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Corporate entrepreneurship and sustainability transitions: resource redeployment of oil and gas industry firms in floating wind power

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Abstract

Established firms are often described passive in the development of clean technologies. However, it has been recently argued that the vast resources of established firms could also accelerate sustainability transitions e.g. in the energy sector. This paper contributes to the study of sustainability transitions and corporate entrepreneurship by investigating resource redeployment of three Norwegian oil and gas industry firms in corporate ventures in floating offshore wind power technologies. Using interview and document data, the findings show that the opportunity to use existing firm resources was a key motivation for the firms to engage in entrepreneurship in such technologies. Moreover, the firms could use their specialized and general-purpose resources in their entrepreneurial ventures, and could develop new technologies on the basis of their existing resources. This paper thus suggests that the process of resource redeployment can help to explain why, and describe how, established firms may engage in corporate entrepreneurship in new cleantech.

Keywords

Corporate entrepreneurship; Floating wind power; Oil and gas industry; Sustainability transitions

1. Introduction

Established firms in the energy sector, for instance those responsible of the production of oil and gas (O&G), are often considered to be passive or to resist sustainability transitions (Newell & Paterson, 1998; Geels, 2014). This is because they have vested interests in the current energy system, and their competences may be focused on the routines and capabilities related to the extraction of hydrocarbons (Nelson & Winter, 1982; Hess, 2014). Thus, clean technologies, such as renewable energy technologies, are often expected to be developed by smaller start-up firms (Hockerts & Wüstenhagen, 2010).

However, recent studies have nevertheless reported that established companies can also play an important role in development of new cleantech (Berggren et al., 2015; Wesseling et al., 2015). As argued by Frank Geels, “incumbent actors can resist, delay or derail low-carbon transitions, but they can also accelerate them if they reorient their strategies and resources towards niche-innovations” (Geels, 2018). The lock-in and rigidity posed by the existing resources and competences of established firms is therefore perhaps only one side of the coin in the relationship between established firms and cleantech innovations (cf. Pavitt, 1991). However, few studies in sustainability transition studies have investigated why and how the established firms use their resources in the development of new cleantech (Wesseling et al., 2015; T. Hansen & Coenen, 2017). Moreover, while the literature on corporate entrepreneurship often describes the use of existing firm resources as a key mechanism in corporate ventures (McGrath et al., 1994; Narayanan et al., 2009), few studies have investigated this process in detail.

I will address these gaps in research by performing a multiple case study of the use of resources in three Norwegian O&G industry firms’ corporate entrepreneurship in floating offshore wind power (OWP). This empirical topic presents an illustrative example of resource redeployment between two technologically related industries (G. H. Hansen & Steen, 2015). Floating OWP, for its part, has the potential of making an important contribution to the sustainability transition in the energy sector. Peculiarly, the technology development in floating OWP has not been driven by traditional wind energy firms, but by (for instance Norwegian) established O&G industry firms. Floating OWP is still in its early phase with only a few demonstration projects worldwide, but it is expected to show a steeper rate of cost reduction over time than the traditional bottom-fixed OWP, thus possibly becoming the most cost-efficient means of producing OWP by 2030 (IEA, 2018). Using the resource-based view of a firm and literature on corporate entrepreneurship, I analyzed how the O&G industry firms had used their existing firm resources in corporate ventures in floating OWP, as well as their underlying motivations for such activities.

My findings suggest that the redeployment of existing firm resources was a key process in corporate entrepreneurship in floating OWP. First, the opportunities for resources redeployment acted as a key motivation. Second, the established firms had used their

specialized and general-purpose resources in their entrepreneurial ventures. Third, the firms had used their existing resources in developing new floating OWP specific technologies. Resource redeployment and corporate entrepreneurship were not without their challenges, however, and the established firms faced the need to e.g. develop new types of mindsets and identities. In sum, the results suggest that the resource redeployment can be a key process in explaining why and describing how established firms may engage in cleantech innovation, and thus potentially accelerate sustainability transitions.

In section 2, I will elaborate on the theoretical foundations of this paper, while section 3 explains the methodology. Section 4 presents the empirical findings, and section 5 discusses these results.

2. Theoretical perspectives

2.1. Corporate entrepreneurship

Corporate entrepreneurship is understood in this paper as a process of an established company engaging in innovation in a new market, which may include creation of a new organization either internally or externally to the company (Sharma & Chrisman, 1999). Firms may engage in corporate entrepreneurship e.g. to improve their performance amidst changing environmental conditions (Zahra & Covin, 1995), to achieve strategic renewal (Guth & Ginsberg, 1990), and to develop future revenue streams by reusing their existing firm resources (McGrath et al., 1994). It can take place through the creation of a new venture aiming at developing a new business through an innovative technology. Such ventures can be placed in a new organization, either internally in the existing company as e.g. a project or a division, or in separate company (Sharma & Chrisman, 1999; Kuratko & Audretsch, 2013). Internal ventures may take the form of e.g. in-house development of technology in a completely new market. External ventures can take place for instance through setting up a separate company for in-house technology development, or acquiring a start-up company with an innovative technology.

The decision to develop ventures in-house rather than buying shares in an external company can be motivated e.g. by the desire to have a stronger control over technology development (Bjørgum, 2016). For instance, an established firm may develop new technologies in their R&D laboratories, and then seek to bring them to the marketplace (Buenstorf, 2016). In-house ventures therefore often utilize the existing resources of established firms, for instance human resources and the technological and marketing expertise (Tidd & Taurins, 1999).

On the other hand, acquisition of a technology start-up can be a faster way to develop a new business, and provide flexibility for established firms in comparison to the more committed and arduous in-house development (Bjørgum, 2016). Acquired firms often have a

complementary knowledge space with the established firms. Smaller companies may have the advantages in developing disruptive technologies, while larger firms may possess resources that are useful in commercialization (Maula et al., 2005; Andersson & Xiao, 2016). For instance, by using their larger resource base and experience, the established firms can often support start-up firms in their R&D efforts, and use their existing firm resources in legitimizing and scaling up the new technologies (Bjørgum & Sørheim, 2015; Lindholm-Dahlstrand et al., 2018). Access to such complementary resources through (the often patient) ownership of established firms can be particularly helpful in developing new-to-the-world technologies, as it may otherwise be difficult to obtain such assets externally due to the high uncertainty related to such technologies (Park & Steensma, 2012; Bjørgum & Sørheim, 2015).

To summarize, corporate entrepreneurship typically draws on the existing resources of established firms (Narayanan et al., 2009). Using existing firm resources in new markets, i.e. resource redeployment, is therefore a key process (Guth & Ginsberg, 1990). However, this process is rarely described in detail in the corporate entrepreneurship literature. For this purpose, I draw on the resource-based view of a firm to discuss the rationale for resource redeployment in firms.

2.2. Resource redeployment

Firm resources refer to all assets, organizational processes, knowledge, facilities etc. possessed by the firm. Firm resources have been argued to be central for growth and for firm's ability to compete in the marketplace (Penrose, 1959; Barney, 1991). Such growth can take place particularly through the use of existing resources in related markets (Helfat & Lieberman, 2002). Resource redeployment is therefore often considered as a key process determining in which markets established firms choose to enter, and why (Sakhartov & Folta, 2015; Lieberman et al., 2017). The key notion in resource redeployment is that some firm resources are fungible, meaning that the resources are not only confined to their current use, but can also be applied in other markets (Teece, 1982; Anand & Singh, 1997). Fungibility of resources can be seen as a continuum between specialized and general-purpose resources, where former are limited to only few markets, while latter ones are applicable in several markets (Helfat & Lieberman, 2002; Pisano, 2017).

Redeployment of existing firm resources alone is unlikely to be enough for building a successful new business, and therefore development of new specialized resources is also needed (Pisano, 2017). Nevertheless, resource redeployment can take place also in the development of new resources (Kaul, 2012). For instance when new specialized knowledge or technologies are developed internally, the existing R&D capacity of firms is often used. This way the new resources are developed on the basis of existing firm resources, such as the technological knowledge, laboratory facilities and staff inside a company. Moreover,

managerial attention and financial resources are needed, also when acquiring the resources externally, e.g. through acquisitions or contracting. The resource redeployment in development of new resources is illustrated through the opportunity cost that is associated in such investments. In other words, development of new resources may disallow the use of the same R&D capacity, managerial attention or financial investment in the other markets of the firm (Levinthal & Wu, 2010).

Different authors use various categorizations for the content of resources (see e.g. Helfat & Lieberman, 2002; Tanriverdi & Venkatraman, 2005). As the interest of this paper is particularly on technology development in corporate entrepreneurship, *technological resources* are highlighted. Technological resources of the company consist particularly of the knowledge regarding technologies. Firms commonly utilize their existing technological competences when developing and learning about new technologies, and firms tend to enter markets where they can use their existing technological resources (Granstrand, 1998; Breschi et al., 2003). *Organizational resources* consist of e.g. managerial capabilities (Tanriverdi & Venkatraman, 2005), product design and manufacturing capabilities (Magnusson et al., 2005), human and financial assets (Chatterjee & Wernerfelt, 1991; Farjoun, 1994), as well as institutions such as the established practices and the identity of the company (Melewar et al., 2005). Possibility to redeploy *both* technological and organizational resources, and not only one type of resources, can be crucial in whether established firms will engage in developing new technologies (Magnusson et al., 2005).

3. Methodology

I performed a qualitative multiple case study of three companies. The empirical analysis had three phases.

First, all Norwegian O&G operator and supplier companies, who had engaged in developing and commercializing floating OWP technologies, were identified. Seven companies were contacted, while three agreed to take part in the study (see Table 1). Following the European Commission's definition, two of the companies were large and the remaining one was medium-sized. Two of the companies had developed a floating OWP technology in-house, while the remaining one had acquired a share in a start-up company with a novel floating OWP concept. All technological concepts put emphasis on the foundation structure, and were not seeking to develop e.g. new types of generators or blades. Hence, the challenges and opportunities faced by the companies were similar in all cases, making them comparable.

Table 1 Case study companies

Name	Type of company and corporate entrepreneurship
Firm 1	A large company, an in-house technology development
Firm 2	A medium-sized company, an in-house technology development
Firm 3	A large company, purchase of shares in an external floating OWP venture

Second, semi-structured interviews with the companies were performed in two rounds and used as the main source of data (see Appendix for the list of interviews). The first round of interviews took place during April-September 2018. A total of seven interviews with senior managers in the case study companies were made. Moreover, five industry experts, selected for their high level of knowledge of the Norwegian O&G industry and its activities in OWP, were interviewed. All interviews lasted approximately an hour, were recorded, conducted in English in person, by phone or audio/video connection, and fully transcribed into written format. The used quotes in this paper are therefore presented verbatim. In the second round of interviews in January-February 2019, a draft version of this research paper was sent to the key respondents in the case study companies prior to the interview meetings. In the meetings, the preliminary findings were presented, providing an opportunity to discuss the results, to correct any prior misunderstandings, and to gather additional data. These second round meetings lasted an hour, were not recorded, but extensive meeting notes were gathered instead.

I further collected and analyzed documental data, such as annual reports, firm websites and other available documents, to triangulate the results. Patents available in the Espacenet service of the European Patent Office were also gathered. The search terms were “wind” in title and abstract, and the company names as the applicants. Non-OWP related patents were discarded, and concluded with 23 patents. The citations made in these patents (in all available country versions, removing duplicate citations) to other patents were collected. By reading through the abstracts, it was determined if the cited patent was describing a technology mainly intended for wind power production, O&G or other markets.

Third, the data was analyzed with the help of the NVivo software. The initial part of coding identified the motivations and firm resources involved in corporate entrepreneurship. Next, the redeployed resources were categorized by the degree of specialization: specialized resources (mainly applicable in offshore markets), general-purpose resources (i.e. resources applicable in multiple markets) or new resources (i.e. resources developed for floating OWP) (Pisano, 2017). They were also coded in terms of their content (technological and organizational resources) (Magnusson et al., 2005).

4. Results

4.1. Floating wind power technologies

OWP is a capital-intensive technology which is beginning to mature as a cost-competitive renewable energy technology (see Figure 1). The first bottom-fixed projects, i.e. turbines attached to the sea bottom, without public subsidies are now implemented (FT, 2018). However, bottom-fixed technologies are believed to be limited to water depths of maximum 40-60 meters and to suitable sea-bottom conditions. Hence, to disseminate OWP to more geographic locations in the world, e.g. the deep shores of Western coast of North America and Japan, floating OWP technologies are required.

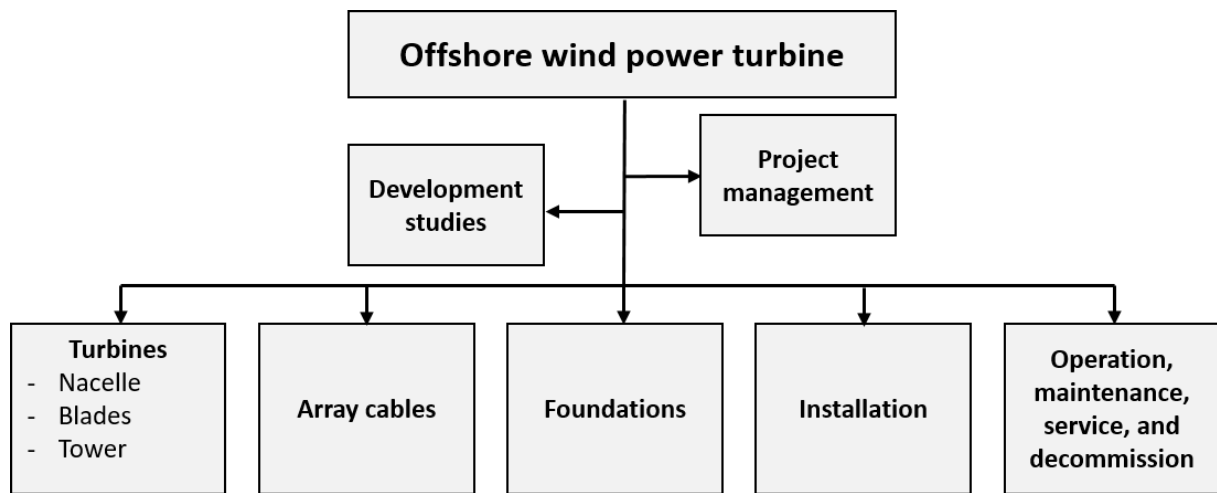


Figure 1 A typical value chain of OWP turbines (adapted from NORWEP, 2017).

Floating technologies, such as buoyant *semi-submersible* constructions, cylindrical up-right floating *spar* buoys, and *tension-leg* platforms standing on “stiff” vertical moorings, are novel to the wind power sector, but are well-known in the offshore O&G industry. Due to this technological relatedness, floating OWP has therefore been seen as a market opportunity in the O&G industry, and several O&G industry companies, especially in Norway, have engaged in floating OWP development (cf. Mäkitie et al., 2018; 2019). It therefore presents an illustrative context to study where established firms have used their existing resources in technology development and corporate entrepreneurship in new cleantech.

4.2. The motivations of firms to pursue corporate entrepreneurship in floating OWP

Two key factors had motivated the firms to engage in floating OWP ventures: a perceived transition in the energy sector, and an opportunity to redeploy existing firm resources.

First, especially in Europe, renewable energy production has grown rapidly in recent decades, with a clear trend of public ambitions to increase its share in the electricity mix.

“We saw quite clearly [--] that we are going to have the energy market in a huge transition. We will try to be in the forefront, so we will try to move early. (1)

Pressure to do so is particularly relevant for O&G industry firms, which in the long term may end up being locked into the declining and “undesirable” side of the energy market. This caused pressures for diversification towards renewable energy, which was also seen as an increasingly attractive market opportunity. However, all companies remained committed in continued operations also in the O&G market.

“[Some of] our clients [--] have divested their O&G business. So the question is if oil will be over time the new tobacco. This is not what I think, but there are people saying that. [--] So there is a fundamental change in the business. And for the first time we are seeing that [--] renewables is certainly picking up and becoming a reliable source of energy.” (7a)

For Firm 1, diversification to renewable energy was a strategic goal in and of itself. Entrepreneurship in floating OWP therefore possessed also a symbolic meaning in showing to the public that the company is not only focusing on the O&G market, but also has a sustainable energy business.

Second, the opportunities to redeploy existing firm resources played a central role in why the firms had engaged in floating OWP ventures. The firms could utilize their existing knowledge regarding O&G technologies and techniques, thus developing floating OWP technologies based on known and proven O&G technologies. Especially the in-house technology developers saw an opportunity in leveraging their existing engineering competences. The acquirer company Firm 3 was considering to do the same, but eventually decided to acquire shares in an external company.

“We actually developed a design ourselves which is based on our technology in floating O&G. We quickly realized that the clients were after proven concepts. [--] Coming from analysis model and drawings into a tank test and building a prototype, it would take us years. [--] So we went out on to the market and quickly understood that the best fit with our technology was [the acquired company]. So, we invested in [the acquired company].” (7a)

In the large Firm 1, the logic of resource redeployment was used inside the organization to convince the top management to allocate resources for the project. Resource redeployment was seen to reduce the uncertainty, cost and time involved in the technology development, thus making the project more attractive for the top management.

“We were looking into a quite a set of different ideas and concepts but found that should we be able to promote this idea, it has to be built upon known technologies. Many people had proposed a lot of wind turbine ideas, which combine a lot of new technologies that have to be developed. Who would put the money into that? [--] [Using existing technologies] was, I think, an important selling argument.” (12)

In the following section, I analyze such redeployed resources in more detail.

4.3. Resource redeployment in corporate entrepreneurship

4.3.1. Existing specialized resources

The case study companies had used several specialized resources in their ventures (see Table 3). Particularly the technological resources proved important.

Table 2 The redeployed specialized resources. Light grey color: redeployment took place. Dark grey: no redeployment.

	Specialized offshore resources	Firm 1	Firm 2	Firm 3
Technological	Floating offshore foundations			
	Mooring			
	Power cabling and electrical equipment			
	Offshore materials			
Organizational	Offshore identity			

Technological resources

The existing knowledge regarding **floating offshore foundations** was a central redeployed resource in all firms. Albeit transferring floating technologies from O&G to OWP required some changes e.g. in the size and the design of the structures, the companies were confident of their ability to adapt.

“To optimize the design of these structures in the marine environment, those are the same things we do when we optimize a floating [O&G] structure or a platform structure.” (1)

Another important technology was the **moorings**, i.e. the anchorage and chains attaching the floating device to the sea-bottom, where the companies could use their prior O&G knowledge. Similarly, two companies could use their O&G experiences in **power cabling and equipment**, which in the O&G are used in e.g. subsea technologies, i.e. technologies operated at the sea-bottom, and powering platform equipment. The companies also had plenty of knowledge regarding suitable **offshore materials**, such as steel and concrete, used in offshore

constructions. Besides mitigating corrosion caused by the saline sea water, this was important to minimize the costs of foundations and enabling problem-free fabrication.

Organizational resources

Over the years of business activities in the offshore O&G market, the companies had developed an **offshore identity** which was visible in their willingness to engage in entrepreneurship in floating OWP. For example in Firm 2, while the market opportunity also played a role, this inherent interest in offshore technology development was described as a key factor for their commitment in their venture, disregarding the fact that the financial return for their investment was still highly uncertain.

“We are sort of nerds here (laughs) so we see what we know and what we are interested in developing from technological perspective.” (4a)

The offshore identity of the case study companies and awareness of offshore technologies was perceived to be in contrast with the wind power industry at large, which were seen more accustomed to transferring on-shore wind technologies, such as the monopile foundation, turbines and blades, to offshore conditions.

4.3.2. Existing general-purpose resources

Especially the large Firms 1 and 3 had redeployed several kinds of general-purpose resources (Table 4). The organizational resources played an important role.

Table 3 Redeployed general-purpose resources

	General-purpose resources	Firm 1	Firm 2	Firm 3
Technological	Broad technical capabilities			
	Integration of technologies			
Organizational	R&D and engineering capacity			
	Established R&D processes			
	Management of large projects and supply chains			
	In-house financing			
	Financial strength and credibility			
	History of diversification and entrepreneurship			
	International presence			

Technological resources

The large companies (Firms 1 and 3) had employed their **broad technical capabilities** also outside of the offshore competences. Such competences included e.g. meteorology, logistics and environmental impact assessment. In addition, they had also redeployed their experience in **integration of technologies** into a single complex system.

“We know how to design the details of those components and analyze the dynamic system in one piece. So this [--] dynamic analysis, we are quite strong in that.” (8a)

Such system integration of technologies is an important feature in highly complex constructions, such as the floating O&G platforms. While OWP turbines are somewhat “simpler”, it is nevertheless important to be able to understand how the different components of offshore wind turbines, e.g. the foundation, the generator, and the blades, affect each other in a challenging natural environment characterized by e.g. strong winds and heavy waves.

Organizational resources

All firms had utilized their **R&D and engineering capacity** in developing a new technological concept. In the acquirer Firm 3, the start-up company was primarily responsible of the R&D, but through its broad engineering capacity, Firm 3 itself could nevertheless give support in specific engineering challenges.

“[They] can't afford to have a big materials school for example. [--] We probably have more material engineers than they have engineers.” (8a)

In the in-house developer Firm 1, such redeployment of R&D capacity from highly profitable O&G market to still much smaller OWP was not without controversies, and was described as a management dilemma.

“We have to compare pears and apples here. Because it has a hard strategic value to develop the next generation [offshore wind] technologies. But it also has a very high shorter value to optimize this [O&G] production. So, it's a struggle.” (1)

Offshore O&G projects are usually custom-made, as the particular characteristics of O&G reservoirs and the differing requirements of O&G operator companies mean that technologies used in one reservoir are rarely directly applicable in others. This means that companies continuously need to adapt and develop new technologies for projects. In this context, the

floating OWP technologies were often seen as just another technology development project, allowing the companies to redeploy their usual **R&D processes**.

"[Our company] has been a pioneer in the O&G, developing technologies. [--] [The floating wind project], that's just a part of the technology development I have been part of over the years working for the O&G industry." (2)

The two large companies could redeploy their existing capabilities in **managing large projects and supply chains**, which was seen important when the technologies were advancing towards e.g. demonstration projects and commercialization.

"The R&D took this concept to a certain level, and when it was decided to build it, [the R&D department] was out of the project and there was a professional project execution team that was used to build big platforms and do big projects and could do this professionally with contracts, with timing, and budgeting." (12)

Supply chain management was seen as a key redeployed competence when seeking to bring the floating OWP turbines closer to commercialization. Such processes in OWP were perceived similar to the O&G.

"If we are going to produce thousands and thousands of tons of steel on global basis, that's where [our company] has a rock-solid background [---]. This is sort of the value that [our company] brings to the table: the solid long-term competence in technical solutions, global operations and project execution down to commission." (8b)

Firms had delivered **in-house financing** to ventures by redeploying financial and human capital. This was crucial as external financing, especially commercial financing, was difficult to attract due to the high level of uncertainty in the early phases of technology development. The medium-sized Firm 2 was particularly struggling when the venture was moving towards a demonstration project.

"We don't have the muscles to do that or the financing, so that's what we are struggling with these days." (4a)

The acquirer company, Firm 3, had helped their start-up company with similar issues, and had provided **financial strength and credibility** to the venture.

"Although [the acquired company] has a fantastic technology, they are a great company, they are only [less than 50] people. So they need the balance sheet and the credibility of a big organization. So that's what [our company] is providing in that ownership." (7a)

One of the case study companies date back well before O&G was even discovered in Norway, and had originally diversified to O&G through redeployment of e.g. mechanical and marine

engineering competences. Moreover, also the remaining two had engaged in other energy technologies and markets over the years. Hence, the case companies had a **history of diversification and entrepreneurship** in new markets. This enabled the companies to draw learnings from prior diversification and entrepreneurial activities, including prior mistakes.

“We had some experiences that we are diving into things [too early]. [--] I think what we see quite often, the best is not always to be the first one, you can be number two.” (4a)

The two large companies could also use their **international presence**, as they had offices in multiple locations around the world. As multinational companies, they had essentially a global scope in attempting to find project opportunities, and could use their local offices in such tasks.

4.3.3. Development of new firm resources

Firms had developed also new resources (Table 5). The firms could use their existing resources in the development of specialized floating OWP technologies.

Table 4 Development of new firm resources

	New firm resources	Firm 1	Firm 2	Firm 3
Technological	Specialized OWP technologies			
Organizational	New customer and supplier relationships			
	Cost-efficiency mindset			
	New identity and status in the market			

Technological resources

All companies had engaged in creating new **specialized OWP technologies**. Especially the two in-house technology developers, Firms 1 and 2, were heavily engaged in this with 23 found patents for their OWP technologies. In terms of the overall citations of these patents to other patents, three quarters referred to other wind power technologies, while O&G related citations were few (see Figure 1). This difference in citations may reflect different patenting practices between the two industries. However, the large number of patents and wind power citations show that the companies had developed an extensive knowledge in specialized OWP technologies.

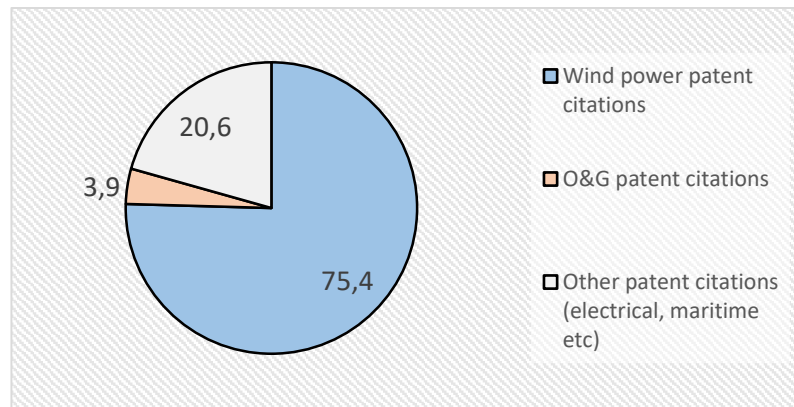


Figure 2 The OWP patent citations to other patents (per cents, 281 citations in total).

However, several of the new OWP technologies were described to be strongly based on their existing O&G knowledge.

“The whole idea was to [--] directly use what we had done in O&G industry before. [--] We have a known floating concept, we are using a known wind turbine concept, we are using a known mooring concept. So, there is nothing new. We know all the components, but we put them together in a different way and use it for a different purpose.” (12)

OWP turbines nevertheless differ from O&G platforms, which posed a need for completely new technologies. In Firm 1, controller systems of turbines were considered important.

“So that's the real own technology development that we have.” (2)

Such controllers minimize the movement of the turbine, and reduce its fatigue in the harsh open sea conditions, thus extending its lifetime to at least 20 years. Even though these were new technologies, the company could nevertheless lean back to their engineering competences developed in the O&G industry in solving similar kinds of technical challenges.

“We do understand how these interacted systems work together and how the forces from the wind, from the waves, from the tides, from the currents, how all these forces come together and suppress the system and how it can be designed to move as little as possible. So all these things are transferred directly [from O&G].” (1)

Organizational resources

The companies had also developed **new stakeholders and supplier relationships**. Especially the relationships with wind turbine manufacturers proved to be challenging to establish, as they were described reluctant to explore floating OWP technologies.

“We wanted to put a standard turbine on top of this [floating structure]. [The turbine manufacturers] were very skeptical, because they had never seen a turbine which was put on a device that could move.” (12)

Establishing relationships with large turbine manufacturers was particularly challenging for the medium-sized Firm 2.

“It’s crucial for succeeding in this market to have good relations with [large turbine manufacturers], which is quite difficult actually if you are a small player. They don’t want to listen to you and especially they haven’t been too interested in the floating wind.” (6a)

Another key challenge was the importance of cost-efficiency in OWP.

“The cost is the difficult part (laughs). We can make anything [in OWP] if the cost was not a concern.” (8a)

This has to do with the different requirements for the O&G and OWP technologies. In an O&G platform, people work close to high-pressurized and explosive materials, where technological malfunctions may lead to loss of life, major environmental pollution and gigantic financial losses. Quality and safety of technologies is therefore a priority. In comparison, the reduction of cost is a key imperative in the OWP market to make it competitive against other forms of electricity production. Moreover, safety is less critical as turbines operate without personnel. OWP technologies are also mass produced, while O&G technologies are typically custom-made. For the studied companies, this meant the development of a **cost-efficiency mindset**.

“We have to overcome our tendency to tweak everything to perfection. Because [in O&G] you don’t take chances. [--] But in wind we have to sort of tweak it to the right level, which is good enough, and then leave it. And this I think will be a mental challenge for our technology teams.” (8b)

Moreover, while being established players in the O&G market, especially the large companies found themselves in a new role as new-comers and small players in the OWP market. However, such **new identity and status** was welcomed with a positive response from the side of the employees.

“We had an advert out for a leader of the wind team. And there were more than 50 applications. Internal only. A few years ago we were all skeptical towards renewables. [--] [Now] everyone wants to join the team.” (7a)

This reflects a perceived on-going transition in the energy industry, attracting O&G employees to apply their competences in renewable energy technologies.

5. Discussion

While established firms, such as the O&G industry firms, can be passive or even resist sustainability transitions (Geels, 2014), recent papers have argued that they can also take a more constructive role in cleantech innovation and potentially accelerate sustainability transitions (Geels, 2018). This paper showed that established firms for instance in the energy sector indeed can behave in different ways in regards to cleantech innovation. Ironically, however, it was the O&G industry firms, such as the ones studied in this paper, which had provided the entrepreneurial agency in developing floating OWP technologies, while the established wind power industry firms were described to be passive and reluctant. Therefore, I investigated why such established O&G industry firms had engaged in corporate entrepreneurship in floating OWP technologies, and how did they use their existing resources in such process. Three main findings regarding resource redeployment emerged.

First, while the perception of an on-going energy transition was an important motivation, the opportunity for resource redeployment was a key factor why the firms had engaged in corporate entrepreneurship in floating OWP (cf. Wesseling et al., 2015). The firms believed to be able to utilize their existing O&G resources in both their in-house ventures and external acquisitions, and thus achieve a competitive advantage in the possible future market for these technologies. Hence, the perceived opportunity of resource redeployment may help to explain why established firms may engage in corporate entrepreneurship in cleantech (Helfat & Lieberman, 2002; Narayanan et al., 2009).

Second, both the existing specialized and the general-purpose resources of the firms were redeployed in entrepreneurial ventures (McGrath et al., 1994; Pisano, 2017). While the specialized offshore technology resources were particularly important in in-house ventures, the large firms could also utilize their general-purpose resources, most importantly their organizational resources. Moreover, financial strength and managerial capabilities were considered as key contributions of how the large company could drive the ventures forward. Thus, while all companies could redeploy specialized technological resources, the large companies could also redeploy their organizational general-purpose resources, which played a key importance in their efforts to commercialize the new technologies.

Third, resource redeployment also took place when the firms developed new specialized floating OWP knowledge. Even though the patent citations suggested otherwise, the new technologies were described to be based on the existing O&G experience and knowledge of the companies. In other words, while the ventures required creation of new technological knowledge, this process could nevertheless utilize the existing resources of the firms, for example the engineering competences of the employees (Kaul, 2012). The firms, however, were challenged by the need to also develop new organizational resources, such as a mindset of cost-efficiency, to succeed in this.

To summarize above three findings, then, resource redeployment was a key process in explaining why and how the studied O&G industry firms had engaged in corporate entrepreneurship in floating OWP. The process of resource redeployment can therefore provide further insights on the differing roles of established firms in cleantech innovation, and how they may contribute to accelerating sustainability transitions. Moreover, the findings show that the redeployment of both specialized and the general-purpose resources firms can have importance in *how* established firms engage in corporate ventures, and that resource redeployment can take place also when developing completely new technologies. Nevertheless, further research needs remain.

This paper remained limited in assessing what are the implications of corporate entrepreneurship and associated resource redeployment for the system-level innovation around floating OWP (Bergek et al., 2008). For instance, while my results suggest that the O&G industry firms had provided e.g. entrepreneurial agency in technology development in floating OWP (Lindholm-Dahlstrand et al., 2018), thus reducing technological uncertainty, and had mobilized resources for innovation (T. Hansen & Coenen, 2017), it is also possible that the redeployment of O&G technologies may direct the search towards sub-optimal technological trajectories. Hence, the assessment of whether the corporate entrepreneurship of O&G industry firms is “good” or “bad” for innovation in floating OWP technologies remains as a task for future research.

Moreover, I studied resource redeployment in corporate entrepreneurship in a single national and technological context. Further studies would need to expand the scope of the empirical analysis to other industries and countries. Such perspectives would contribute to better insight on resource redeployment as a potential key process in shaping the established firms’ engagement in cleantech innovation.

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Appendix: the list of interviews

Nr.	Organization	Interviewees
1	Firm 1	Vice President (VP)

2	Firm 1	Research Manager
3	Firm 1	Research Manager (follow-up meeting)
4	Firm 2	VP (a) + Deputy Technology Manager (b)
5	Firm 2	Deputy Technology Manager
6	Firm 2	VP (a) + Deputy Technology Manager (b) (follow-up meeting)
7	Firm 3	Head of Business Development (HBD) (a) + Finance analyst (b)
8	Firm 3	Engineering Manager (a) + VP, supply chains (b)
9	Firm 3 (acquired firm)	HBD
10	Firm 3	(HBD) (a) + Research & Innovation Manager (b) (follow-up meeting)
11	University	Former Research Director
12	University	Former Senior Engineer in Firm 1
13	Industry Organization	Director
14	Commercial bank	Senior Advisor
15	Public financing institution	Senior Manager

Biographical note

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