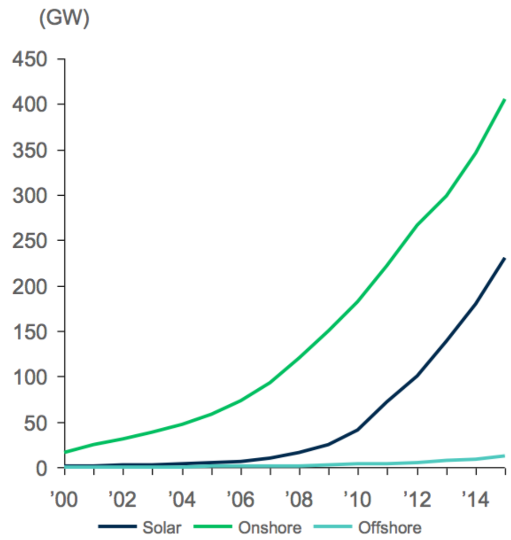


Figure 12: Installed renewable energy capacity globally in solar (PV), onshore and offshore wind (MAKE Consulting 2016)

than years ahead of schedule (IEA 2016), after Vattenfall won the tender for the Kriegers Flak project at EUR 49,9/MWh (Vattenfall 2016). The most recent milestone in the industry development is a contract for offshore wind development in Germany (Andresen 2017). It is the only contract won without subsidy support so far, and the project stands out due to particularly lucrative factors such as shallow waters, great wind conditions and closeness to shore. In addition, but more in thread with all recent tenders, the wind farm is expected to be operative first in 2022. The developer has anticipated a continued technological evolution and associated cost reduction in their calculations, in line with general industry forecasts.

In spite of the possibility that this latest development is a special case, it still demonstrates the potential of offshore wind. The fact that offshore win farms now *can* be developed without subsidies, alters the perception of offshore wind as being too expensive and shows a promising future on the horizon.

## 4.2 THE CASE FIRMS

Table 3 provides an overview over the firms that have been analysed in our case study. Year of entry is defined as the year when the firm obtained their first contract, and the amount of projects accounts for all officially signed or fulfilled contracts within the offshore wind industry. The firm type specifies which sector each firm belongs to, while core product or service is the most important value proposition each firm offers the offshore wind industry. The number, 1 – 8, which is allocated to each firm will be used to reference the empirical evidence obtained from each firm, in chapters 5 and 6.

| # | Firm | Year of entry | # Projects | # Employees | Firm type | Core product or service |
|---|---|---|---|---|---|---|
| 1 | Statoil | 2005 | 7 | 18 000 | Project owner | Project Development |
| 2 | Kongsberg Renewables | 2016 | 1 | 450 | Data Analysis | Condition monitoring |
| 3 | StormGeo | 2007 | 50 - 100 | 340 | Data Analysis | Weather Services |
| 4 | Aibel | 2011 | 2 | 3 000 | Manufacturing | Substation Platforms |
| 5 | Kværner Verdal | 2007 | 2 | 2500 | Manufacturing | Jackets |
| 6 | Nexans Norway | 2001 | 13 | 1600 | Manufacturing | Cables |
| 7 | Fred. Olsen | 2011 | 24 | 600 | Maritime | Turbine Installation Vessels |
| 8 | Ulstein | 2015 | 3 | 6 | Maritime | Service Operation Vessels |

Table 3: Overview of case firms

### 4.2.1 *Case firm descriptions*

A short description of the eight case firms follows below. The description will briefly address each firm's background, entry into offshore wind, and the current offshore wind activities for the firm.

*Statoil*

Statoil ASA is Norway's largest company, and is publicly traded with the Norwegian Government as the majority owner. The firm was established in 1972, in the aftermath of the discovery of oil on the Norwegian continental shelf. Since then, it has become one of the world's largest oil and gas companies. Today, Statoil identify themselves as an energy company, expecting up to 15-20% of their investments to be directed towards new energy solutions in 2030. As of today, their activities are still mostly associated with the oil and gas industry. Initially, the offshore wind interests became a part of the firm when Statoil and the oil and gas division of Norsk Hydro merged in 2007. Hydro had held a 50% stake of the joint venture owning the right to develop a wind farm at Sheringham Shoal, since 2005. Moreover, the floating wind mill-technology, called Hywind, is a product derived from technology developed by Hydro. Thus, Statoil's offshore wind activity can be said to be a result of M&A activities. However, the offshore wind activity was only at a planning stage at the time of the merger, and Statoil has since increased their role both as a financial investor as well as a project developer.

*Kongsberg Renewables*

Kongsberg Gruppen ASA is present in four business areas: maritime, defence systems, protech systems and digital. Kongsberg Digital AS was officially established in 2014, and consists of maritime simulation, oil & gas, and renewables & utilities, with the offshore wind efforts being a part of the latter. When Kongsberg diversified into onshore wind, they hired new employees with experience from the generic wind industry and built up a new department. In this thesis, however, we only address the motivation for and entry into the *offshore* wind industry. The entry is defined as obtaining the only contract Kongsberg currently has within the offshore wind industry, at Statoil's first ever floating wind mill. Statoil was awarded a grant from ENOVA[3] to test the condition monitoring capabilities of the Kongsberg EmPower system for the floating wind turbine Hywind Demo.

*StormGeo*

StormGeo AS was founded in 1997. The company offers weather forecast services to industries and markets that experience moderate or high weather dependencies. They offer capture, translation and forecast modelling of meteorological data, including planning, installation and maintenance of all sensors. The firm delivers services to six core industries: shipping, offshore oil and gas, onshore, aviation, media and renewables. Within Renewables, offshore wind has become their most important market. StormGeo started its offshore wind activities in Germany, and is currently the global market leader of weather forecasting

3 ENOVA is a Norwegian state enterprise that supports the implementation of new, climate-friendly technologies through financial contributions.

in the offshore wind industry.

*Aibel*

Aibel AS was officially founded in 2002, but has a more than 100 year long history under other names. They started out with repairing ships, but have in recent years been most heavily present in the oil and gas industry. Aibel delivers products and services within modification and yard services, oil field development, and renewables. They see themselves as a total solution supplier, able to provide the client with a full range of EPC services[4]. In the offshore wind industry they have in cooperation with ABB delivered a transformer station (HVDC-platform) to the Dolwin Beta wind farm, an are currently developing solutions for substructures for floating offshore wind turbines at the Hywind Pilot Park in Scotland.

*Kværner Verdal*

Kværner AS, location Verdal, is part of the Kværner ASA group. Kværner ASA provides operators with complete oil and gas offshore platforms, as well as onshore process plants. Kværner's yard in Verdal, formerly known as Aker Verdal and Kværner Verdal, is a construction yard that produces large steel constructions, with the main product being steel jackets. These have historically been deployed in the offshore oil industry, but similar jackets have in later years been manufactured for the offshore wind industry. To this date, Kværner's yard in Verdal has produced foundations for two offshore wind projects, both located in Germany. The first project was production of 6 tripod foundations, while the second was an EPC-contract for 49 jacket foundations. Kværner stated in 2012 that they would no longer actively pursue offshore wind projects (Recharge 2012).

*Nexans Norway*

Nexans SA is a French company, which manufactures different types of cables. Nexans Norway AS is wholly owned by Nexans SA, and has approximately 1 550 employees. Nexans Norway is among the world's leading manufacturers of offshore control cables and high-voltage submarine cables. In addition, the firm is a leading supplier of power, telecommunications, installations and heating cables in Norway. In the offshore wind industry, Nexans Norway first and foremost supply high voltage submarine cables, manufactured at the specialised

4 Engineering, Procurement and Construction

Halden plant. They also offer cable installation.

*Fred. Olsen*

Fred. Olsen Windcarrier AS was established in 2008. The firm is a subsidiary of Fred. Olsen Ocean Ltd, which is wholly owned by Bonheur ASA. The Fred. Olsen companies date back to 1848, when they entered the maritime industry, through ship owning and later also ship building. They have since then entered a range of emerging industries such as aviation, oil and gas exploration and production, and latest within renewable energy. Fred. Olsen Renewables, another Fred. Olsen subsidiary, has been involved in onshore wind since the 1990's. In the offshore wind industry, Fred. Olsen Windcarrier NO owns and operates two purpose built jack-up installation vessels, while Fred. Olsen Windcarrier DK they have a fleet of seven transfer vessels.

*Ulstein*

Ulstein International AS are headquartered in Ulsteinvik, Norway, and are a part of the family-owned Ulstein Group. Ulstein International AS manages the global sales activities of the Ulstein group, and engage in project establishment and business development of new projects. They work closely with other Ulstein businesses, such as Ulstein Design & Solution AS and Ulstein Verft AS, also located in Ulsteinvik, to ensure the whole process from project selection to vessel design and shipbuilding. Ulstein have designed a range of offshore wind specific vessels for different maritime segments, but have so far delivered two service operation vessels (SOVs), Windea Leibniz and Windea La Cour, and have a construction support vessel (CSV) under construction.

### 4.2.2 *Case firm characteristics*

The case firms thus represent a wide spectrum of the offshore wind supply chain. However, they have several shared characteristics. These are:

- Previous experience with diversifying into new markets
- Obtained at least one contract in the offshore wind industry
- Entered the wind industry during the co-evolutionary stage
- A substantial part of their business rooted in the offshore oil industry

- Defined their offshore wind presence as successful so far

The firm's were not required to specify whether their successful entry was measured as financial profitability, market leadership, market position, brand value or any other quantitative parameter. It is merely an internal evaluation of their own strategic objectives.

# 5 EMPIRICAL ANALYSIS

## 5.1 MOTIVATION FOR EARLY ENTRY

To enter an emerging industry at an early stage is in many ways a risk-seeking endeavour. The immense *costs* associated with constructing an offshore wind farm, combined with the *uncertainty* regarding further development and standardisation of the market, signify a remarkable risk for firms that choose to invest. As an emerging industry appears as a particularly challenging context to enter, a wide range of firms still choose to diversify into emerging industries at an early stage of their development. This section explores why.

### 5.1.1 *General diversification motivation*

Some of the factors identified to that have motivated the case firms to enter the offshore wind industry at an early stage are also factors of motivation for diversification in general. These are identified in table 4.

| **Motivation** | **Description** |
|---|---|
| *General ambition for growth* | Create shareholder value both in the short and long term |
| *Relative market attractiveness* | Push factors in existing industry presence and pull factors from other industries |
| *Risk distribution* | Decrease unsystematic risk and vulnerability to market factors |
| *Competency relatedness* | Reduce both internal and external barriers to entry |

Table 4: Motivation for diversification

We will briefly address the first three here. The latter, regarding competency relatedness, will be discussed in detail when specifically addressing the motivation for early entry specifically, in section 5.1.2.

*1/5, or maybe 1/10, attempts are successful.*
*— StormGeo*

Large corporations often emphasise their general ambition for growth, and that alterations in industry presence lies in the firm's nature (1, 2, 7, 8). They will at all times be aware of a set of potential growth markets, and be prepared to enter if an appealing opportunity arises (1, 3, 4, 6, 7). Not all attempts at diversification will lead to actual entry, and not all entries will necessarily be profitable. However, diversification can be highly profitable if successful. And if a firm general ambition for growth includes optimising expected economic profits, the firms have to actively and regularly re-evaluate their scope (1, 2, 3, 4, 7, 8). Fred. Olsen (7), for instance, have been present in a wide range of industries throughout their history. They were early entrants into the oil industry in 1965 as an attempt at related diversification, and gradually shifted more and more resources in that direction as oil proved viable as a main activity. Now they are attempting a variation of the same strategy in shifting from the oil industry to renewables, with the offshore wind industry being an important segment. The firm has identify this continuous ability to adapt to market megatrends as a main source of their success. Being positioned for entry in multiple industries at the same time is a requirement to be able to make such shifts (1, 2, 4, 7).

*The offshore wind industry was something we phased in as oil and gas pretty much disappeared.*
*— Ulstein*

While diversification can be motivated solely by having identified an attractive, new market (2, 4, 6, 7), it can also indicate undesirable push-factors in their current market segments. StormGeo (3) explored offshore wind largely because they encountered challenges with providing desirable products in the onshore wind industry. And Kværner (5) allocated an employee to investigate the offshore wind industry in 2003, as a response to internal forecasts that indicated a decline in their oil industry activity. Addressing pull-factors, a recognised reason why the offshore wind industry can be perceived as attractive, is due to being part of the recognised megatrend of a shift from carbon-intensive to carbon-efficient, renewable energy (1, 2, 3, 4, 7, 8).

*We knew that this was a growing market.*
*— Aibel*

However, a range of industries are associated with the renewable sector, and many of the case firms are also present in other renewable industries (1, 2, 3, 4, 7). The attractiveness of the offshore wind industry in particular is heavily linked to its status as an emerging industry, which will be further addressed in section 5.1.2.

Companies operating solely in one industry are extremely vulnerable to change in market factors. Different, or preferably inverse, business cycles, work as a form of insurance, as a downturn in one industry does not necessarily equal a crisis for the firm as a whole. Ulstein (8) specifically states that the most frequent reason why they have ended up pulling out of what appeared to be desirable markets, with attractive markets factors and related competency requirements, is that the markets proved to have a business cycle more similar to their other business areas than they had initially thought. However, shareholders are invested in a firm to be exposed to their specific market factors, and are often critical toward a too dramatic shift in risk exposure.

All case firms have a significant presence in the offshore oil industry. The market risks in the oil industry are first and foremost related to the fluctuating price of oil. In contrast, a presence in offshore wind secures a quite steady revenue steam. In addition, the oil industry is a mature, high-carbon industry, and highly vulnerable to the gradual shift towards a more carbon-efficient energy mix. Offshore wind mirrors all these uncertainty factors. The risk profiles of the oil and the offshore wind industry are thus complementary, to a high degree. Entry into offshore wind is highly risky, but it exposes the firms to a new set of risk elements, compared to many mature industries, and to the oil industry in particular. Being present in both can therefore be seen as desirable.

*It's fine as long as it's under the radar, but there has been scepticism toward including renewables as a significant part of Statoil's investment profile.*
*— Statoil*

### 5.1.2 *The ease of entering early*

> *So everyone had the same starting point. No one was an expert at this - no one!*
> *— Fred. Olsen*

As addressed, a main source of motivation for early entry is that the firm has identified an attractive opportunity for growth in a particular industry. All of our eight case firms believed that offshore wind was a growing industry, and identified an attractive potential business case there. Specifying the ambition to enter *early* can simply be based on an ambition to take part in expected growth as early as possible, implying that that less of the growth potential would have already been captured by other firms.

Those firms that enter early, enter a competitive environment where no one is an expert. This implies no established actors, which drastically reduces some of the *entry barriers* often associated with acts of diversification. When attempting diversification into a mature industry, or into an emerging industry at a later time, the incumbent firms have already developed networks, product standards, lock-in effects and a general way of doing business (2, 3, 4, 5, 7, 8). The lack of established actors lowers the competition to be the most attractive supplier, and a lower level of specialisation can be seen as adequate.

*Product-wise, it's quite similar, but competency-wise it's the exact same thing.*
*— StormGeo*

It is evident that the reason the offshore wind industry first appeared on the case firms' radar is because it demands products and services that to some degree are similar to products and services that the firms already offer. Ulstein (8) decided two years ago to alter their strategy to include the entire ocean space and not just the oil and gas industry, because in the end "a boat's a boat". Aibel (4) state that they saw possibilities for synergy effects between their oil and gas operations and offshore wind, due to similar competency and equipment requirements. And Nexans (6) merely viewed offshore wind as a new industry demanding submarine cables. When asked whether their presence in the oil industry and the offshore wind industry was related, StormGeo (3) responded "The products are quite similar, maybe 10% is different. But competence wise it's the exact same thing!".

*No matter how much we want to, trying to do things we don't know anything about rarely ends well.*
*— Ulstein*

When the case firms refer to their own competencies, the empirical evidence states that they are referring to the combination of the firm's technology, and the skills of the firm's employees. The level of competency relatedness in the offshore wind industry and the industries where each firm was already present is thus hereby defined as *similar demand for the firm's technology and for the skills of the firm's employees.*

To simply quantify how related each case firm initially saw their existing competencies compared to what was required in the offshore wind industry, the table below illustrates the necessity to require *any new employees* to possess all the competencies required to attempt an entry into the offshore wind industry. The categorisation is based on whether the firms (1) believed that it needed to obtain new competency or (2) believed further developing the existing competencies of their current employees to be sufficient, cf. table 5.

We see that only two out of the eight firms needed to recruit new employees obtain the competencies they believed to be required to enter the offshore wind industry (1, 7). The six remaining case firms, category 2 firms, believed developing the

| # | Firm | Response | Category |
|---|---|---|---|
| 1 | Statoil | Some. But we mainly utilised expertise from Hydro and Statoil. | 1 |
| 2 | Kongsberg | You need someone who knows the industry. We hired externally when entering onshore wind, but those same people are now working on offshore wind. | 2 |
| 3 | StormGeo | Not initially, but later, for capacity reasons. | 2 |
| 4 | Aibel | No, we did not need any new personnel to to enter the industry. But we have supplemented later. | 2 |
| 5 | Kværner | No, we used our own employees. | 2 |
| 6 | Nexans | We did not have to hire anyone to obtain the competency required to enter a new market, but we had to hire later due to increase our capacity. | 2 |
| 7 | Fred. Olsen | Yes! We built a whole department from scratch. Built around myself and three others that had worked with tankers. | 1 |
| 8 | Ulstein | No, we identified people within our own firm. | 2 |

Table 5: Recruitment needs: Did you hire new employees to enter the offshore wind industry?

competencies of their existing employees to be sufficient (2, 3, 4, 5, 6, 8). This may reflect that the internal entry barriers to attempt an act of related diversification were quite low, as the firms could simply reallocate some of their own employees.

StormGeo (3) had to develop from the oil industry's demand of predicting wave height with accuracy of around one meter, to their offshore wind client's demand of detailed information down to every 10 cm. Kværner, Kongsberg, Aibel and Ulstein can also be said to have had similar internal barriers to develop a offshore wind-specific product or service. All these firms would have to expand their knowledge and alter their existing products and services to enter the offshore wind industry. And an actual entry would require some level of strategical deliberateness, organisational rearrangement and technical engineering (2, 3, 4, 5, 8). But especially in an emerging industry context, where the products are not standardised yet, competency relatedness provides a desirable position for industry entry.

Nexans holds a particular position, as the competencies required to supply cables for the offshore wind industry was not only similar to, but *identical* to the competencies the firm already held. Each cable is custom-made, so the specific product was not identical to something they had already supplied, but very similar. Thus, this is an outlier of what at attempt at related diversification can look like. According to Ulstein (8), "you see more and more shipowners trying to use existing ships in this new industry". Ulstein themselves have not attempted such a move, but the quote illustrates that equivalent moves exist also in other parts of the supply chain. Some firms simply see the offshore wind industry as a new market to utilise existing products, or as Nexans: to utilise existing technology.

Statoil (1) is one of the largest offshore oil companies in the world. The firm states that established competencies from the oil industry provides a strong competitive advantage also in offshore wind. Their experience with management systems, design and legal issues, as well as stakeholder management and general project execution capabilities are all traits very much related to competencies required to operate in the offshore wind industry. Fred. Olsen (7) already knew how to follow up on yards to build ships. They also knew how to run a ship, and they were familiar with manuals and security requirements. But Fred. Olsen had to build an offshore wind specific division from scratch to develop a ship for the offshore wind industry, by recruiting externally. Statoil also chose to employ new people to obtain the competencies required to enter the offshore wind industry. Both firms already had *similar competency* in-house, but had to supplement by retrieving expertise externally.

### 5.1.3 *The value of entering early*

Early entry is associated with reduced entry barriers due to the lack of established actors. Based on the same rationale, early entrants can obtain learning effects and become those established actors. Aibel (4) state that they are pleased with their time of entry, even though they faced challenges due to market immaturity, because entering now would have been much more difficult. According to StormGeo (3), when entering an emerging industry, "timing is crazy important". To be able to understand the emerging industry and it's dynamic, it is important to be visible and present as early as possible (3, 4). Obtaining a first contract early can help firms win the next contract as well, and further secure a position in the industry over time.

*If we had entered offshore wind any earlier, we might have built even smaller boats, incapable of competing in the current market — Fred. Olsen*

However, early entry is also associated with a high level of risk. Statoil (1) states that right before their first offshore wind project, a similar project was executed by a different actor. The other actor encountered challenges related to fastening the pole to the turbine with a cement glue. Statoil planned to do the exactly same thing, but since became aware of the challenges up front, they were able to find an alternative solution. And had Fred. Olsen (7) entered even earlier, their boats would probably be obsolete already.

*We entered in 2014-15 and that was definitely early enough.*
*— Ulstein*

Being *first* comes with a high risk of things not going as planned, and both Statoil and Fred. Olsen are thankful that they did not enter any earlier. But they state to be pleased not to have entered any later either. In fact, all the case firms, in retrospect, claim to be pleased with their own timing. This despite the 15 years that separates the first (6) and the last (8) entry. The table below provides an overview of which considerations the firms had regarding the timing of their own entry into offshore wind. They are categorised based on whether their early entry was (1) a in intentional choice or (2) mainly a derivative of identifying an attractive project, cf. table 6.

| # | Firm | Response | Category |
|---|---|---|---|
| 1 | Statoil | Being present early provides an established track record and machinery ready to capture growth as the industry develops. We're not the market leader, but we are positioned to be a part of this. | 1 |
| 2 | Kongsberg | We're developing a disruptive product so naturally we aim to be first to market. | 1 |
| 3 | StormGeo | Timing was crucial. We were an established actor before the competition became too tense, and gained lots of valuable experience. | 1 |
| 4 | Aibel | It would have been harder to enter now, because we wouldn't have the experience that we've already obtained. | 2 |
| 5 | Kværner | We entered when we found a contract we wanted. | 2 |
| 6 | Nexans | We entered when we identified a demand. | 2 |
| 7 | Fred. Olsen | If we entered earlier we might have build even smaller boats... But you can't fall behind either! Time-to-market is important in offshore wind too, the first mover gets a big part of the market. | 1 |
| 8 | Ulstein | We value the importance of waiting, it's saved us millions of kroners. Having established premise providers is crucial, and entry in 2015 was early enough. | 2 |

Table 6: Timing of entry: What considerations do you have regarding your timing of entry into the offshore wind industry?

The table illustrates that an act of diversification can be attractive for some firms even if it turns out to be a one time project. Category 2 firms are simply motivated by available market demand, and not necessarily based on deliberate, long-term strategy for the firm as a whole, even though the firms naturally hope to capture market share in the long-term as well (4, 5, 6, 8). Other firms might be prepared to invest money in the short term, due to a long term expectation for growth (1, 2, 3, 7). The latter group of firms are in our study found to be the owner and developer of offshore wind mill farms (1), as well as three service providing firms. The fact that service providing firms have are more time-term oriented can be a natural consequence of them having to carry the majority of the investment risk themselves. The category 2 firms are manufacturing firms, delivering engineer-to-order products.

*We saw that a first-mover position would only drain us of equity and unnecessary resources. — Ulstein*

It is evident the the actual year of entry is not the most interesting measure in regards to the deliberateness of a firm's timing. The interesting strategic considerations adress the extent to which each firm's part of the supply chain has stabilised. The three first case firms to enter were Nexans (6) in 2001, followed by Statoil (1) four years later, and Kværner in 2007. Two of these delivered a quite standardised product, namely cables and tripods, and both fall under the categorisation of deliberate earliness, as their entry was motivated by identifying a tender for a product they already had a proven track record for. Statoil (1) entered as an owner and project developer, and thus they did not need to convince a client in the same way as supplying firms. They thus stand in an isolated category, as their largest barrier to entry to obtain their first contract, was internal will.

The fourth firm to enter, early and wholeheartedly in 2009, was Fred. Olsen. A offshore wind report published in 2016 highlight Fred. Olsen as the big winner among all Norwegian firms currently in the offshore wind industry (MAKE Consulting 2016). The report estimated that the firm has had a 10% market share for turbine installations so far, and has won 18% of the already awarded contracts leading up to 2020. They chose to enter as early as they did, because they wanted to take a market leading role. And they do indeed hold such a position now. But it is evident that they have spent a lot of resources on obtaining that position.

Ulstein (8) was the last firm to enter, out of all eight firms, in 2015. However, they considered the same move as Fred. Olsen, namely to enter the turbine installation segment at an early stage. But the firm was not willing to enter a market that lacked established premise providers, due to the high risk such a move would involve. Not knowing who the stakeholder are, drastically increases the uncertainty of any predictions about how the industry will evolve. Ulstein underline the importance of not entering too early, to avoid high burning rates on activities that they expect to come, but possibly will not. Which can to some extent be said about Fred. Olsen's entry, since the amount of installation projects have not been as compact as initially expected. However, as the established actors and premise providers emerged around 2013, Ulstein eyed a range of potential business opportunities, and decided to take one. Because "when one first identifies an attractive niche, moving fast can be crucial to successfully enter a new industry". To move fast enough, one can not first conduct every analysis they would have preferred to do. But they first waited until they had a predictable outlook of what the market demand would look like.

Ulstein (8) state that they have found the golden mean between entering too soon and too late. They have entered successfully, but without the extremely high risk that Fred. Olsen (7) had. Fred. Olsen on the other hand, state that they entered early, and that is why they have gained a market leading role. Ulstein are now considering entry into the turbine installation segment, but with boats designed to handle the next generation of mills, 10 - 15 MW, which the existing, such of those operated by Fred. Olsen, will not be able to supply. Fred. Olsen are also considering to build new boats, if that proves necessary to follow the technical development in the industry. But they will not do it in the same manner as the last time, building the boats before having any guarantee that they will have a contract waiting.

The value of early entry is higher is the firm's ambition is to be present in the long-term. None of the case firms motivated their early entry by an expectation that the offshore wind industry would become their core industry. But Statoil (1) want to emphasise that offshore wind is currently their main activity within renewables, and Fred. Olsen (7) that the offshore wind industry is where they expect to grow the most, as the peak of the oil era has been passed, and that a turn toward renewable is currently ongoing. StormGeo (3) is the market leaders within their segment, and their stated long term strategy is world domination. And Kongsberg (2) aim to disrupt the industry once their product is finalised. Nexans (6) also have a heavy industry presence, having delivered cables to 13 wind farms, but they state that offshore wind-specific projects will never be prioritised at the expense of other projects. This notion also applies to Aibel and Ulstein (4, 8), while Kværner (5) has already exited the industry. The case firms' long-term ambition determines whether the timing for industry entry is a deliberate action towards long-term presence or mainly an short-term opportunity, where the timing was a derivative of an emergent strategy.

## 5.2 OBTAINING THE FIRST CONTRACT

To win an tender (5, 6, 8) or persuade a client to give them a contract directly (2, 3, 4, 7), the case firms had to convince the market that they could deliver the product at the agreed upon time, price and quality, better than potential competitors. In research question number one we addressed the case firms' motivation for entering early. And found that the timing was in large a function of the offshore wind industry's demand for products and services that the firms were well positioned to supply. This second section takes it a step further and addresses the value that the a firm's existing competencies has to actually be awarded a contract in an emerging industry. We discard the wide range of market factors that will also influence the potential client's decision, and focus the analysis on the markets perceived value of the firms' existing competencies and value proposition.

### 5.2.1 *Track record as a prerequisite for entry*

> *You need references and you need a good name, if not you won't get a penny. You can probably get a ship yard for free, I mean, there is extreme over capacity. But you'll never get a bank to finance building a ship there.*
> *— Ulstein.*

Projects in emerging industries, are always associated with a significant level of risk. The immense costs associated with building an offshore wind farm, mean that any technical flaw or installation bottleneck can have huge financial consequences for the project as a whole. Thus, project developers want to be as certain as possible that all their suppliers deliver on both time and quality. However, the delay associated with developing new, custom-made solutions is also costly. Thus, as evident in the offshore wind industry, the first projects were in large dominated by trying to utilise technologies originally developed for other industries and purposes.

In established industries, finding suppliers with a proven track record of having successfully delivered the same product or service on time, with the right quality, is established practice to reduce risk. But in emerging industries there are no established firms, standards or technology. Incumbents from other, related industries can have a track record of having delivered *similar and successful* projects. Statoil (1), actually being a project developer, and having bought products and services from several of the other case firms, confirm this notion. One can question whether a proven track record can directly represent a firm's existing competencies, or if it just reflects that the firm is perceived as a *proven brand*. However, this track record will provide the firm with at least some level of credibility and therefore a competitive advantage, depending on how similar the previous product is to the new one.

Offshore wind is so cost-intensive that it can be defined as a financial activity, with the banks and insurance companies as key stakeholders (1, 8). Especially in industrial industries, like offshore wind, proof of concept is practically a requirement to enter some of the value chain activities. And the banks can simply say no if a firm tries to choose an unknown, and thus risky, supplier, for any core activity (1, 6, 7, 8). All our eight case firms have a proven track record from different industries related to the offshore wind industry. Their most related and relevant experience are from offshore oil (1, 3, 4, 5), maritime (7, 8), onshore wind (2), and submarine power cables (6). But to enter the offshore industry, it was less relevant where they came from, and rather how related their capabilities and track record were.

In the table below we address the responses from the firms when asked about the main reason why they were able to obtain their first contract. And they all highlight the absolute requirement of having existing relevant experience[1]. The categorisation is based on whether (1) a proven track record, (2) proven concept or (3) proven technology was necessary to obtain the contract, cf. table 7.

The three firms Nexans, StormGeo, Kongsberg and Kværner had a similar approach to obtain their first contract. All had a track record of delivering very similar products and services to the offshore oil (3, 5), onshore wind (2) and submarine power cables (6) industries. Therefore, they focused their efforts on approaching decision makers at conferences and by directly contacting potential clients.

*A track record is one of the things clients care about the most. The same naturally goes for getting a really bad track record, that's two sides to the story.*
*— Fred. Olsen*

1 Excluding Statoil, since they entered the industry as an owner/investor, and thus did not have to win a contract based on a value proposition, but merely be provide the highest bid to win a contract

| # | Firm | Response | Category |
|---|---|---|---|
| 1 | Statoil | Internal will to make the investment. | - |
| 2 | Kongsberg | Proven technology from onshore wind. We have come far within condition-based maintenance. | 1 |
| 3 | StormGeo | Experience from the oil industry combined with an understanding of the clients challenges. And being locally present in Germany. | 1 |
| 4 | Aibel | Having developed a concept that the client believed in, in cooperation with ABB. Standard solutions for HVDC-platforms don't exist yet. And also, price. | 2 |
| 5 | Kværner | We had made jackets for the oil industry. And then we were visible and present among potential offshore wind clients. | 1 |
| 6 | Nexans | We were one of very few firms supplying the required technology. | 1 |
| 7 | Fred. Olsen | We had a purpose-built ship available and ready. | 3 |
| 8 | Ulstein | Our boats were innovative, we had to pretty much start from scratch due to the low-cost focus of the industry. The product was perceived as suitable for is purpose. | 2 |

Table 7: Obtaining the first contract: What was the main reason you were able to obtain your first contact?

By becoming a recognised brand they managed to receive their first contract due to a proven track record from a related industry. Kværner and Nexans won their first contract through a tender, while StormGeo and Kongsberg was awarded theirs after having persuaded a client. All three firms had to provide an understanding that they would alter their products to best fit the offshore wind needs, but neither of the firms had to make any large investments into creating a custom-made product *before* obtaining the contract. A *proven track record* from a similar industry was adequate be perceived as competent enough to gain the first offer.

Ulstein has a proven track record from a range of maritime operations, but they have to design a new ship to win a contract in a new industry. They were present at conferences and seminars from early on, to promote themselves and their vision for offshore wind, but postponed the actual product innovation phase until they found a potential client that they considered a proper fit. Which turned out to be Windea, owned by Siemens. When Ulstein chose to attempt an entry into offshore wind, they chose to do so with maintenance vessels. This conclusion was reached after having had a close dialog with Windea, becoming reasonably certain that the product they wanted to offer was a fit with market demand. Their track record from the maritime industry was adequate to get them in the door, but they had to develop a new product to win a contract. And that product was more based on appealing to external market demand than pure resource based consideration of internal capabilities.

Aibel won their first contract through a tender, in cooperation with ABB. ABB was the official winner of the tender, Aibel being accounted for as a supplier. But the winning concept was developed by the two firms in unison, as one holistic product. Aibel obtained their relationship with ABB through a proven track record of having created HVDC-technology for the oil industry, but had to develop a offshore wind specific product that the end client believed in, before they were awarded a contract within the offshore wind industry.

Both Ulstein and Aibel obtained their first contract in offshore wind by utilising their track record from the maritime and offshore oil industries to get inside the door. From there, they thoroughly analysed what the industry demanded through close dialog and cooperation with already established actors. They won their first contract because their product offering was perceived as desirable, and also, price was essential. Both Ulstein and Aibel used cost-efficiency as a key selling point, referring to how it would help the offshore wind industry to reduce subsidy dependence. They spent time understanding their potential clients and developed a product offering based on that, but founded on their core competencies. And to win the tender they needed a finalised product offering. A proven track record was not enough, Ulstein and Aibel needed a *proven concept*.

Fred Olsen (7) tried to refer to their proven track record in building ships, combined with a finalised ship design, to win a contract. Their reputation got them in the door with a range of potential clients and they guaranteed that "if you give us a contract, we'll build the ship". Fred. Olsen were certain that they had both a proven track record and a proven concept; they can build ships, and this specific ship would be ready at time and with all practical requirements intact. Still, no one would give them a contract. A central reason being that they were worried that the ship would not be ready on time and become a bottleneck for installation. So Fred. Olsen built the ship themselves, all risk on them. And were not awarded a contract before they could prove with certainty that the ship would be ready at a specific date. A proven concept was not enough, they had to have a *proven technology*. The client wanted to know for a fact that the ship would be 100% finished and available when they

*"We're Fred. Olsen! So you can give us a contract? We'll order a ship as soon as we get a contract." But it was out of the question, because no one had made a boat like that before...*
*— Fred. Olsen*

needed it, and to get there they practically wanted to see the ship in its final form. We conclude on three distinct levels of external requirements to be able to enter an emerging industry, presented in table 8.

| Requirement | Properties |
|---|---|
| *Proven track record* | Experience with delivering a similar product or service to a different industry |
| *Proven concept* | Proven track record combined with having engineered an industry-specific concept in dialog with the client |
| *Proven technology* | A tangible product offering that the firm can prove guarantee will be |

Table 8: Proven specialisation: External requirements to obtain a contract in an emerging industry

*Initially, for many others in the firm, offshore wind seemed a bit... Carl I. Hagen would use the word foreign-cultural. But now, there is broad support in the cafeteria and people know what it is I'm working on.*
*— Statoil*

Statoil stands as an isolated category, as their main barrier to entry was internal. But the internal process of aligning the entire firm to attempt industry entry, is also simplified if the firm has a proven track record for similar endeavours. This finding is also relevant for all the other case firms. A firm's existing competencies are important due to industry restrictions, but also due to internal considerations. Firms and their employees are is often resistant to change (1, 8), but if the change is still closely linked to their core competency, the company culture may appear less threatened.

### 5.2.2 *Blinded by relatedness*

> *All our activities are related, but they live their own lives and have their own market mechanisms.*
> *— Ulstein*

We defined successful entry as being able to obtain one's first contract in the offshore wind industry. And though we are somewhat surprised by the empirical evidence stating that a proven track record appears to be an unwavering minimum requirements, the fact that competency relatedness was important for early entry appears quite obvious. However, we also find that a too strong perception of the level of relatedness between the technology demanded in a firm's established industries and the demand in an emerging industry, can also influence the firm in a negative manner once the contract is to be fulfilled. Viewing the competency and technology requirements from established industries as close to identical to that of an emerging industry, might *blindside* a firm into believing that a new industry can be treated as an extended market segment. And thus lure the firm to neglect the challenges associated with the emerging industry context.

Many of the firms were to some degree surprised by the lack of established standards and specifications when they initially entered the market (1, 4, 8). But Kværner (5) hold a particular position. The firm did everything after the book: went to conferences, became a recognised brand, and received a contract do deliver a product they had a proven track record for; tripods. They learnt a lot from their first project and received a new contact, this time for jackets. And did not expect German certification authorities would allow the client to demand a change of the design after the contract was signed, without taking into account the increase in associated costs. Kværner officially announced a departure from the offshore wind industry in 2012. They were not willing to deal with the immature market mechanisms.

Offshore wind was a new, related and attractive market. When bidding for the contract, Kværner's main concern was regarding the shift from engineer-to-order to mass production; an internal product unrelatedness issue. They knew that technological uncertainty was a emerging industry characteristic. But they also *knew* that they had made jackets many times before and that their technology was solid. The technology relatedness was such a dominant dimension of their strategy, that after the contract was signed, they neglected the market factors and treated the offshore wind-specific product as just another contract. Which would be natural if the contract was for a mature, standardised, predicable industry. And were completely blindsided when their client suddenly "decided" that the product was not compatible for the offshore wind industry.

## 5.3 THE TRANSITION TOWARDS MATURITY

Statoil has developed two offshore wind projects off the coast of Norfolk in the UK, roughly half a decade apart, named Sheringham Shoal and Dudgeon. The firm describes the first project at Sheringham Shoal as being brought together by ships and solutions built for something else, causing a number of problems. But, "at Dudgeon, everything runs smoothly! Everything is built for this exact purpose, and we have done it before and we have found methods that work" (1). Since inception, there has been an general consensus that the technological solutions constituting the industry has to improve for the cost to decrease and the industry to become competitive. This development has been the main driver towards maturity for the industry. However, the pace of technological evolution in the different segments has varied greatly and imposed different challenges to the firms operating in each segment[2].

This section is rooted in the third research question and first addresses the industry evolution for the offshore wind industry as a whole before analysing the different paces of technological evolution that the firms have experienced in their distinct parts of the supply chain.

### 5.3.1 *Industry development*

When addressing the history of the emerging offshore wind industry, Dedecca et al. (2016) have divided the evolution towards maturity into 3 stages, similar to the distinction made by Gustafsson et al. (2016). The first one is called the initial stage and is dominated by experimentation and prototypes. It is followed by the co-evolutionary stage where commercialisation and the emergence of a dedicated supply chain falls into place. Lastly, the industry is characterised by a established supply chain and technological stabilisation, in the growth stage.

*The whole industry is full of tragic stories.*
*— Kværner*

In the initial stage, identified by Dedecca et al. (2016) as the period up until 2001, the offshore wind industry was dominated by test projects. The first offshore wind projects were set up close to shore, in shallow waters. There were few turbines in each farm and the capacity for each turbine was modest and based on onshore wind capacity restrains. These earliest projects were absolutely necessary to provide valuable lessons for the industry, but where dominated by prototypes to establish proven technology. Many start-ups and also established firms tried to enter at this stage, resulting in a significant number of

2 Kongsberg (2) are currently developing a disruptive product, and are hence not present in a part of the value chain that is approaching maturity. They will thus not be directly addressed in section 5.3.

bankruptcies (5). An overview over some of the earliest offshore wind projects can be found in appendix D.

All case firms addressed in this thesis entered the offshore wind industry within or close to the co-evolutionary stage. The shift into the co-evolutionary stage for the industry was marked by a project that was significantly more advanced than before, namely the Horns Rev 1 project. The shift from the initial to the co-evolutionary stage can thus be defined to be in 2002, when Horns Rev 1 became operational. For all the wind farms up until then, the maximal installed capacity was 40 MW at a project in 2001, and before that there largest was one at 16,8 MW in 1996. At the time, Horns Rev 1 was seen as "a representation of the new era" (Zaaijer and Henderson 2004). Some of the case firms entered after 2009, which according to Dedecca et al. (2016) was the year when the offshore wind industry reached the growth stage. However, we still argue that all case firms entered into their segment of the supply chain during the co-evolutionary stage. In accordance with Phaal et al. (2011), different parts of the industry may have developed to different extents, so even though the scale of wind farms had increased, none of the case firms entered the industry after a dominant design had been set.

The growth stage can be said to have started in 2009 based on the shift in total installed capacity seen that year and the following years, as illustrated previously in figure 11. The supply chain becomes increasingly specialised, with dedicated manufacturing facilities and installation vessels. Dominant designs, mass production, scale and standardisation drives the industry to become less subsidy dependant, and reduces the dependency on subsidies. In addition, an increase in competition is seen, as the offshore wind industry is starting to transition towards maturity. However, the technological development of the core technology, the wind turbines, is still expected to continue to grow.

As illustrated by the industry timeline in figure 10, the offshore wind industry has developed rapidly since its inception. Measures to reduce costs have been one of the key characteristics of the offshore wind industry, and technological advancement has been the main driver for this trend. The wind turbines have developed so fast that a turbine is in large outdated as it is being assembled (1). Among other things, this rapid development has highly influenced the requirements for installation vessels that install wind mills (7), demanding larger vessels

*"Initially, the technological advancements are huge, as we've seen. But then the effects become smaller and smaller, because the entire supply chain is being shaken to its core"*
*— Fred. Olsen*

than what dominated the industry in the earlier stages. Another example of the rapid technological development is found in the monopile foundation segment. Monopile foundations have refuted the initially established consensus that monopile structures were only applicable for quite shallow waters of 20-25 meter. Now, monopiles have proven to be applicable for depths down to 45 meters and are currently the dominant category of offshore wind foundations. The technological development will naturally have to stabilise at some point, but the pace of technological development in core technologies like turbine capacity is expected to continue at high speed until it reaches around 14-15 MW (1, 2).

### 5.3.2 *The pace of technological evolution*

> *They've done it before, they've worked out methods and tools that work. Now, the tools are custom-made, as opposed to a giant wrench.*
> *— Statoil*

*You can't just rent an AirBnB apartment and show up now and then. You have to be present and be dedicated.*
*— StormGeo*

As the industry transitions toward maturity, the case firms stand prepared to adapt their strategy to meet both market and technological developments. For instance, Ulstein (8) creates a strategy for seven years at the time, but revises it every third year, and also has a monthly evaluation of the current status and forecasts to consider whether they should make any changes.

Statoil (1) have won their newest tender in the United States[3]. The firm states that the US is a market where they have limited competency and have conducted limited research, compared to many other offshore wind markets. But "evidently, someone really wanted to enter the US. And we do see a huge market potential if it does indeed materialise" (Ringnes 2017). In a dynamic market, firms have to be able to move fast. And in order "to move fast enough, we cannot always be certain about everything" (1).

One of the main uncertainties the firms are exposed to when entering an emerging industry is the pace of technological evolution. Table 9 reflects the unexpected challenges the case firms have experienced since their entry. The firms are either (1) directly exposed to a fast pace of development or (2) are experiencing a more slow pace of technological evolution. Kværner is

3 As of June 5th 2017.

solely placed within a third category. A argumentation for this categorisation is given below.

| # | Firm | Response | Category |
|---|---|---|---|
| 1 | Statoil | The high level of capital that wants to enter renewables, and that some firms are willing to have lower margins here, causes immense competition to win a contract. | 1 |
| 2 | Kongsberg | No. | - |
| 3 | StormGeo | We experience those first now, and that's the maturing of the industry and the increased pressure on price. | 2 |
| 4 | Aibel | The market was even more immature than we expected, and the clients uncertain of what they wanted. Specifications and standards weren't ready. | 2 |
| 5 | Kværner | That the client were allowed by German certification authorities to change the design after the contract was signed, without absorbing associated cost. | 3 |
| 6 | Nexans | Not really. But the industry was immature, so we had to alter the specifications and standards. However, we're past that now. | 2 |
| 7 | Fred. Olsen | The fast pace of turbine size development. | 1 |
| 8 | Ulstein | More immature than expected, the solutions haven't found their final form. | 2 |

Table 9: Unexpected challenges: Did you encounter any challenges that you didn't expect upon entry?

As seen, Fred. Olsen (7) was, like the industry as a whole, surprised by the rapid turbine development. However, apart from Statoil (1), this has influenced few of the other case firms' products and services directly. Many of the firms were generally surprised by the level of immaturity, and lack of technical specifications upon entry (4, 5, 8), with Kværner (5) having experienced the most dramatic event caused by the lack of standardisation and technology maturity. StormGeo and Nexans were not really surprised by anything, but are currently altering their product offering to a more mature and competitive market.

Fred. Olsen initially entered the offshore wind industry with the ambition to be present in *foundation installation*, as well as turbine installation. But at that time they expected 3,6 MW mills, and not a technological development as rapid as what has later proven itself evident. Their boats are simply not big enough to satisfy the current technical requirements to install foundations. Nevertheless, they have still gained and successfully fulfilled several turbine installation contracts, and have become specialised and recognised for that. Fred. Olsen now state that "even though it was not the initial strategy, it turned

*There were a bunch of engineers down in Germany, Düsseldorf or wherever, making new things. Nobody told us that.*
*— Fred. Olsen*

out that way". And returning to the initial strategy would require immense capital investments to build a larger boat, as well as to develop new competency, since foundation installation requires approximately three times as many engineers as turbine installation. Fred. Olsen has stayed committed to the offshore wind industry, but have altered their strategy as the industry has developed in a unforeseen direction.

To be able to keep up with the technological development and continue to deliver *turbine installation*, Fred. Olsen has altered their existing installation ships. They have extended the already 80 m long legs of the ships with 14 m, and the crane with 20 m. So now, the ship can reach the current industry standard of 9 MW mills. But product alteration only goes so far, and the possibility of the ships being outdated within few years is highly present. Their main option if they still want to be present in the turbine installation segment in a few years from now is probably to build a new boat.

*It's incredibly important that we succeed with every one of those large investments that aren't really a part of our core business.*
*— Statoil*

Statoil (1) is also experiencing a fast paced technological environment, as they too are directly affected by the rapid turbine advancement. The firm states that the reason they are still heavily invested in offshore wind is it has proved itself as promising over time. Thus, had the technological evolution been too challenging, or too slow, they might have prioritised different business areas, as their deliberate considerations are based more on being a part of the renewables shift than specifically being present in the offshore wind industry.

In other parts of the value chain, the technological development has developed at a much lower pace. Technologies such as submarine cables have already been improved for years, and the pace of technological development has thus been much slower compared to other segments. However, measures to reduce costs have been implemented here as well. Nexans has developed new cables that can transport more electricity to shore, thereby helping the client operate with a higher margin, as well as reduce the material usage for their cables to help the client reduce initial investment cost (4).

*Competing on price is not the solution to reduce cost. One can also develop new and more efficient technology, and that' what we have done.*
*— Nexans*

For products that are quite easy to copy, a transition to maturity pressures the early entrants to manage a shift from competing on quality to competing on price (3, 6). When the offshore wind industry emerged, only 2-4 actors made submarine cables, so the contracts came without too much effort. The current market is much more crowded, and the pressure on price has sharpened (6). StormGeo describes a similar development.

This cost cutting pressure is expected to increase further as the subsidies are phased out. To tackle this, product adaption in terms of cost cutting measures have been implemented by both firms (3, 6). For instance, Nexans describes how reducing the cable with a millimetre here and there is an extensive cost cutting contribution when the cable is 100 km long.

Nexans has to a minimal degree altered existing technology when delivering their first cable to the offshore wind industry, but "today, the parks are much larger and the importance of design is much more optimised." In addition, to avoid competing purely on price, the firms are altering their products to differentiate themselves from competitors. Nexans has been the first firm offering each new voltage level since they entered in the offshore wind industry in 2001. They offer installation-services as well, providing the costumer one point of responsibility. StormGeo say that they try to differentiate their products with design, to make the product more user friendly. Thus, Nexans and StormGeo have adapted their product by *cost cutting* measures, and *service differentiation*.

Ulstein (8) actively chose not to enter the emerging offshore wind industry before they could identify the key stakeholders. First after these were identifies, and a dialog established, was the firm pleased with the predictability of the long term demand in the industry. To achieve this and still enter quite early, they entered a part of the offshore value chain where the technological evolution was not expected to develop too fast, and where they themselves could influence the industry standard.

*Cost orientation often favours proven technology as the preferred choice. But that tendency has probably characterised the market more up until now than it will for future field developments.*
*— Ulstein*

Identifying the pace of technological evolution for all case firms is difficult. Aibel (4) has only had two projects in the offshore wind industry, within two different segments, and there is thus not ground to identify the pace of technological evolution in their segment. However, since their first contract they have announced a continued strategic partnership with ABB to deliver HVDC-projects, so they appear to have a long term ambition to remain in that industry segment, and to expect a manageable, slow pace of technological evolution. Hence, their technological pace resembles the second category, cf. table 9. Nexans, however, are easier to place within this category. Ulstein (8) has already been addressed as having obtained a similar, second contract for a very similar ship within their core competency of designing and building engineer-to-order ships. Thereby, they can also be identified within this second category of technological evolution.

Kværner (5) initially believed they were present in a slow paced technological evolution, with a high level of relatedness between the jackets they had historically delivered to the oil industry, and the jackets they were developing for the offshore wind industry. However, they were faced with an unexpected shift in technological demand, when their client "found out" that the agreed upon dimensions were not viable in the offshore wind industry. Being blinded by relatedness, may materialise as an unexpected shift in the pace of technological evolution. All of a sudden the technology is not what it is expected to be.

The empirical evidence of this case study points to the existence of three different categories of technological evolution. Even though all firms have entered the same emerging industry with an overall rapid technological development, they each have experienced different technological developments and been affected in various ways.

Part IV

# DISCUSSION AND CONCLUSION

# 6 DISCUSSION

Diversification into an emerging industry requires different strategic considerations than the general targeting of mature industries. Short time horizons, strong technological uncertainty, expected cost reduction, first-time uninformed buyers and state intervention are some of the emerging industry characteristics that affect the challenges and benefits associated with industry entry. We suggest that from a diversifying firm's perspective, the most important distinctions when specifying *diversification into an emerging industry* regards the sensitivity of timing of entry, emphasis on competency relatedness, and the unpredictable pace of technological development.

The timing aspect of extant diversification literature is solely addressed by promoting entry when the industry is not at an equilibrium, for instance during a technological shift. In emerging industries these shifts take place at a much higher rate, and entering an emerging industry thus amplifies the importance of timing of entry. A firm's timing of entry can be deliberate or a derivative of other emergent, strategic considerations. Further, diversification literature establishes a positive correlation between competency relatedness and firm's competitive advantage in a new market. This notion is reinforced in an emerging industry, due to the high initial cost associated with developing a proven value proposition, combined with the risk of making these investments in a unpredictable market. However, relatedness can also have a negative a impact, not addressed in extant diversification literature, as the high level of technological relatedness can lure the firm to neglect the lack of standardisation found in an emerging industry context.

The pace of technological evolution as the industry transitions towards maturity, combined with a firm's willingness to specialise and distance themselves from their core competencies, to meet the the emerging industry's demand, is decisive for whether the firm is able to compete in said industry over time. The pace of technological evolution can be either fast, slow or in the form of a technological shock.

## 6.1 RQ 1: WHAT MOTIVATES A FIRM TO DIVERSIFY INTO AN EMERGING INDUSTRY AT AN EARLY STAGE?

All the case firms entered their segment of the offshore wind supply chain during the co-evolutionary stage. This stage is characterised by a gradual increase in scale and a shift towards custom-made technology and commercialisation of the industry. We argue that this is *an ideal time of entry* for *related diversification* in particular. At this stage the high risk of launching new technology, due to not being certain about for how long it will be deemed valuable, amplifies the value of existing competencies. And the immature market structure implies a lack of established firms, and thus a limited level of competition and less restrictive external entry barriers. Entering in the initial stage can not be justified from a dedicated corporate perspective, and postponing the entry to the growth stage can degrade the initial value the firm's existing, related competency, due to a specialisation of the market, as well as the market becoming more competitive.

We agree with Markides and Geroski (2005), whom state that diversifying firms should enter the industry right before the dominant design is set, namely at the end of the co-evolutionary stage, to minimise risk and maximise return. However, predicting when the dominate design will be determined is difficult to forecast. In the offshore wind industry, jacket type foundations were for some time "known" to be the dominant design, but as the technological evolution advanced, monopiles proved more solid than initially expected and are now the established dominant design. Miscalculating the establishment of a dominant design, combined with following Markides and Geroski (2005)'s strategy of waiting, can thus lead to firms attempting entry too late. Firms should determine how early in the co-evolutionary stage they are willing to enter, based on how important they view the emerging industry as a part of in their corporate portfolio. If they have deep pockets and are willing to invest in long-term ambitions, an earlier entry is justifiable.

We identify said long-term ambitions for half of the case firms. Their motivation for entry during the co-evolutionary stage was based on a deliberately aim to enter early enough to be positioned for *first-mover advantages* (1, 2, 3, 7). The remaining four firms follow a more emergent strategy, where the timing of entry is mainly a passive result of the pull-factor of having identified an attractive business case at that time (4, 5, 6, 8). Hence, the case firms' motivation to obtain fist-mover advantages is closely linked to the firms' level of deliberateness for early entry (Lieberman and Montgomery 1988; De Wit and Meyer 2014).

The deliberate case firms have truly identified a strategic fit and are willing to forgo other business-opportunities in the short-term in favour of a long-term strategy (1, 2, 3, 7). Fred. Olsen (7) is the outlier of representing this strategy, as they made an immense, high-risk investment by ordering a ship during the the co-evolutionary stage, before having obtained a single contract. Fred. Olsen and StormGeo (3) both argue that their early entry was crucial to obtain an early, high market share, which is further the main reason why they have a leading role in the industry today. Statoil (1) have no immediate aim be be the market leader, but motivate their entry during the early co-evolutionary stage with the desire to have an established track record and experienced machinery in position to take part in the growth when the industry begins to stabilise. Kongsberg (2) is developing a brand new technology, where an obvious driver for motivation is to be first in the market and face "zero" competition, coherent with blue ocean strategies (Kim and Mauborgne 2005). The four firms in this cluster recognise that there can also be first-mover disadvantages, but choose to overcome these in pursuit of a long-term presence (1, 2, 3, 7).

The other group of case firms first and foremost see entry during the co-evolutionary stage as a way to obtain growth as soon as possible, and wanted to enter because the margins of their first offshore wind project was higher than any immediate alternatives (4, 5, 6, 8). Their timing of entry was not based on the notion of timing, but rather, that they identified a lucrative business case. These firms also describe a desire to remain present in the offshore wind industry in the long run, and they might also experience first-mover advantages, but these factors are not deliberate source of motivation for their entry during the co-evolutionary stage. Ulstein (8) even describe an inverse deliberateness to entering early, by deliberately valuing the importance of waiting higher than the value of being a first mover. These four firms act more in direct accordance with the ideas of Markides and Geroski (2005). The optimal strategy for established firms contemplating entry into an emerging industry is not a first-mover approach, but a being a fast-second (4, 5, 6, 8).

This distinction in motivation for early entry nurtures two different approaches to enter during the co-evolutionary stage: a *deliberate* (1, 2, 3, 7) and an *emergent* approach (4, 5, 6, 8). Our initial hypothesis was that established firms are reluctant to invest before they can identify a viable business case, but are concurrently intrigued by the opportunity to position themselves for potential future growth. This balance fits well with the industry factors characterising the co-evolutionary stage. However, the firms following an emergent approach are less concerned with positioning and more concerned about an immediate viable business case, than the deliberate firms are. This differentiation may have implications for the firms willingness to specialise and invest when faced with the emerging industry's transitions toward maturity.

## 6.2 RQ 2: WHAT ROLE DOES THE EXISTING COMPETENCIES OF A FIRM PLAY, TO SUCCESSFULLY DIVERSIFY INTO AN EMERGING INDUSTRY?

Our empirical evidence reinforces the anticipated positive correlation between competency relatedness and successful entry into an emerging industry, by stating that existing competences from a related industry not only provides a competitive advantage, but are a *prerequisite* to successfully enter the emerging offshore wind industry at an early stage. This necessity is largely derived from the fact that offshore wind is an industrial industry with financial actors such as banks and insurance companies as important stakeholders, and they demand "proven" security for their investment. This is often the case for emerging industries, as they require external capital investments before becoming commercially viable (Porter 1980). Any technical flaw or installation bottleneck can have huge financial consequences for the project as a whole, and firms that have successfully delivered similar products or services to similar industries before, will always be chosen over one that has not.

A proven track record is really a representation of the firm's perceived brand, more than tangible proof of a firm's competencies, but we still argue that a proven track record, combined with the desire to enter, can be a valid representation of related competency. And that if there is a high level of competency relatedness between the competencies a firm already holds and those required in an emerging industry, said firm can with limited efforts qualify as the best candidate to win a tender (5, 6, 8) or persuade a client to provide them with a contract (2, 3, 4, 7).

Some firms are able to enter purely based on their proven track record (3, 6). However, four of the case firms (2, 3, 4, 8) had to combine their existing competencies with initiating a dialog with potential clients and develop an industry-specific design, before they were able to secure a contract. And one firm was so motivated for early entry that it chose to enter before there was an established demand (7). Fred. Olsen (7) had to assume all the risk, develop a proven, tangible technology and hope that the demand, and lack of competition, had emerged in accordance with their forecasts, once their product is finalised. Fred. Olsen is a outlier for making such a risk-seeking investment. But in an emerging industry, the unpredictable context will foster more outliers than normal, and these should thus not be dispatched as unimportant, but seen as noteworthy particularities that can take place.

The empirical evidence's emphasis on competency relatedness strongly supports a resource-based view: at early stages of industry emergence a firms ability to enter is first and foremost a derivative of that firm's existing competencies (Penrose 1959). This finding is also in accordance with emerging industry literature, which states that at early stages of industry emergence, push factors of competency relatedness are stronger than the market pull factors (Wüstenhagen and Menichetti 2012). Market factors and future prospects should be given less attention since it is still difficult to know whether the forecasts are accurate and whether the market will take off (Agarwal and Bayus 2004).

However, letting a resource-based perspective dominate the market considerations might lead a firm into believing that entering an emerging industry can be treated like just another contract, neglecting the entry barriers associated with an emerging industry context. Viewing the competency and technological requirements from established industries as close to identical to that demanded in an emerging industry, can lure firms to be *blinded by relatedness*. The case of Kværner's second contract in the offshore wind industry illustrates this. They *knew* that they had made jackets many times before and that their technology was solid. Competency relatedness was such a dominant dimension of their strategy, that after the contract was signed, they neglected the emerging industry context. And were completely blindsided when their client in the offshore wind industry deemed their jackets as unfit.

There are no rules of the game in an emerging industry, and first-time uninformed buyers, lack of established standards and strong technological uncertainty are emerging industry characteristics (Porter 1980; Kirkwood and Srai 2011). Kværner's client had no experience with similar purchases, and no standardised offshore wind-specific product to compare the agreed-upon design to, so when one German professor questioned the initial dimensions, the client meant that they had grounds to refused them as unfit. Kværner had not even considered the risk of such an event. The firm was able to successfully obtain a contract in an emerging industry at an early stage, due to competency relatedness. But, blindsided by relatedness, Kværner failed to grant the unrelated industry aspects enough consideration. The firm later proclaimed that they were exiting the industry to rather focus on the oil industry. They were not willing to deal with the uncertainties associated with the offshore wind industry, even though the level of competency relatedness was still high.

Other firms balance their existing competencies and the emerging industry context in a truly deliberate manner. Ulstein (8) considered a range of different entry opportunities, and could certainly have been able to enter the offshore wind industry sooner, if they had tried. But they chose to wait for a more predicable marketplace where they could develop a proven concept in close dialog with the eventually definable stakeholders. This led them to discard, for instance, an early entry into the turbine installation vessel segment, as opposed to Fred. Olsen (7), whom chose to enter. Fred. Olsen took a huge risk, building a whole new department and two custom-made ships, to obtain the proven technology they needed to win their first contract. That strategy has currently placed them as a market leader in their segment, and as Norway's best example of successful entry into the offshore wind industry, according to a recent report (MAKE Consulting 2016). But they are also at risk of having to depreciate their two jack-up vessels much sooner than forecasted.

This friction between the strategic considerations of the two maritime firms illustrate that external entry barriers are not necessarily the most challenging barriers to overcome, in order to obtain a contract. Internal consideration of whether it is the right strategic choice or not, as mentioned by Statoil (1) as their biggest obstacle to enter, is also relevant for all the other firms, in accordance with fundamental corporate strategy. A firm's existing competencies are a prerequisite for diversification into an emerging industry, due to industry restrictions, but also due to internal considerations.

Our hypothesis was that competency relatedness is an important asset to successfully enter an emerging industry. We verify this along two parameters. Firstly, competency relatedness eases the process of aligning the entire firm to attempt industry entry. This is clearly in line with established theory (Noori et al. 2012). Secondly, a proven track record from an established industry is a prerequisite to enter, to provide financial stakeholders with adequate security. Surprisingly, competency relatedness can also have negative implications. By becoming too focused on product and relatedness factors, firms may neglect that there are no rules of the game in emerging industries.

## 6.3 RQ 3: HOW DOES THE TRANSITIONING TOWARDS MATURITY INFLUENCE THE EARLY DIVERSIFIERS?

In the offshore wind industry, the technological advancement and accompanying cost reduction has been the main driver for the rapid industry development. Larger and more efficient turbines combined with the increase in wind farm scale has brought the offshore industry into the growth stage much faster than anyone initially expected (MAKE Consulting 2016; Dedecca et al. 2016). And when the first subsidy-free bid was approved this year, the cost calculations were based on forecasts where this fast-paced technological innovation and development are assumed continue. The early entrants have to keep up with the industry development to be able to remain in the industry as it transitions towards maturity.

However, the case firms have experienced very different paces of technological evolution since their entry, depending on their supply chain activity. Even though addressing the industry as a whole can provide insights regarding the future market development, it provides little insight regarding the sensitivity of a firm's timing of entry, or to what extend they have to specialise their initial product offering to stay relevant. All the case firms have, due to specialisation, experienced a reduction in competency relatedness between their core industry and the offshore wind industry, but the degree to which their competencies have evolved differs. We here differentiate between three technological environments that a firm can encounter when entering an emerging industry at an early stage, identified based on our empirical findings.

For some firms, the pace of technological evolution has kept a *moderate and predictable* level. The relatedness between the product or services the firm offers the offshore wind industry and their initial industries remain high. StormGeo (3) state that they must constantly develop their offshore wind-specific product further, to reduce the pressure to compete mainly on price, and to continue to stay relevant and noticeable at industry conferences. But the development has never resembled a revolution, just a steady evolution of improvements. The case firms that are found to have this relation to the pace of changing technology are firms that were initially able to enter the offshore wind industry based on a proven track record (3, 6). But also firms that have developed an industry-specific proven concept, which design has been perceived as leading edge, now experience such a technological environment (4, 8). Ulstein (8) can illustrate the latter. After innovating a whole new concept to win their first contract for two ships, they have since been rewarded a second contract for a very similar one. A slow technological pace might indicate that the dominant design is close to being reached (Suarez et al. 2015). And thus that the early entrants are positioned to capture first-mover advantages, associated with having a significant market share. *Durable relatedness* enables the firm to maintain synergistic effects between their different business units, and to act as a technological leader, less exposed to market factors.

For other firms, the technological evolution has been more challenging to keep up with. The firms experiencing a fast paced technological evolution have had to be more emergent in regards to their product innovation. Fred. Olsen (7) entered a segment that was expected to be characterised by fast technological evolution, but the extent to which the turbine capacity and size has evolved is even more significant than expected. Hence, they had to forego their initial ambition to also install foundations, and to continue to install turbines they had to re-engineer and extend the ships' legs and crane quite drastically. In addition, they stand at risk of having to build a whole new ship if the fast technological pace continues in accordance with forecasts. Statoil (1) can also be said to experience this technological pace as they too are directly influenced by the rapid turbine development. Today, an installed wind turbine is in large outdated as it is being assembled. Firms present in a fast paced technological environment are less positioned for first-mover advantages, and depend on deep pockets to remain in the industry until it stabilises. But they may temporally be positioned for a monopolistic market-situation, and can obtain the same advantages as the slow paced firms, once the market stabilises.

In addition to the the slow and fast paces of technological evolution, already identified by extant literature (Suarez and Lanzolla 2005), the empirical findings of this thesis add the notion of the possibility for a sudden shift in the pace of technological evolution. For Kværner (5), the technological evolution initially appeared hold a slow pace, with a high level of relatedness between the jackets they had historically delivered to the oil industry, and the jackets they where developing for the offshore wind industry. But, in their eyes out of nowhere, they where faced with a shift in technological demand, when their client realised that the agreed upon dimensions were not viable in the offshore wind industry. Being blinded by relatedness, as discussed in 6.2, may materialise as an unexpected shift in the pace of technological evolution. In contrast to a quite linear evolution, though slow or fast, the shift appears as a small revolution, and we thus define it as a *shock*.

The three evolutionary trajectories for technological pace are summarised in the table below.

| **Pace** | **Properties** |
|---|---|
| Slow | The technology evolves at a moderate and predictable pace. |
| Fast | The technology evolves at a high and unpredictable pace. |
| Shock | Unforeseen or disruptive change in technological demand. |

Table 10: Technology evolution trajectories

According to Suarez and Lanzolla (2005), the higher the technological pace, the deeper the pockets of the early entrants must be to keep up with the technological evolution. Our theoretical contribution of identifying the pace-trajectory of a shock, furthers the notion that firms must have *even deeper* pockets to be able to "secure" being able to stay in the industry. If not, firms risk the possibility of becoming irrelevant, required to depreciate their entire investment.

The level of relatedness and the pace of technological evolution have an inverse relationship: the higher the pace, the more specialised the technology, and thus a reduction in the level of competency relatedness. Figure 13 reflects this relationship, by illustrating how different evolutionary trajectories influence the competency relatedness over time.

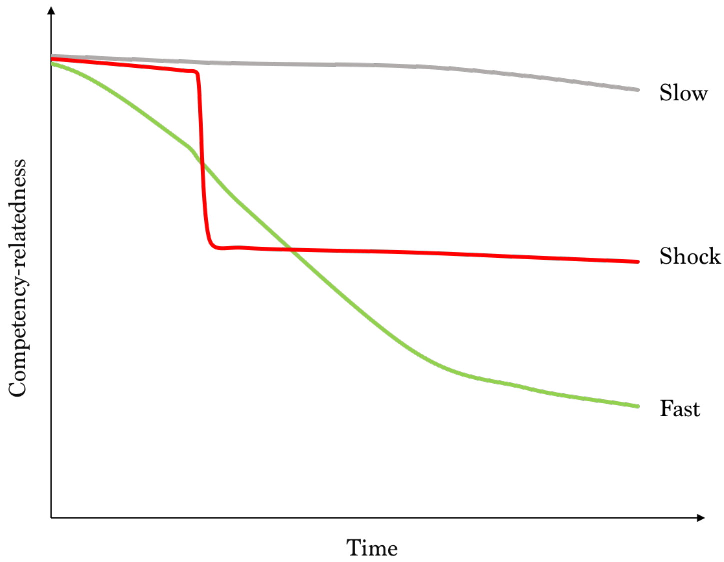


Figure 13: Technology evolution trajectories

This framework addresses the relationship between the two parameters previously addressed in this thesis: The timing of entry and the level of relatedness. The durability of relatedness over time varies greatly depending on the pace of technological evolution. We argue that whether a firm manages, and desires, to remain in the industry as it matures, is a found by coupling the firm's level of deliberateness, addressed in 6.1, and the pace of technological evolution.

Firms entering the offshore wind industry mainly due to low entry barriers and a short-term ambition for growth, identified as having an *emergent approach*, should enter early or in a segment developing at a slow pace, to able to compete (4, 5, 6, 8). If they find themselves if a fast paced segment they must either alter their initial ambition and specialise, or exit the industry.

The firms with a *deliberate approach*, are willing to invest, specialise and potentially make the emerging industry one of their core industries int the long run. It should thus be able to compete both in slow and fast paced segments of the offshore wind industry (1, 2, 3, 7). These firms may also overcome a technological shock, if they have deep enough pockets and a deliberate enough strategy to have a long-term presence in the industry. The technological relatedness will still be quite high after the shock, and if the firm manages to fulfil the contact in spite of the shock, as Kværner did, they should be well positioned to target similar projects again. But as Statoil (1) stated, it is crucially important for a firm that each of their first projects in a new industry is successful, so that the firm's shareholders remain positive, and for the firm to continue viewing the industry as a good fit. In addition, Fred. Olsen (7) pointed out that a bad track record can be as bad as no track record at all, when trying to win a contract. Being exposed to an technological shock is not synonymous with delivering a low-quality product, and thus not a direct stroke to a firm's track record, but it can still cause some damage in a competitive market. Experiencing a technological shock can thus be unmanageable enough to force a firm out of the industry. Based on the empirical evidence of the deliberate firms analysed in this thesis, two have been able to remain in a fast paced industry (1, 7), one is the market leader in a slow paced industry (3). Kongsberg are still developing their own, disruptive product, and are thus merely exposed to a pace of technological evolution imposed by themselves.

Our initial hypothesis regarding the rapid development seen in emerging industries, was that it forces early entrants to innovate in order to remain in the industry. This can to some extent be verified, as all the case firms have specialised their products or services since initial entry. However, we see that the rapid technological development observed for the industry as a whole has only influenced two of the case firms directly. We suggest that the supply chain segments directly linked to the core technology that is driving the industry, may expect a fast paced technological evolution, while firms offering supporting functions may experience a slow pace. Thus, firms with a high level of competency relatedness should consider entry into emerging industries, as many will be positioned for first-mover advantages based on limited innovation and specialisation efforts. However, the firms must never neglect the unpredictable context of an emerging industry. Even though their desired segment appears to be dominated by a slow paced technological evolution, they stand at risk of experiencing a shock.

## 6.4 IMPLICATIONS FOR MANAGERS

The first implication regards measures to avoid being blinded by relatedness for firms entering an emerging industry at the co-evolutionary stage. The firms can not consider entry into an emerging industry purely based on traditional diversification literature. The unpredictable nature of emerging industries should be deliberately analysed, and stakeholders identified, even if the firm has a short-term ambition in the industry. Secondly, though a firm's track record can be adequate to obtain a contract, they can not assume the specifications in an emerging industry to be identical to what they have previously delivered. Lastly, firms entering what appears to be a slow paced segment of the industry are more likely to neglect market factors, and should thus be increasingly cautious.

The second implication regards the particularities associated with having used the offshore wind industry our case industry. This thesis is relevant all managers exposed to the diversification into an emerging industry. However, the offshore wind industry falls under categories such as capital-intensive and industrial, which can have influenced the findings of this thesis. And the majority of newer emerging industry research regards software-based industries. Thus, in particular, managers of firms present in the energy sector or any other long lived-assets industry should find this thesis as a valuable extension to existing theory.

## 6.5 LIMITATIONS

A common issue with qualitative studies is the limited generalisation of the findings. Although this thesis has eight case firms instead of one, the findings can not be fully generalised for all firms diversifying into the offshore wind industry. Even harder is it to generalise these findings to all diversifying firms in all emerging industries. The latter is partly due to the particularities encountered when as a result of the the offshore wind industry being industrial, capital-intensive and dependent on long lived assets. Thus, this thesis does not aim at generalising the contributions to this extent, but rather give some pointers to what possible connections might be, and where more research is needed.

Another limitation to this study is the retrospective bias that can emerge when respondents talk about events or developments of the past. This effect is not always a source of great limitation, but for emerging industries where unforeseen events happen to a greater extent, the need to rationalise when thinking back may cause this retrospective bias to increase.

## 6.6 FURTHER RESEARCH

We believe that this thesis confirms the value in connecting diversification and emerging industry literature. Although our study identifies important aspects of how firms approach and successfully conduct early entries into emerging industries, we also identify needs for further research. Thus, our first suggestion for further research is to investigate the link more thoroughly, either by

Secondly, as this study develops a framework where the speeds of technological evolution are considered, the coupling toward innovation literature could be valuable. The technology evolution described as a shock in this thesis could be compared to the concept of disruptive innovation. Particularly, going deeper into whether firms can influence pace of technological evolution in long lived assets-industries. But also researching whether our findings are also applicable for the more frequently researched sector of software-driven industries.

Moreover, further research should examine whether the concept of technology evolution trajectories could apply not only to emerging industries but to all industries prone to technological change.

# 7 CONCLUSION

Our study finds that extant diversification theory is not adequate to address an act of diversification into an emerging industry. The dynamic and chaotic nature of an emerging industry affects the strategic considerations regarding entering such an industry context. Thus, the theoretical contribution of this thesis is an extension to the diversification research steam, by introducing a link to concepts from the timing stream of emerging industry literature.

This thesis presents a framework that summarises our key findings. It illustrates the level of competency relatedness that early entrants will experience over time, depending on the pace of technological development in their supply chain segment. Initially, the level of relatedness will be high for all related firms, as a proven track record from a related industry is a prerequisite for diversification into an emerging industry. As the industry transitions toward maturity, the pace of technological evolution can be either fast, slow or in the form of an unexpected shock.

Fast paced segments will require the firms to specialise and distance themselves from their core competencies, while a slow pace induces durability of relatedness. However, firms that believe that they are in a slow paced technological environment may be at risk of overlooking the emerging industry context. This can lead firms to be blinded by relatedness, and experience an unexpected shock in the pace of technological evolution. Whether the early entrants are able to, and desire to, tackle the different paces, is determined based on whether they have a deliberate long-term or short-term agenda in the industry.

# Part V

# APPENDIX

# A NORWEGIAN FIRMS IN OFFSHORE WIND

The Norwegian firms and stakeholders listed in the 4C Offshore (2017) database are presented in table 11, along with a categorisation of which segments they have operated within. This table was used as a basis for assessing which firms could be relevant to this study.

| # | Firm | Projects | Realised projects | Turbine manufacturing | Turbine installation | Foundation supply/manufacturing | Foundation installation | Array cable supply | Array cable installation | Array cable vessel provider | Export cable supply | Export cable installation | Export cable vessel supply | Substation foundation | Substation foundation installation | Vessel other | Metmast instrumentation | Metmast installation | Owner/ Investor | Consulting | Investor/ owner | Manufacturing/ supply | Installation | Consulting/ Development/ Management |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | ABB AS | 15 | 13 | | | | | | | | 1 | 1 | | | | | | | | 1 | | 1 | | 1 |
| 2 | Aibel AS | 1 | 1 | | | | | | | | | | | | | | | | | 1 | | | | 1 |
| 3 | Aker Solutions | 1 | 1 | | 1 | | | | | | | | | | | | | | | | | | 1 | |
| 4 | Aker Verdal AS | 3 | 2 | | | 1 | | | | | | | | 1 | | | | | | 1 | | 1 | | |
| 5 | Aqualis Offshore | 1 | 1 | | | | | | | | | | | | | | | | | 1 | | | | 1 |
| 6 | Arena - Ocean of Opportunites | 2 | 2 | | | | | | | | | | | | | | | | | 1 | | | | 1 |
| 7 | Automasjon & Data AS | 1 | 1 | | | | | | | | | | | | | | 1 | | | | | 1 | 1 | |
| 8 | CCB Kollsnes | 2 | 2 | | | | | | | | | | | | | | | | | 1 | | | | 1 |
| 9 | cmr Prototech | 2 | 2 | | | | | | | | | | | | | | | | | 1 | | | | 1 |
| 10 | DeepOcean Group Holdings | 4 | 4 | | | | | | 1 | 1 | | | 1 | | | | | | | | | | 1 | |
| 11 | DNV GL Group | 45 | 40 | | | | | | | | | | | | | | | | | 1 | | | | 1 |
| 12 | Dr techn Olav Olsen | 4 | 1 | | | | | | | | | | | | | | | | 1 | 1 | 1 | | | |
| 13 | Eide Contracting AS | 7 | 7 | | | | 1 | | 1 | 1 | | 1 | 1 | | | | | | | | | | 1 | |
| 14 | Enova SF | 2 | 2 | | | | | | | | | | | | | | | | 1 | | 1 | | | |
| 15 | Farstad Shipping | 1 | 1 | | | | | | 1 | 1 | | | | | | | | | | | | | 1 | |
| 16 | FORCE Technology | 2 | 2 | | | | | | | | | | | | | | | | | 1 | | | | 1 |
| 17 | Fred Olsen Renewables Ltd | 7 | 2 | | 1 | | | | | | | | | | | | | | 1 | | 1 | | 1 | |
| 18 | Fred Olsen United AS | 4 | 4 | | | | | | | | | | | | | | | 1 | | | | | 1 | |
| 19 | General Cable Nordic AS | 1 | 1 | | | | | | | | 1 | 1 | | | | | | | | | | 1 | 1 | |
| 20 | Global Maritime AS | 2 | 2 | | | | | | | | | | | | | | | | | 1 | | | | 1 |
| 21 | Grieg Group | 1 | 0 | | | | | | | | | | | | | | | | 1 | | 1 | | | |
| 22 | Grieg Logistics | 1 | 0 | | 1 | | | | | | | | | | | | | | | | | | 1 | |
| 23 | Grieg Seafood | 2 | 2 | | | | | | | | | | | | | | | | 1 | 1 | 1 | | | |

| # | Firm | Projects | Realised projects | Turbine manufacturing | Turbine installation | Foundation supply/manufacturing | Foundation installation | Array cable supply | Array cable installation | Array cable vessel provider | Export cable supply | Export cable installation | Export cable vessel supply | Substation foundation | Substation foundation installation | Vessel other | Metmast instrumentation | Metmast installation | Owner/ Investor | Consulting | Investor/ owner | Manufacturing/ supply | Installation | Consulting/ Development/ Management |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 24 | Gwind | 2 | 2 | | | 1 | | | | | | | | | | | | | 1 | | 1 | 1 | | |
| 25 | Haugaland Kraft AS | 2 | 2 | | | | | | | | | | | | | | | | 1 | 1 | 1 | | | 1 |
| 26 | Haugesund Kommune | 1 | 1 | | | | | | | | | | | | | | | | 1 | | 1 | | | |
| 27 | HAVGUL Clean Energy AS | 7 | 0 | | | | | | | | | | | | | | | | 1 | | 1 | | | |
| 28 | Havgul Nordic AS | 2 | 0 | | | | | | | | | | | | | | | | 1 | | 1 | | | |
| 29 | Jøsok Prosjekt AS | 1 | 0 | | | | | | | | | | | | | | | | | 1 | | | | 1 |
| 30 | Karmøy Kommune | 1 | 1 | | | | | | | | | | | | | | | | 1 | | 1 | | | |
| 31 | Lofotkraft Holding AS | 6 | 0 | | | | | | | | | | | | | | | | 1 | | 1 | | | |
| 32 | Lofotkraft Vind AS | 2 | 0 | | | | | | | | | | | | | | | | | 1 | | | | 1 |
| 33 | Lyse Energi AS | 3 | 0 | | | | | | | | | | | | | | | | 1 | | 1 | | | |
| 34 | Lyse Produksjon AS | 3 | 3 | | | | | | | | | | | | | | | | | 1 | | | | 1 |
| 35 | MacGregor Pusnes AS | 1 | 1 | | | 1 | | | | | | | | | | | | | | | | 1 | | |
| 36 | Main Tech AS | 1 | 1 | | | | | | | | | | | | | | | | | 1 | | | | 1 |
| 37 | Marine Aliminium AS | 1 | 1 | | | | | | | | | | | | | | | | | 1 | | | | 1 |
| 38 | Marine Energy Test Centre (METCentre) | 1 | 1 | | | | | | | | | | | | | | | | | 1 | | | | 1 |
| 39 | Master Marine AS | 1 | 1 | | 1 | | | | | | | | | | 1 | | | | | | | | 1 | |
| 40 | METCentre - Marine Energy Test Centre | 3 | 3 | | | | | | | | | | | | | | | | 1 | | 1 | | | |
| 41 | Mika AS | 1 | 1 | | | | | | 1 | | | | | | | | | | | | | | 1 | |
| 42 | Miros AS | 1 | 1 | | | | | | | | | | | | | | 1 | | | | | 1 | | |
| 43 | Multiconsult | 1 | 0 | | | | | | | | | | | | | | | | | | | | | |
| 44 | Nexans Norway AS | 2 | 2 | | | | | 1 | | | 1 | | | | | | | | | | | 1 | | |
| 45 | NLI | 1 | 1 | | | | | | | | | | | | | | | | 1 | | 1 | | | |
| 46 | norcowe - Norwegian Centre for Offshore Wind Energy | 2 | 2 | | | | | | | | | | | | | | | | | 1 | | | | 1 |

| # | Firm | Projects | Realised projects | Turbine manufacturing | Turbine installation | Foundation supply/manufacturing | Foundation installation | Array cable supply | Array cable installation | Array cable vessel provider | Export cable supply | Export cable installation | Export cable vessel supply | Substation foundation | Substation foundation installation | Vessel other | Metmast instrumentation | Metmast installation | Owner/ Investor | Consulting | Investor/ owner | Manufacturing/ supply | Installation | Consulting/ Development/ Management |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 47 | Nordkraft Vind AS | 6 | 0 | | | | | | | | | | | | | | | | 1 | | 1 | | | |
| 48 | Nordnorsk Havkraft KS | 6 | 0 | | | | | | | | | | | | | | | | | 1 | | | | 1 |
| 49 | Nord-Norsk Vindkraft AS | 2 | 0 | | | | | | | | | | | | | | | | 1 | 1 | 1 | | | |
| 50 | NOREQ AS | 1 | 1 | | 1 | | | | | | | | | | | | | | | | | | 1 | |
| 51 | NVE | 15 | 13 | | | | | | | | | | | | | | | | | 1 | | | | 1 |
| 52 | Norsea AS | 2 | 2 | | 1 | | | | | | | | | | | | | | | | 1 | | | |
| 53 | NTNU | 1 | 0 | | | | | | | | | | | | | | | | | 1 | | | | |
| 54 | Norwind (ceased trading?) | 4 | 1 | | 1 | 1 | | | | | | | | | | | | | | 1 | | 1 | | 1 |
| 55 | Ocean Installer AS | 1 | 1 | | | | | | | | | 1 | 1 | | | | | | | | | | 1 | |
| 56 | Oceanteam ASA | 2 | 2 | | | | | | | | | 1 | | | | | | | | | | | 1 | |
| 57 | OceanWind AS | 1 | 0 | | | | | | | | | | | | | | | | | 1 | | | | 1 |
| 58 | Offshore Vindenergi AS | 4 | 0 | | | | | | | | | | | | | | | | 1 | | 1 | | | |
| 59 | Olympic Shipping AS | 5 | 5 | | | | | | 1 | 1 | | | | | | | | | | | | | | |
| 60 | OWEC Tower AS | 9 | 8 | | | 1 | | | | | | | | | | | | | | 1 | | | | 1 |
| 61 | Parker Scanrope AS | 6 | 6 | | | | | 1 | | | 1 | | | | | | | | | | | 1 | | |
| 62 | Pelagic Power A/S | 1 | 1 | | | | | | | | | | | | | | | | | 1 | | | | 1 |
| 63 | Polytec | 1 | 1 | | | | | | | | | | | | | | | | 1 | | 1 | | | |
| 64 | Prekubator TTO | 2 | 2 | | | | | | | | | | | | | | | | | 1 | | | | 1 |
| 65 | REINERTSEN AS | 1 | 1 | | | | | | | | | | | | | | | | | 1 | | | | 1 |
| 66 | Rogaland County | 1 | 1 | | | | | | | | | | | | | | | | 1 | | 1 | | | |
| 67 | Rogaland Ressurssenter | 1 | 1 | | | | | | | | | | | | | | | | 1 | | 1 | | | |
| 68 | Scanergy AS | 2 | 1 | | | | | | | | | | | | | | | | 1 | | 1 | | | |
| 69 | Scatec | 1 | 0 | | | | | | | | | | | | | | | | 1 | | 1 | | | |

| # | Firm | Projects | Realised projects | Turbine manufacturing | Turbine installation | Foundation supply/manufacturing | Foundation installation | Array cable supply | Array cable installation | Array cable vessel provider | Export cable supply | Export cable installation | Export cable vessel supply | Substation foundation | Substation foundation installation | Vessel other | Metmast instrumentation | Metmast installation | Owner/ Investor | Consulting | Investor/ owner | Manufacturing/ supply | Installation | Consulting/ Development/ Management |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 70 | Seatower AS | 1 | 1 | | | | | | | | | | | | | | | | | 1 | | | | 1 |
| 71 | Seloy Undervannsservice A/S | 2 | 2 | | | | | | | | | 1 | 1 | | | | | | | | | | 1 | |
| 72 | Siem Offshore AS | 5 | 5 | | | | | | 1 | 1 | | 1 | 1 | | | | | | | | | | | |
| 73 | SimonMosker Shipping | 2 | 2 | | | | | | | 1 | | | | | | | | | | | | | 1 | |
| 74 | SINTEF | 1 | 0 | | | | | | | | | | | | | | | | | 1 | | | | 1 |
| 75 | Siragrunnen Vindpark AS | 1 | 0 | | | | | | | | | | | | | | | | | 1 | | | | 1 |
| 76 | SKS | 6 | 0 | | | | | | | | | | | | | | | | 1 | | 1 | | | |
| 77 | Solstad Offshore ASA | 8 | 8 | | | | | | 1 | 1 | | | | | | | | | | | | | 1 | |
| 78 | Stadt Wind AS | 4 | 0 | | | | | | | | | | | | | | | | 1 | | 1 | | | |
| 79 | Statkraft | 12 | 8 | | | | | | | | | | | | | | | | 1 | 1 | 1 | | | |
| 80 | Statkraft Development AS | 2 | 2 | | | | | | | | | | | | | | | | | 1 | | | | 1 |
| 81 | Statnett Transport AS | 1 | 1 | | | | | | 1 | 1 | | | | | | | | | | | | | 1 | |
| 82 | Statoil ASA | 16 | 13 | | | | | | | | | | | | | | | | 1 | 1 | 1 | | | |
| 83 | StormGeo AS | 22 | 19 | | | | | | | | | | | | | | | | | 1 | | | | 1 |
| 84 | STX Europe AS | 2 | 1 | | | 1 | 1 | | | | | | | | | | | | | | | 1 | | |
| 85 | SWAY A/S | 4 | 2 | | | 1 | | | | | | | | | | | | | 1 | 1 | 1 | | | |
| 86 | SWAY Turbine AS | 1 | 1 | 1 | | | | | | | | | | | | | | | | 1 | | 1 | | |
| 87 | Swire Seabed | 6 | 6 | | | | | | | | | 1 | 1 | | | | | | | | | | 1 | |
| 88 | TAFJORD | 1 | 0 | | | | | | | | | | | | | | | | 1 | | 1 | | | |
| 89 | Technocean AS | 2 | 2 | | | | | | 1 | 1 | | | | | | | | | | | | | 1 | |
| 90 | Trelleborg Offshore Norway AS | 1 | 1 | | | | 1 | | | | | | | | | | | | | | | | 1 | |
| 91 | Troll WindPower AS | 1 | 0 | | | | | | | | | | | | | | | | | 1 | | | | 1 |
| 92 | Troms Kraft AS | 6 | 0 | | | | | | | | | | | | | | | | 1 | | 1 | | | |

| # | Firm | Projects | Realised projects | Turbine manufacturing | Turbine installation | Foundation supply/manufacturing | Foundation installation | Array cable supply | Array cable installation | Array cable vessel provider | Export cable supply | Export cable installation | Export cable vessel supply | Substation foundation | Substation foundation installation | Vessel other | Metmast instrumentation | Metmast installation | Owner/ Investor | Consulting | Investor/ owner | Manufacturing/ supply | Installation | Consulting/ Development/ Management |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 93 | Troms Kraft Produksjon AS | 3 | 0 | | | | | | | | | | | | | | | | 1 | | 1 | | | |
| 94 | TrønderEnergi AS | 1 | 0 | | | | | | | | | | | | | | | | 1 | | 1 | | | |
| 95 | TrønderEnergi Kraft AS (TEK) | 1 | 0 | | | | | | | | | | | | | | | | | 1 | | | | 1 |
| 96 | Ugland Construction AS | 1 | 1 | | | | | | 1 | 1 | | 1 | 1 | | | | | | | | | | 1 | |
| 97 | Universitetet i Stavanger | 2 | 2 | | | | | | | | | | | | | | | | | 1 | | | | 1 |
| 98 | Utsira Kommune | 1 | 1 | | | | | | | | | | | | | | | | 1 | | 1 | | | |
| 99 | Vestavind Kraft AS | 6 | 0 | | | | | | | | | | | | | | | | 1 | 1 | 1 | | | |
| 100 | Vestavind Offshore AS | 3 | 0 | | | | | | | | | | | | | | | | 1 | 1 | 1 | | | |
| 101 | Vestlandsalliansen | 1 | 0 | | | | | | | | | | | | | | | | 1 | | 1 | | | |
| 102 | Vici ventus Technology | 2 | 0 | | | | | | | | | | | | | | | | | 1 | | | | 1 |
| 103 | Viking Supply Ships AS | 1 | 1 | | | | | | | | | | | | 1 | | | | | | | | 1 | |
| 104 | VisSim AS | 9 | 9 | | | | | | | | | | | | | | | | | 1 | | | | 1 |
| 105 | Volstad Maritime AS | 5 | 5 | | | | | | 1 | 1 | | 1 | 1 | | | | | | | | | | 1 | |
| 106 | Westcon Group AS | 1 | 1 | | | | | | | | | | | | | | | | | 1 | | | | 1 |
| 107 | WindSea AS | 1 | 1 | | | | | | | | | | | | | | | | | 1 | | | | 1 |
| 108 | Østensjø Rederi | 3 | 3 | | | | | | | | | | | | | 1 | | | | 1 | | | | 1 |
| 109 | Østensjø Rederi AS | 1 | 1 | | | | | | | | | | | | | 1 | | | | 1 | | | | 1 |
| | Total | 381 | 263 | 1 | 7 | 7 | 3 | 2 | 11 | 11 | 4 | 10 | 8 | 1 | 2 | 2 | 2 | 1 | 36 | 50 | 37 | 12 | 24 | 39 |

Table 11: Norwegian firms in offshore wind

# B

# INTERVIEW GUIDE

The interview guide that was used as as the basis for our semi-structured, open-ended interviews. The interviews were conducted in Norwegian, so the guide has been translated to be presented here. In addition, the guide was customised before each interview, so the actual questions and phrasing may have differed from the interview guide.

**1. Motivation**

a) Why did your company enter the offshore wind industry?

b) Do you consider the offshore wind activity a main activity or a side activity for the company? Do you expect this to change over time?

c) Did your company have any prior diversification experience?

d) Which challenges did you identify before entering the offshore wind industry?

**2. Offshore wind presence and organisation**

a) Did you encounter any challenges that you didn't expect upon entry?

b) What was the main reason you were able to obtain your first contact?

c) How is your offshore wind activity organised?

d) Do you consider your offshore wind engagement to be successful thus far? Why or why not?

e) What considerations do you have regarding your timing of entry into the offshore wind industry?

**3. Deliberateness**

a) Was entering the offshore wind industry based on a deliberate strategy, or primarily an opportunity that presented itself?

| | |
|---|---|
| | b) Was the offshore wind entry one of several diversification opportunities that were considered? |
| | c) Hypothetically, if the activity level in the oil & gas industry were to rise back again, would you exit offshore wind? |
| | d) In the bigger picture, do you think a decline in oil related industries would be positive or negative for the offshore wind industry? |
| **4.** | **Relatedness** |
| | a) Would you say that your offshore oil activities and offshore wind activities are related industries? |
| | b) To what extent have you adapted your existing products or services to the offshore wind industry? |
| | c) Has your R&D activities increased as a consequence of your offshore wind activity? |
| | d) Did you hire new employees to enter the offshore wind industry? |
| | e) To what extent can your company reallocate equipment? |
| | f) To what extent did you exploit your existing network when investigating the offshore wind industry before entry? |
| **5.** | **Financial and market considerations** |
| | a) Do you have an ambition to grow fast within the offshore wind industry? |
| | b) How risky an investment would you describe your offshore wind efforts to be, relative to oil and gas? |
| | c) What are your ambitions in a log-term perspective? |

Table 12: Interview guide

# C

# INTERVIEW AND SEMINAR OVERVIEW

The two tables that constitute appendix C provide an overview of all interviews conducted the in the spring of 2017, as well as seminars and conferences we have attended the past year. This is to provide an overview of potential biases we have had writing this thesis, supplementing the academic literature and industry reports addressed in the bibliography.

| **Firm** | **Name** | **Title** | **Date** | **Method** |
|---|---|---|---|---|
| Statoil | Tarald Gjerde | Head of Project Execution, Wind Business Development | 09.03.2017 | T |
| Kongsberg | Kristian Holm | VP Renewables & Utilities | 23.02.2017 | P |
| StormGeo | Jostein Mælan | VP Renewables | 20.03.2017 | P |
| Aibel | Lars Henrik Hosøy | Business Development Manager, Renewables | 01.03.2017 | P |
| Kværner | Kjell Eggen & | Former VP Business Development | 24.03.2017 | P |
| | Lars Minsaas | VP Business Development | | |
| Nexans | Morten Langnes | Sales Manager | 21.04.2017 | T |
| Fred. Olsen | Ketil Arvesen | Vice President | 27.03.2017 | P |
| Ulstein | Jon Olaf Brett | Deputy Managing Director | 24.02.2017 | T |
| | | **Additional interviews** | | |
| Storebrand | Philip Ripman | Senoir Analyst | 24.03.2017 | T |
| Statoil | Anniken Ringnes | Senior Cost Estimating Engineer, New Energy Solutions & Utilities | 29.03.2017 | T |

P = personal meeting, T = telephone interview.

Table 13: List of all interviews

| **Conference / Seminar** | **Organiser** | **Date** | **Location** | **Type** |
|---|---|---|---|---|
| InNOWiC inception meeting | Intpow | 23.05.2016 | Trondheim | S |
| InNOWiC workshop | Intpow | 08.11.2016 | Oslo | S |
| Energy transition 2017 | NTNU, FME CenSES and Statoil | 07.03.2017 | Trondheim | C |
| Can you make money on renewable energy? | ZERO | 05.04.2017 | Oslo | C |

S = seminar, C = conference

Table 14: List of attended seminars and conferences

# D
# OFFSHORE WIND PROJECTS

Table 15 presents a brief selection of some of the earliest offshore wind farms, to illustrate the evolution the industry has seen since inception. The technological evolution is in large represented by the turbine capacity, as well as the depth an distance to shore, while the market evolution can indicated by the increase in number of turbines per wind farm. The table is sorted by year, and a distinction is made where the industry entered a new stage, according to Dedecca et al. (2016) and Gustafsson et al. (2016).

| Year | Country | Wind farm | Turbine capacity (MW) | # of turbines | Depth (m) | Distance (km) |
|---|---|---|---|---|---|---|
| | | | **Initial stage** | | | |
| 1990* | Sweden | Norgersund | 0,22 | 1 | 7 | 0,3 |
| 1991 | Denmark | Vindeby | 0,45 | 11 | 4 | 2,3 |
| 1994 | Netherlands | Lely | 0,50 | 4 | 3,5 | 0,8 |
| 1996 | Netherlands | Irene Vorrink | 0,60 | 28 | 1,5 | 0,03 |
| 2000* | UK | Blyth | 2 | 2 | 8,5 | 1,6 |
| 2000 | Sweden | Utgrunden 1 | 1,5 | 7 | 8,5 | 10,3 |
| 2001 | Denmark | Middelgrunden | 2 | 20 | 4 | 2 |
| | | | **Co-evolutionary stage** | | | |
| 2002 | Denmark | Horns Rev 1 | 2 | 80 | 10 | 17 |
| 2003 | Denmark | Nysted 1 | 2,3 | 72 | 8 | 11 |
| 2007* | UK | Beatrice | 5 | 2 | 45 | 22 |
| 2008 | Sweden | Lillgrund | 2,3 | 48 | 7 | 7 |
| 2009* | Norway | Hywind | 2,3 | 1 | 220 | 10 |
| 2009 | Denmark | Horns Rev 2 | 2,3 | 91 | 13 | 30 |
| | | | **Growth stage** | | | |
| 2010 | Belgium | Belwind 1 | 3 | 55 | 29 | 46 |
| 2013 | UK | London Array 1 | 3,6 | 175 | 13 | 19,5 |
| 2014 | Germany | Riffgat | 3,6 | 30 | 21 | 23 |
| 2015 | UK | Gwynt y Môr | 3,6 | 160 | 33 | 18 |
| 2017 | Netherlands | Gemini | 4 | 150 | 36 | 55 |

Table 15: Overview of offshore wind projects (4C Offshore 2017)

*Only one or two turbines, not considered to be wind farms, but individual prototypes. They are still included here due to their relevance when addressing the technological development of offshore wind farm development.

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