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Determinants of Variable Renewable Energy Developers' Financial Performance

Master's thesis in Industrial Economics and Technology Management
Supervisor: Øyvind Bjørgum
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Abstract

Renewable energy (RE) has great potential for decarbonization of electricity production, and variable sources (i.e., solar and wind) are predicted to be the most significant contributors. Governments have expressed a need to accelerate the deployment of variable renewable energy (VRE). While governments may facilitate the deployment, firms ultimately develop VRE. To increase the speed of development, VRE developers need to attract capital from investors who are typically concerned with profitability (Rastogi et al., 2020).

In this thesis, we explored the firm performance of VRE developers. Through our literature review, we found limited research related to firm performance in the renewable landscape. In addition, the research outcomes of the published literature were ambiguous, which illustrates the complexity of the topic. Ambiguous research results upon the impact of single attributes suggests that authors should explore the joint effect of combinations of attributes, as no single attribute is sufficient for explaining firm performance. We did not find any previous research analysing the combined effects of attributes, i.e., configurational research, of firm performance for VRE developers. As such, this thesis contributes with configurational research into the field of renewables and provides novel insight into why combinations of selected attributes enable or constrain superior financial performance of VRE developers.

We carried out an exploratory study by (1) conducting twelve semi-structured expert interviews to gather primary data and holistic insights into the performance of VRE developers. (2) Through guidance by literature and industry experts, we selected the following attributes as possible determinants of VRE developers' performance: size, technological diversification, country diversification, market maturity and EPC (Engineering, procurement, Construction). (3) Data on firm performance and attributes were gathered from financial databases, annual reports, and websites. (4) Possible associations between firm attributes and financial performance were analysed using a qualitative comparative analysis (QCA). In sum, we sought to explore whether the mentioned attributes, and combinations of which, are associated with the VRE developers' ROA (return on assets).

Our study showed complex causal recipes of superior and inferior performance. Specifically, we found indications of that large firms diversified across technologies, markets of varying maturity and engaged in EPC exhibit superior ROA. This could be related to these firms' limited exposure to risks, yielding ripple effects such as superior networks, bargaining power, reduced costs, and capital access and opportunities. Notably, being large was not identified as a necessary condition of superior performance, illustrated by our finding in that large firms operating in a single mature market exhibit inferior performance. Furthermore, our results combined with expert opinions indicate that small players may find success by being specialized if their focus and strategy are well crafted. However, we observed an overweight of configurations with small firms showing inferior performance, suggesting that the path to profitability is more uncertain for small firms.

Sammendrag

Fornybar energi er en viktig brikke i dekarboniseringen av global elektrisitetsproduksjon. Av fornybar energi antas variable energikilder, for eksempel solkraft og vindkraft, å spille en vesentlig rolle. Myndighetene verden over har uttrykt et behov for å akselerere utbyggingen av variabel fornybar energi. Selv om myndigheter er viktige parter som kan støtte oppunder fornybar utbyggingen, er det uansett utviklerne og selskapene involvert som står for den faktiske utbyggingen. For å hente inn nødvendig kapital bør disse selskapene vise til profitt slik at de fremstår som attraktive for eventuelle investorer (Rastogi et al., 2020).

Utbygging av variabel fornybar energi har vist seg å være lønnsomt, men selskapene møter også diverse utfordringer (Ibarloza et al., 2018; Schabek, 2020; Sinsel et al., 2020). I denne masteroppgaven har vi utforsket den finansielle suksessen til selskaper som er involvert i utbygging av variabel fornybar energi (VRE). En litteraturstudie avdekket en begrenset mengde forskning som ser på faktorer, også kalt attributter, som er avgjørende for fornybar energiutvikleres suksess. Vår oppgave bidrar med ny innsikt i hvordan kombinasjonen av attributter muliggjør eller motvirker fornybarutvikleres suksess, målt ved avkasting på eiendeler (ROA).

Masteroppgaven er en utforskende studie hvor vi (1) gjennomførte tolv semistrukturerte ekspertintervjuer for å samle inn primærdata og få en helhetlig forståelse av mulige attributter som kan påvirke VRE utvikleres suksess. (2) Med støtte i litteratur og intervjuer endte vi opp med å undersøke hvorvidt suksessen til et selskap som har spesialisert seg innen fornybar energi påvirkes av følgende attributter: størrelse, diversifisering på tvers av teknologier, diversifisering på tvers av land, modenhet i marked og om selskapet er med på utbyggingsfasen av prosjekter. (3) Vi gjennomførte deretter en omfattende data innsamling og behandling. Her vi benyttet oss av fritt tilgjengelig data fra finansielle databaser, årsrapporter og VRE utviklernes nettsider. (4) Til slutt identifiserte vi mulige relasjoner mellom kombinasjoner selskapsattributter og finansiell suksess ved hjelp av kvalitativ komparativ analyse (QCA), før vi forsøkte å tolke relasjonene.

Resultatet av denne masteroppgaven er en sammenstilling av hvordan kombinasjonen av forskjellige faktorer, også kalt konfigurasjoner, påvirker suksessen til VRE utviklere. Vi har kommet frem til komplekse kausale forhold som medfører god, og dårlig, finansiell suksess. Resultatene indikerer at store selskaper som diversifiserer på tvers av teknologier, land og markeder med ulike grader av modenhet, og som er involvert i EPC prosessen, oppnår finansiell suksess. Imidlertid ser vi også at store og *teknologisk diversifiserte* selskaper ikke er ensbetydende med lønnsomhet. Vi finner også en overvekt av konfigurasjoner for små selskaper som er ulønnsomme, men resultatene antyder likevel at små spesialiserte selskaper kan oppnå lønnsomhet.

Preface

This thesis concludes our Master of Science in Industrial Economics and Technology Management at the Norwegian University of Science and Technology (NTNU).

First, we want to thank our academic supervisor, Øyvind Bjørgum, for valuable support and guidance throughout this thesis.

We also want to thank Dag Håkon Haneberg for prompting and providing input to the QCA methodology. We also want to thank family for valuable input regarding the final draft of the thesis.

Lastly, we want to express our gratitude to the industry experts interviewed. They contributed with valuable insights into the world of renewable energy developers.

10.06.22

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Abbreviations

BM	Business model
csQCA	Crisp set QCA
EPC	Engineering Procurement and Construction
fsQCA	Fuzzy set QCA
IEA	International Energy Agency'
LCOE	Levelized cost of energy
n/N	Number of cases
NTNU	Norwegian University of Science and Technology
RBT / RBV	Resource based theory / view
RE	Renewable Energy
QCA	Qualitative comparative analysis
SCP	Structural conduct performance
TCT	Transaction cost theory
VRE	Variable renewable energy

1. Introduction

During Autumn 2021, global leaders gathered in Glasgow for the COP26, the 26th climate change conference (UN, 2021). The purpose of COP26 was to agree on how the international community could mitigate the consequence of climate change. The carbon emissions are closely related to the electricity generation industry (Dewan, 2021), as the decarbonization of electricity production is critical for reducing carbon emissions (Johannes Friedrich, 2020). The outputs of non-renewable electricity represent the largest source of human-generated carbon emissions, with fossil fuel-based energy making up 74% of electricity from the grid in 2020 (DNV, 2021).

Apart from the imminent threat of global warming, the deployment of renewable energy can have geopolitical implications. This is highlighted by the ongoing Russian invasion of Ukraine and the recent surge in gas and oil prices (IEA, 2022). The resulting volatility of energy prices sparked interest in how states may reduce dependencies on energy imports. One solution discussed is an accelerated deployment of renewable energy. For example, Germany recently accelerated their renewable energy (RE) goals by five years to 100% renewable utilization within 2035. Moreover, renewables are emphasized in the International Energy Agency's(IEA) "10-Point Plan to Reduce the European Union's Reliance on Russian Natural Gas" (IEA, 2022), demonstrating the importance of the topic.

1.1 Renewable energy development

The deployment of renewables is in the hands of businesses, realizing governmental plans and goals. Thus, companies engaged in the industry must have sufficient capital and incentives to operate. Governments may facilitate and incentivize the deployment of renewables. However, companies need to display the potential for profitability to attract the necessary capital from investors (Rastogi et al., 2020).

While renewable energy historically has cost more to produce than fossil fuel-based energy, *"Technological advances, large-scale production, and competition among Asian countries have resulted in substantial reductions in the initial outlay needed to get the investment going"* (Guaita-Pradas & Blasco-Ruiz, 2020, p. 1). As a result, renewable energy developers can achieve positive financial results (Ibarloza et al., 2018; Schabek, 2020).

Interestingly, renewable energy producers' market share and results have increased while traditional utilities' have decreased (Schabek, 2020). Unsurprisingly, even though fossil fuel-based energy represents the largest share, the share of renewable energy to total electricity generated has increased, and the increase is expected to accelerate going forward (Dana Olson, 2017; IEA, 2021).

Variable renewable energy (VRE, i.e., solar and wind) have been predicted as the most significant renewable energy contributor (DNV, 2021; IRENA, 2018). However, challenges associated with the development of VRE exist. This includes VRE's lack of compatibility with existing power systems, resulting in a need to store variable amounts of produced electricity (Sinsel et al., 2020; Syranidou et al., 2020). Moreover, previous research has found both the cost *and the revenue* of VRE developers to in parallel decrease, challenging the profitability of VRE development (Zipp, 2017). As a result, more research on the profitability of VRE businesses is vital to ensure that sufficient renewable energy is built to meet the needs of tomorrow.

Considering the success and profitability of VRE developers, determinants of firm performance are more generally a fundamental question attracting the interest of business professionals and academic researchers alike (Greckhamer et al., 2008). An awareness of determinants of firm performance may enable firms to alter their business models to increase profits. However, previous firm-performance-research outcomes and identified causal links have been found inconsistent, and have received some critique (Miller et al., 2013). Ambiguous literature on the effects of single variables deems more research capturing the complexity of the topic as necessary.

Renewables represent a subfield of firm performance research, and our literature review, which we will return to in section 4.1, identified the subfield as limited. Within the subfield, we found that most literature analysed the impact of single determinants. In addition, we found the literature to be directed toward legislators, analysing the impact of governmental intervention (e.g., Jaraite and Kazukauskas (2013); Pakulska (2021)). Moreover, the literature echoes other research in that firm performance is a complex topic. As an example, Ruggiero and Lehkonen (2017, p. 3865) emphasize that the levelized cost of energy (LCOE) and technology costs impact the profitability of RE firms, in addition of other factors. Other factors mentioned are *"[…] cheap natural gas, a stagnant demand for electricity, overcapacity, nuclear phase-outs in some countries" (Ruggiero & Lehkonen, 2017).* Furthermore, Maqbool et al. (2020) find that the financial and non-financial factors impacting the success of renewable projects are connected. In sum, research of RE businesses' performance is in a developing stage, calling for further research exploring the complexity of the topic (Hart & Dowell, 2011; Ruggiero & Lehkonen, 2017).

1.2 Research Questions, structure and contribution

The combination of an urgent need for renewable energy deployment, previous contradicting research results on firm performance and lack of prior business focus in energy research motivated the following problem statement:

How do combinations of attributes explain VRE developers' performance?

The complexity of the problem statement and the myriad of potential attributes impacting the profits of VRE developers call for a thorough method selection. After reviewing previous research on firm performance, we found qualitative comparative analysis (QCA) to be a method allowing for analysing the combined effects of different attributes[1]. Various configurations[2] may be associated with an outcome and reveal complex causality (Ragin, 1989). The QCA method is novel, while it has demonstrated value in the field of firm performance research (e.g., see Greckhamer et al. (2008), Hernandez-Perlines et al. (2016), Lisboa et al. (2016))

To answer the selected problem statement, we first need to map a selection of attributes which may impact VRE developers' financial performance. The deemed need of mapping relevant attributes leads to the first research question:

[1] In QCA terminology, an *attribute* represents a case specific factor.
[2] In QCA terminology, a configuration represents a combination of attributes.

1) What attributes may impact the performance of VRE developers?

The mapping of potential firm performance determinants yields a longlist that we may narrow to a selection further to be explored. The attributes should be analysed as a joint unit with a combined effect on firm performance, to accommodate for the complexity of the topic. Therefore, we next need to determine possible combinations of attributes (configurations) that impact the operations of VRE developers. This culminated in the following research question, to be approached by QCA:

2) What configurations of attributes may explain VRE developers' performance?

Finally, we explore the attributes and their impact in depth leading to the following RQ:

3) Why do combinations of attributes impact VRE developers' performance?

The primary academic contribution of this study is populating the evolving, but limited, field of firm performance research in the renewable energy landscape. Furthermore, the exploration of complex causality demonstrates the potential for configurational research, such as QCA, within the field. Moreover, we conduct an international analysis and populate a research gap on international firm performance research in the energy landscape (Schabek, 2020).

In practical terms, the outcomes of this thesis could prove insightful for clean energy investors and the VRE developers themselves, as to understand what drives successful businesses. This may further contribute to more viable companies. Moreover, the findings and a better understanding of the profits of VRE developers can support policymakers in (1) how to stipulate the financial viability of VRE developers and (2) how to provide support to the parts of the renewable industry most in need. Therefore, this research might represent a small contribution to the clean energy transition.

2. The Variable Renewable Energy Industry

Before exploring the performance of VRE developers, we elaborate on the setting in which VRE developers operate.

Production of electricity

Renewable energy consists of geothermal, biomass, gas, wind, solar and hydro-based energy (Shin et al., 2018). The spread of renewable energy sources ignites discussion regarding technological differences in maturity, LCOE, carbon emission reduction potential, market growth rates, modularity and the posed impact on land, the surrounding environment and wildlife. The name variable renewable energy (VRE) illuminates that electricity generation from solar PV and wind is variable. The variability means that the amount of electricity produced depends upon the daily sun and wind conditions. This contrasts the predictability of other renewable and fossil fuel-based energy sources, with known production capacities.

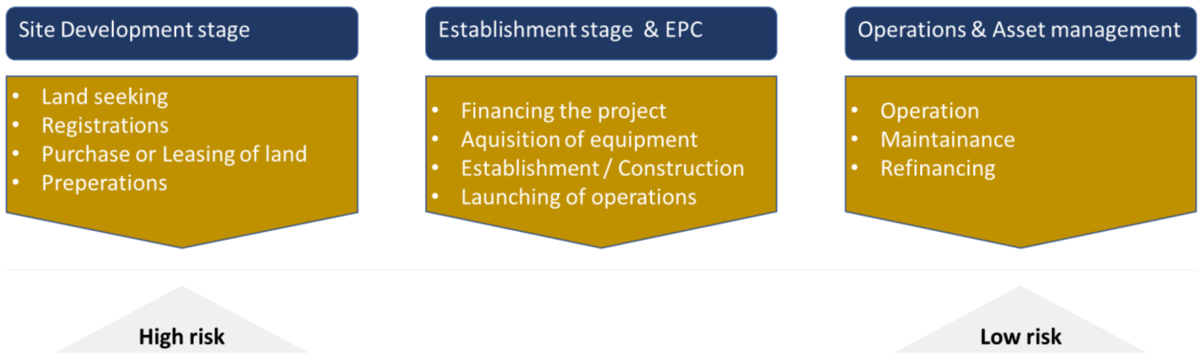
The value chain of electricity, illustrated in Figure 1, can be interpreted as the domain of the energy business. Although, companies' generation patterns and value chain focus are changing (Giehl et al., 2020). Energy developers and fossil fuel-based energy developers have typically been involved in large-scale projects on the left-hand side of the value chain. In contrast, VRE is highly modular. This means solar PV and wind technologies may be installed anywhere, e.g., in urban areas and on rooftops (IRENA, 2020). VRE may therefore be generated on small scales by consumers on the right-hand side of the value chain, selling surplus energy to the grid (Burger & Luke, 2017).

Figure 1. The electricity production value chain.

Note: The figure illustrates a simplified value chain from raw resources (left) to electricity consumption (right). Orange demonstrates the part of the value chain where energy developers and producers are involved. The figure is inspired by Giehl et al. (2020).

In this thesis, we focus on companies engaged in the "electricity generation" portion. We consider a more detailed, VRE-specific, three-folded split appropriate for demonstrating VRE developers' operations. A visualization of which can be found in Figure 2.

Figure 2. Detailed value chain presenting parts of the operation of a VRE engaged firm.



Note: The figure represents an overview of different processes that VRE developers engage in, within the various parts of the life cycle of a variable renewable energy power plant. Furthermore, the risk level in the different phases is illustrated at the bottom. The figure is our creation, inspired by European Commision (2020).

A firm engaged in VRE deployment may be active in different portions of the value chain. Some companies specialize in one activity, but it is common to engage in several activities. This thesis explores firms active in one or several parts of the value chain presented in Figure 2, herby labelled VRE developers.

The progressing VRE industry

The VRE industry has progressed as society embrace sustainability (Shin et al., 2018). Moreover, fossil fuel-based electricity production companies, sometimes referred to as utilities, have increased their investments in renewable energy technology (IEA, 2021). The LCOE of VRE has decreased and become competitive with the LCOE of fossil-fuel based energy sources (IEA, 2020). Therefore, VRE threatens utilities' market shares and represents a market opportunity for energy production. The utilities' entrance into VRE, the modularity, and the competitive LCOE explain why VRE have been predicted as the most significant renewable energy contributor (DNV, 2021; IRENA, 2018). By 2030, the share of VRE electricity to the total global electricity production is expected to be 15%, building on the previous growth of 1.7% in 2010 to 8.7% in 2020.

The utilities carry a business model (BM) of large-scale energy production into the renewable energy industry. Utilities entering with this BM and the economies of scale of VRE production (Dana Olson, 2017) explain why utility-scale production is expected to be the dominant share of installed renewable energy capacity (Dana Olson, 2017). Utility-scale presentation of VRE also explains that while VRE *can* be placed anywhere, Shin et al. (2018) states that the electricity generating infrastructure is regularly located in vast and remote areas. Constructing the necessary transmitting infrastructure to electricity consumers can be expensive in these areas (Shin et al., 2018). However, economies of scale from large-scale production have the potential to counterweigh the extra costs.

The entrance of utilities complicates the labelling of what is a renewable and a fossil-fuel based developer. In this thesis, we define VRE developers as pure variables renewable energy developers, i.e., companies which are not engaged in hydro or fossil-fuel based energy sources.

The contextual environment and industry maturity
Another trait of the VRE industry is the significance of the contextual environment. The societal interest in the success of VRE development can be attributed to the technologies' potential to reduce the reliance on fossil fuel-based energy sources causing carbon emissions and biohazards (Rastogi et al., 2020; Seetharaman et al., 2019). The link to the contextual environment of VRE developers is further illustrated by VRE being unfitted to inherent power systems, with lacking transmission capacity or generation adequacy (Sinsel et al., 2020; Syranidou et al., 2020). The unfitting power systems designed for traditional energy sources limit VRE development, while the construction of facilitating infrastructure makes external stakeholders of the VRE industry necessary. Complementing technologies that address these challenges, such as batteries and electricity storage, may support VRE development. At the same time, the dispersion of complementing technologies increases the interdependency of VRE developers and external stakeholders. Including other businesses in the energy industry, legislators, system operators, and utilities deciding upon which technologies to use and how these are regulated. In sum, stakeholders' increased dependency and prevalence may be necessary for the VRE deployment, while it may also complicate the industry context.

The significance of stakeholders in the industry may be a symptom of the immaturity and dynamic traits of renewables (Brennand, 2001; Karlsen, 2018; Kim & Kim, 2015). The lack of maturity may further be considered an inhibitor of profitable businesses. Continuous exploration demanded by a rapidly changing industry implies a lack of optimization, economies of scale, and profits, thus challenging the operations of the VRE developers.

3. Literature and Theory

We mentioned in the Introduction that the subject of what drives firm performance is a fundamental question attracting the interest of researchers. As a result, a vast range of performance determinants, i.e., attributes, have previously been explored (Goddard et al., 2009). Consequently, a mapping of *all* possible firm performance determinants can be an extensive and interesting research project by itself, as illustrated by the work of Capon et al. (1990), Hawawini et al. (2003) and Goddard et al. (2009). For this thesis, we limit the literary scope to explanatory firm performance theories, previous renewable energy firm performance, and configurational firm performance research. Noteworthy, what impacts the performance of firms may be separated into different levels, i.e., firm, industry, country, and macro-specific attributes. To categorize the literature, we use the categorizations described by de Wit (2020), namely firm-specific and contextual attributes.

In 3.1, we present theories explaining firm performance. The theories serve as a foundation for the subsequent theoretical discussion of our research results. In 3.2, we present literature on the performance of renewable energy (RE) firms anchored in the explanatory theories. Notably, the topic of our thesis is the performance of *VRE* developers, while we in 3.2 detail firm performance literature on *RE developers.* This is because there is limited literature specifically focusing on VRE firms' performance. Moreover, the literature in 3.2 primarily describes the causal linkages of single attributes and RE developers' performance. We complement 3.2 with literature presented in 3.3 *on the combined effects of combinations of attributes*, called configurations. The literature presented in 3.2 and 3.3 further anchors our research design, which we return to in section 4.

3.1 Firm performance and explanatory theories

We next present theories from the fields of Economics and Management that may explain firm performance. Conceptually, performance can be interpreted through neo-classical economics (Barney, 2001) or evolutionary economics (Nelson & Winter, 1982). Alternatively, the field of Management presents explanatory theories such as the resource-based view (Barney, 1991), structural conduct performance (SCP) theory (Goddard et al., 2009; Porter, 1979) and Transaction Cost Theory (Coase, 1937; Williamson, 1981). We next introduce the essence of the different theories before we finalize with some remarks on what theories we perceive most relevant for this thesis's topic.

The structure–conduct–performance view (SCP) highlights industry factors as the key drivers of firm performance. Specifically, the SCP builds upon the research by Porter (1979). The theory emphasizes how entry and exit barriers, industry concentration, economies of scale, and competition may affect market dynamics. These elements impact the pricing, costs and margins of the businesses within an industry (Goddard et al., 2009). The fewer the *substitutes*, *competitors*, *suppliers*, and *opportunities* for new entrants, the higher the prices the companies may charge. On the other hand, few and large *customers* may possess bargaining power to push down the costs of the supplied products. In practical terms, the industry structure and the number of suppliers, competitors and opportunities may vary depending on the technologies and geographical region of analysis. In addition to industry concentration and the other factors presented by Porter (1979), industry-specific regulation and capital intensity are industry traits which affect firms (Bharadwaj et al., 1999). These types of factors may both act as stimulating or inhibiting factors of the market dynamics and domain of opportunity for firms.

The strength of the SCP is in explaining the level of profits of an industry in a market. Moreover, SCP, to some extent, may contribute to explaining diversification. Firms may diversify into new sectors with higher profitability. Likewise, firms may arbitrage by competing in the same industry, but in different countries, as to exploit asymmetries in the pricing of products.

RBT states that firms' resources, management practices, and organizational structure dominate the SCP in explaining firms' profitability (Goddard et al., 2009). The theory is rooted in work by Barney (1991), emphasizing resources and capabilities as a source of competitive advantage. Resources can be mapped into *property- and knowledge-based resources, covering* personnel, intellectual, physical and financial resources (Goddard et al., 2009). Capabilities describe firms' abilities to exploit resources and opportunities (Barney, 1991). Unique resources or capabilities can both explain why firms excel and exhibit superior performance. For example, the mix of firms' reputation, stakeholder management and degree of innovation may enable the firms to learn to achieve economies of scale (Goddard et al., 2009), or another related competitive advantage. Likewise, firms may develop a unique learning capability by trial-and-error and learning from mistakes through international diversification (Hitt et al., 1997). This may yield competitive advantage and explain superior performance across markets.

Researchers have argued whether SCP, analysing industry traits, or RBT, analysing firm traits, best explain firms' profits (Hawawini et al., 2003). But the views may also be perceived as complementary. SCP may arguably better explain inter-industry profits, and RBT the differences in firms' profits within the same industry. As such, Hawawini et al. (2003) argue that the larger the extent to which firms outperform/underperform the industry's mean, the better the firm-specific factors explain the performance of firms. On the other hand, a more homogenous performance of firms suggests SCP as better suited for explaining the industry performance.

Within environmental management, the impact of firm-specific factors relates to the natural-resource-based view (NRBV) theory, first presented by Hart (Hart, 1995; Hart & Dowell, 2011). The NRBV extends the RBT, as RBT is perceived to ignore the relationship between firms and the natural environment (Hart & Dowell, 2011). NRBV emphasises that the natural environment may encapsulate firms' availability of resources, thereby impacting firms' ability to succeed. However, NRBV theory may prove to be of limited relevance in the context of this thesis. *Sustainable development* is emphasized as one of the three key strategic NRBV capabilities, while VRE developers, to a large extent, already provide a sustainable product. The two remaining key strategic capabilities are *pollution prevention* and *product stewardship.* However, the relevance may be limited as VRE developers already offer a low to a zero-emission product. We conclude that NRBV is better suited for interpreting differences in firms' performance when there is higher variability in the degree of sustainability, pollution prevention, and product stewardship.

The proposition of NRBV that the endowment of available resources may impact firms nevertheless borders RBT to the literature on *country effects* and SCP. As mentioned above, while considering SCP, different structures of the same industry may be found across markets. Country effects, such as resource endowments, foster market differences, while one may interpret through the RBT to what extent firms are able to exploit the asymmetries. And while theories such as RBT and SCP explain firm and industry effects, "*no single theory is usually sufficient to model the impact of home country effects. Studies of home country effects are found in international business, international economics and finance, and each of them contributes to the development of a model of the home country impact"* (Hawawini et al., 2004, p. 121). Concerning the general state of national economies, the attributes explain why economies with their native businesses show different activity levels and liquidity. As an example of factors, Broadstock et al. (2011) emphasize the significance of GDP, gross federal debt, oil prices, consumers' savings rates and national unemployment rate on firms' earnings.

Related to SCP and industry dynamics is also *evolutionary economics* of industries and the work by Schumpeter (2010), first published in 1943. Schumpeter considered business cycles and suggested that industries continuously evolve while incumbents and entrants perform *creative destruction*. Those who succeed either innovate or are able to adapt, and those who do not diminish. Nelson and Winter (1982) subsequently elaborated that firms evolve and adapt through imitation and innovation. From their perspective, the reality of the business world is a natural selection process of business operations. Firms continuously evolve by replacing inefficient routines with more efficient ones. Heterogenous evolvement and adaption may explain heterogeneous performance.

Evolutionary economics and the search for profit-improving mechanisms are also related to industry maturity and organizational ambidexterity. Organizational ambidexterity refers to firms' dilemma of exploitation or exploration. Immature markets are subject to radical change, and firms need to compete, explore, and realize opportunities (O'Reilly & Tushman, 2013). For example, the renewable energy industry is immature, and firms and investors shift focus between the most prominent technologies (Gupta et al., 2006; March, 1991). Mature markets are contingent on exploitation, optimization, and incremental changes. The maturity of markets has implications on the dynamics of industries and thus the need for exploitation and exploration. The industry structure and deemed need for exploitation and exploration further border SCP to organization ambidexterity. Organizational ambidexterity also borders to RBT in that firms' performance is contingent upon their ability to balance the dilemma of exploitation and exploration. In sum, evolutionary economics may explain markets' level of maturity. The maturity has implications on the industry structure and how to approach the dilemma of exploitation and exploration. Firms' may approach organizational ambidexterity differently, further explaining why firms exhibit different performances in different markets.

In contrast to evolutionary economics' dynamic industry perspective, neoclassical economics presents a static perspective. First presented by D. Ricardo in 1817, this theory emphasizes how supply and demand mechanisms yield an industry equilibrium. The mechanisms determine circulated goods' quantity, quality, and price (Barney, 2001). Considering this thesis, we find an application of neo-classical economics called the merit order effect within energy economics. Zipp (2017) explains that VRE is facing a challenge, as when there is a lot of electricity generated from VRE sources, the prices decrease. Future development of electricity-generating assets (VRE) may thereby lead to a decline in revenues of the VRE developers. These basic supply and demand dynamics suggest that the development of VRE is threatened. Facilitating regulatory measures is deemed necessary to secure the revenues of VRE developers as revenues decline with increased development.

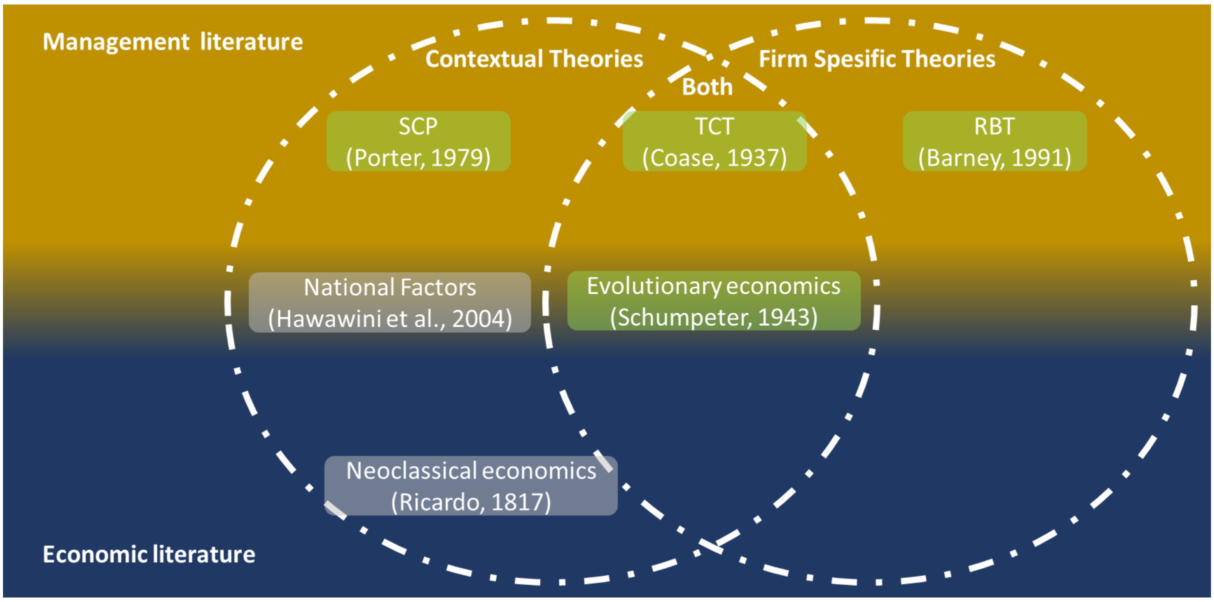
Next, we emphasize the potential of transaction cost theory (TCT) in explaining firm performance. First presented by Coase (1937), the theory suggests that firms exist to minimize transaction costs (TCs). A subsequent extension is that successful firms minimize TC. Transaction costs may incur both between the firm and the external environment, and may also occur within the firm through the flow of resources and information (Williamson, 1981). The level of TC of a firm depends on the firm's corporate structure, how the business units relate to each other, and how the firm employs its human resources. It further relates to what business the firm performs and what parts of the business may be outsourced. For example, transaction costs associated with value chain integration and the capability of the firms to manoeuvre within the value chain seamlessly can explain the performance of firms (Sharma & Gadenne, 2002; Swafford et al., 2006). Integration is a trade-off between specialization and knowledge sharing (Postrel, 2002). As such, the performance outcome of integrated firms may vary, depending upon the learning costs and the possible benefits of the integration.

Moreover, TCT borders the gap between SCP, RBT and evolutionary economics. Firms' *capability* to minimize transaction costs relates TCT to RBT. Minimization of transaction costs across firms in an industry provides implications for the industry structure (SCP) and the industry's evolution (evolutionary economics). As an example, firms may minimize TCT by merging with other accompanies, whereby the merged firm change the industry dynamics.

We end this subsection with Figure 3, visualizing the theories presented above. In sum, researchers may employ different theoretical perspectives from various fields to explain firms' and industries' performance. Figure 3 showcases that we consider RBT, TCT, SCP and evolutionary economics sufficient for this thesis's scope. Notably, we exclude neoclassical economics as part of the framework for interpreting VRE developers' performance. This thesis explores why different combinations of firm attributes yield inferior or superior performance, while we perceive neoclassical economics as more suitable for explaining the pricing mechanisms of an entire industry. And while pricing and the float of goods are factors that potentially impact performance, SCP as an alternative theory may explain industry dynamics and is included as part of the theoretical framework.

In Figure 3, we also placed the literature and theory upon national attributes and the endowments of markets. However, the impact of these attributes may be interpreted through the theories described above. Through the SCP, we may account for the endowment of the national context in that it may impact the dynamics of the industry. The industry dynamics further provide implications for the performance of firms. And through the RBT, we may interpret to what extent firms can exploit opportunities presented across industries and market environments. Through evolutionary economics, we may reflect upon the maturity of markets, and lastly, through the TCT, we may interpret firms' operations in different market environments as to minimize transaction costs. In sum, the mentioned theories of SCP, RBT, TCT and evolutionary economics are deemed sufficient for interpreting elements related to the state of economies.

Figure 3. Overview of explanatory firm performance theories.



Note: The figure presents the explanatory theories introduced in the chapter. Pillar works of the respective theories are presented in brackets. The theories are positioned to represent what field the theory emerged from, being management literature (top) or economic literature (bottom). The theories are further positioned to illustrate whether the theories usually are used to explain firm-specific or industry-specific attributes. The colour green indicates that we will use the theory as part of the discussion.

3.2 Firm performance of renewable energy developers

Next, we present literature on the firm performance of renewable energy developers. The literature provides empirical evidence of the performance of VRE, complementing the theories described above.

Literature of the contextual factors of VRE developers

Among the contextual performance determinants of VRE developers, wind and solar conditions are found by Guaita-Pradas and Blasco-Ruiz (2020) to be the most prominent ones. These are the input of value creation, i.e., electricity production. The national renewable electricity shares may, as a proxy, indicate the attractiveness of the VRE electricity-producing climate of a nation (Schabek, 2020). The share of renewables may further provide information regarding countries' support for clean energy companies, the maturity of the market and the level of competition (Schabek, 2020). On the contrary, competition may negatively impact prices and thus financial performance. Interestingly, Schabek (2020), in their study of emerging markets, found that an increased share of renewables in a market negatively influenced the ROA, reflecting the latter point of competition.

Shin et al. (2018) studied renewable energy utilization and the performance of non-renewable energy producers. They elaborate that the consumers' willingness to pay for, and the stakeholders' willingness to interact with, the VRE producing firms influence the renewable electricity share. The interest in renewables may further be driven by politicians' support regimes and investors' interest, thereby impacting the demand and thus the development of VRE. Furthermore, Luts et al. (2021) highlighted the distinction between the growth in the share of renewables and the growth in total electricity consumption. An increase in total consumption in a market was found to harm the profitability of firms producing energy, attributed to the level of competition among electricity providers. At the same time, the national growth in the share of renewables to total electricity positively influenced profitability for VRE firms. The latter contrast with the findings of Schabek (2020).

As for macroeconomic determinants, Luts et al. (2021) found a positive association between GDP growth and the ROA of renewable developers. This supports the idea that general economic growth catalyses better capital access and operating environments for VRE developers. This idea is also reflected in the study of Gupta (2017), measuring renewables performance through stock prices. They found a positive relationship between oil prices, technology stocks and the market, and renewable energy stocks.

Moreover, we have previously noted that reduced LCOE drives the development of renewables. Simultaneously, the success of renewables depends upon the price of substitute energy sources. Shah et al. (2018) found through a literature review that the GDP, interest rate, and macro-driven oil price are important determinants of RE developers. The impact of which was, however, found ambiguous. As an example, interest rates may be a lagging indicator of economic growth supporting VRE development, while the cost of borrowing should decrease investments and thus the development of renewables. Due to previous ambiguous research results, they suggest researchers increase the granularity of analysis. In sum, Shah et al. (2018) explored the impact of oil prices, GDP, and interest rates on RE generations in three countries. They found that the effects of the oil price depend upon whether a country is an exporter or importer of oil. Importers are more sensitive to the price of substitutes relative to renewables. An increase in oil price thereby makes the development of RE as an alternative more attractive. In addition, regulated renewable markets were found less sensitive to the oil price than market-driven markets.

Considering contingency factors impacting the success of VRE developers, Zhang et al. (2022) explored country risks through the statistical Generalized Method of Moments (GMM) over the years 2001-2018 within the context of China. They found that the economic and financial risks harm VRE companies' performance. Country risk includes economic risks, as the general state of economies may impact supply and demand, thus the electricity prices and VRE developers' financial performance. Zhang et al. (2022 suggested that, in a stable economic environment, businesses increase their activity level and electricity demand. This promotes the performance of RE firms, in contrast to an economic and financial risky one. Notably, this somewhat contradicts the suggestions from Luts et al. (2021) in that growth in consumption and thus increased level of competitiveness harms profitability.

Country risks also include financial risks "*such as foreign exchange risk, interest rate risk, credit risk, and even financial crises, that increase earnings variability and have a significant effect on firm performance*" (Zhang et al., 2022, p. 1). Financial risks may further impact firms' cost of capital and constrain the domain of activity, investment, R&D and growth opportunities, and thus the success of VRE developers. Lastly, Zhang et al. (2022) emphasize political risks' impact on VRE developers. They suggest that policy adjustments yield uncertainties in the short term for immature industries and inhibit activity levels and performance. Guaita-Pradas and Blasco-Ruiz (2020) also emphasize that political risks repel investors and businesses. Another relevant example of considering political risks per time of writing is mentioned in the Introduction. The ongoing Russian-Ukraine conflict stirs the global supply, demand, and price of electricity, and thus possibly ROA of VRE developers worldwide.

Several previous studies have also explored the links between profits of renewable companies and governmental intervention, e.g. (Abbasi et al., 2020; Jaraite & Kazukauskas, 2013; Luts et al., 2021; Pakulska, 2021; Paun, 2017; Sun & Nie, 2015; Zhang et al., 2014; Zhang et al., 2022). However, the links and causality remain unclear. Firms need to comply with regulations (Shin et al., 2018), and ineffective regulation has been found to inhibit VRE adoption. At the same time, governmental support stimulates VRE development. Morina et al. (2021), in a paper like that of Zhang et al. (2022), examined the impact of corporate, country, and macroeconomic factors on renewable energy firms based in European countries over the years 2004-2018. They argue that regulations and subsidies such as FiT are necessary so that firms may achieve profit ant to counterbalance barriers to entry and innovation. New VRE companies with new BMs face obstacles such as regulations, high capital investments and costs. Guaita-Pradas and Blasco-Ruiz (2020) support that the initial investment costs have a significant impact on the success of PV developers. They further state that policies stabilize markets by ensuring appropriate market entry conditions and pricing mechanisms. In sum, national legal and market protection measures affect the efficiency and operations of markets (Westerman et al., 2020). This includes the businesses' access to capital and thereby their domain of feasible projects. Protection mechanisms may yield favourable conditions for incumbent companies, e.g., through an artificially high demand and pricing of products.

Related to barriers to entry, Gupta (2017) emphasizes in their study on stock returns of RE developers the importance of cultural and societal factors. The factors may explain a general interest in carbon reduction, driving RE development and supportive regulation. On the contrary, a society cultivating the nature and preservation of land may perceive VRE development as an intrusion, limiting VRE development. Further considering barriers to entry, Jaraite and Kazukauskas (2013) note that concentrated electricity markets with barriers to entry result in higher profitability but lower productivity. Luts et al. (2021) echoed in their findings that growth in market concentrations yields increased ROA.

Moreover, Gupta (2017) finds VRE developers successful in innovative and well-developed technological markets. Well-developed technological markets are assumed to embrace change and efficiency enhancements. As the markets embrace changes, they likewise are assumed to embrace the transition from traditional energy sources to clean energy.

Paun (2017) compared the performance of traditional and RE based developers for the period 2012-2015. Like previous research in the Baltic states, he found that renewable companies struggled within Romania. The struggle was attributed to a lack of liberalization and maturity of the national energy industry, further pointing out that companies relied heavily on debt financing. Moreover, the immaturity of markets relates to the entry costs of developers through the pricing of PV systems and the level of access to attractive technology (Guaita-Pradas & Blasco-Ruiz, 2020). In the same line, technological barriers, similar to social, regulatory, and economic barriers, have been found to have a negative impact on the deployment of renewable energy (Seetharaman et al., 2019).

Literature of firm-specific factors impacting VRE developers
Returning to the study of Morina et al. (2021), they found "*that profit persists over the years*" and "*that firms' growth enhances profitability is evident in the short run, but in the long run, it is insignificant*" (Morina et al., 2021, p. 32). Schabek (2020) echoes that growth as a determinant is a proxy of energy demand and management efficiency, both positively impacting ROA.

Considering firm-specific factors, Zhang et al. (2022) find that firms with few employees display superior profitability, attributed to higher efficiency. They emphasize that smaller firms may be more oriented toward survival while having the advantage of being nimbler. They may more quickly adapt to changing market conditions by restructuring their organization rapidly per need. While employees may be one measure of size, Zhang et al. (2022) likewise explored the impact of size measured as total assets. Considering the total assets of state- and privately-owned businesses, they found that size had a negative impact on state-owned companies and a positive impact on private companies. Moreover, firm-specific factors were observed by Morina et al. (2021) to dominate the macro factors in explaining the profits of the renewable businesses. However, contrary to Zhang, Morina et al. (2021, p. 32) find "*that firm size has a positive effect on profitability in all models*". Schabek (2020) echoes that size is important in the energy industry as it yields economies of scale and positively influences performance. Further considering the impact of which, Guaita-Pradas and Blasco-Ruiz (2020) take an alternative approach by emphasizing that risk is a key consideration for an investor. Size mitigates risk, and large companies may attract more capital and possess an advantage through leeway. Related to risk, Morina et al. (2021) emphasize that large firms may access more resources to be employed for maintaining a competitive advantage and exploring new endeavours. Large firms may also be more visible and receive reputational advantages.

Luts et al. (2021), researching attributes of unlisted RE companies in Germany, differentiating between small and large firms, found leverage to be insignificant and that size proxied by total assets has a negative effect on the profitability. This was attributed to large firms pursuing strategies with costly market share growth and may support the proposal that nimbleness is a benefit for small firms. Schabek (2020), considering costs, further suggests that investments increase the capacity of production, which should positively impact ROA.

Disregarding the size and considering the financial performance of firms and the impact of capital structure, liquidity and operating levels, Halkos and Tzeremes (2012) found that Greek wind producers outperformed hydropower companies. Moreover, they found that a low debt to equity ratio positively impacted firm performance. Schabek (2020) and the study by Zhang et al. (2022) echo this, having found a negative impact of debt level on ROA. The negative impact was attributed to higher interest payments for large debt-funded firms, reducing the returns. At the same, Schabek (2020) reflect that debt reflects risks, while more risk may be synonymous with increased returns. However, the latter reflection contradicts their findings. On a general note, the capital structure is an important concept explored within finance literature and relates to agency costs (Hillier et al., 2012). A high level of debt may cause firms financial distress, and distress causes indirect costs such as difficulties in obtaining credit and loss of customers, suppliers, and employees. On the other hand, a high debt ratio may keep the management disciplined, given that effective operation is necessary to avoid the risk of default.

While energy firms may not be able to control contextual risks, they still may limit the vulnerability by diversifying their operations. Westerman et al. (2020) and Li et al. (2016) explored the firm performance and diversification of listed renewable and conventional energy firms. Li et al. (2016) point out that, in the context of China, industrial diversification yields inferior performance if a firm competes with non-diversified specialist companies. Industrial diversification may also reflect agency problems and management's agenda. The effect of industrial diversification thereby depends upon to what extent a firm can ensure efficient resource allocation. Another point emphasized is that investors typically prefer diversified industrial firms. These firms thereby enjoy better capital access than those that do not diversify.

As for international diversification, the dependencies of efficient resource allocation, agency problems and investors' preference for diversified firms also apply (Li et al., 2016). In their study on European firms, Westerman et al. (2020) state that international diversification is related to RBT. Companies may develop heterogeneous capabilities, superior knowledge, and resources through operations in different markets. Related, Westerman et al. (2020) allude to TCT. Cross-country operations and handling different market requirements may impose higher TCT through increased overhead and pose a need for monitoring. Likewise, the associated firm performance may depend upon to what extent companies can withdraw advantages from differences in markets, e.g., prices and tax policies (Li et al., 2016). Westerman et al. (2020) further point out that national diversification may result from high-performing, specialized companies desiring to exploit their competitive advantages in a larger market, surpassing that of a home market. Related, Li et al. (2016, p. 3) point out that previous research on firm performance has found dependencies of the impact of international diversification on "capital structure", "corporate governance", and "size".

In sum, Li et al. (2016) found that *industrial* diversification has a negative impact, while *international* diversification positively impacts the performance of renewable energy firms. In contrast, Westerman et al. (2020) found a negative impact of both industrial and international diversification on firms' performance. At the same time, Westerman et al. (2020) point out that cuts in subsidies in European countries in 2012 may explain the negative impact and that a negative impact of international diversification can be attributed to different national protectionary mechanisms. Moreover, economies of scope and no information asymmetry may support industrial diversification. They finalize with a call for further research related to the energy sector, emphasizing that the results may depend upon the types of businesses analysed, where vertically integrated companies diversified across the value chain, as an example, may represent a different type.

This section summarized the literature on firm performance of renewable energy developers. Different attributes were covered, and a summary of the attributes and the associated impact is shown in Table 1. In sum, the research field is limited and immature, as illustrated by the papers' year of publishment. Moreover, we note that most previous research has been directed toward legislators (Abbasi et al., 2020; Jaraite & Kazukauskas, 2013; Luts et al., 2021; Pakulska, 2021; Paun, 2017; Sun & Nie, 2015; Zhang et al., 2014). Regulation is thereby presented as a separate category in Table 1.

Table 1. Performance attributes of renewable energy developers.

Determinants of VRE developers' firm performance	Impact	Literature
Country/macro attributes		
GDP Interest rate Oil price	Ambiguous. The state of the economy impacts the level of investments and interest in renewables.	Shah et al. (2018), Luts et al. (2021),
Renewable electricity share Maturity of market Growth in electricity consumption Stability of energy policies Country risks (Economic, political, financial) Cultural dimensions Infrastructure Innovativeness Technological, social, regulatory, and economic barriers.	Market state and attractiveness. Stable and less risky markets may suggest beneficial operating environments, yielding superior performance. However, it may attract competitors and investors alike. And while less favorable markets can inhibit performance, they may present opportunities for novel companies. Ambiguous.	Guaita-Pradas and Blasco-Ruiz (2020), Shin et al. (2018), Schabek (2020), Paun (2017), Luts et al. (2021), Zhang et al. (2022), Gupta (2017),
Regulation		
Governmental intervention Support regimes Market protection measures	Ambiguous. The regulatory environment may stipulate or inhibit performance.	(Abbasi et al., 2020; Jaraite & Kazukauskas, 2013; Luts et al., 2021; Pakulska, 2021; Paun, 2017; Sun & Nie, 2015; Zhang et al., 2014; Zhang et al., 2022)
Industry-specific attributes		
Technological advancement Market share concentration Market competition Changes to electricity demand Wind / Solar conditions Grid capacity	Has implications to the investment costs and barriers to entry. High investment costs negatively impact ROA, and barriers to entry lead to positive ROA for incumbent companies.	Guaita-Pradas and Blasco-Ruiz (2020) Zhang et al. (2022) Jaraite and Kazukauskas (2013) Luts et al. (2021) Gupta (2017)
Firm-specific attributes – Business and operational attributes		
Size Growth Proportion of employees Industrial diversification National diversification Quality of management	Ambiguous. Firm constructs may reflect or enable organizational efficiencies such as economies of scale and scope, competitive advantages, and reduced risk. It may also inhibit performance.	Schabek (2020) Zhang et al. (2022) Gupta (2017) Morina et al. (2021) Zhang et al. (2022) Li et al. (2016) Westerman et al. (2020)
Firm-specific determinants- Governance and financial determinants		
Capital investments Degree of leverage Price to book (proxy of expected growth) Liquidity Turnover to average assets (Proxy of operating level)	Impact the leeway of firms. Growth may increase the capacity and potential for profitability, while costly growth deteriorates short term profits Increased debt yields increased risk while increased risks increases the expected returns.	Schabek (2020) Zhang et al. (2022) Gupta (2017) Halkos and Tzeremes (2012) Zhang et al. (2022).

This subsection displays the breadth of firm performance research and determinants. The impact of several determinants, such as size, has been found ambiguous. In addition, most research does not address the joint causality and effects of determinants. Though, some authors allude to interrelations between causal attributes. As an example, Zhang et al. (2022) found that size has a positive effect on privately owned renewable energy firms and a negative impact on state-owned firms. In contrast to finding ambiguous research outcomes through the analysis of single attributes, QCA firm performance research contributes to the insight gap upon the joint effect of combinations of attributes. The literature on which will be covered in the following subchapter.

3.3 Configurational research on firm performance

A thorough presentation of the QCA method follows in section 4.2, while we here present a sample of QCA firm performance research. The field is in a developing stage, first pioneered by Greckhamer et al. (2008). Due to the novelty, we present literature on cross-industry configurational firm performance research. Notably, the complex interrelation between attributes does not always allow for a human interpretation. Some QCA research contributes by merely identifying complex relationships. This may also be a symptom of the field's novelty, while presumably, more configurational theories upon which researchers may rely for interpretation will emerge as the field matures.

In their study, Greckhamer et al. (2008) found an interdependence of business, corporate and industry types of determinants. Succeeding Greckhamers article, prevalent QCA firm performance research was published in the 69th special edition of the Journal of Business Research in 2016. Kulins et al. (2016) considered the construct of entrepreneurial listed firms, their business models and their firm performance. They find that some configurations of firms with different value offering designs related to synergies, efficiency, novelty and lock-in of customers and partners display superior performance. Lisboa et al. (2016, p. 1319) employed QCA and RBT to study entrepreneurial organizations by measuring "*innovativeness, proactiveness, and risk-taking dimensions*". They found that different causal paths lead to various firm performance outcomes for Portuguese manufacturing firms. Simon-Moya and Revuelto-Taboada (2016) explored business plans and the survival of new firms. They found different causal recipes for survival by using the number of employees, their education and experience, firms' financial structure, origin and initial capital, functions, and competition as attributes.

Moreover, Bergmann et al. (2016) employed QCA to demonstrate the value of NRBV. They found an impact of several constructs of extreme weather events on cross-industry types of firms' sales growth. With industries as a unit of study, Stanko and Olleros (2013) finds through QCA that slow growth industries with a lack of spill-over effects (i.e., a lack of outsourcing innovation, geographic clustering of firms and labour mobility) are likely unprofitable.

Frambach et al. (2016) also find that customer orientation is a common attribute of high-performing firms within Dutch manufacturing and service providers. The outcome was proxied by self-reported profitability relative to competitors, and large, technological, customer and competitor-oriented firms were found to perform well. Hernandez-Perlines et al. (2016) explored the relationship between training and performance of Spanish firms. They identified the capability of being able to knowledge acquired through training as necessary for superior firm performance. Performance was measured as a multi-dimensional construct. Moreover, Gonzalez-Cruz and Cruz-Ros (2016) considered the causality of size, governance and family involvement in performance, measured as a multi-dimensional construct. They found that size had a positive association for small and medium-sized enterprises (SME) family businesses, while less family involvement is beneficial for family-owned businesses close to medium-size.

Industry-specific studies have also emerged after the cross-industry firm performance QCA-study by Greckhamer et al. (2008). Romero et al. (2016) consider the causation of industry-specific variables and the revenue diversification of UK Airports' firm performance. Balodi and Prabhu (2014) researched young high-technology firms in India and UK. Causal recipes of product development, corporate development, managers' experience, entrepreneurial orientation and the level of competition and technological dynamism implied superior performance, measured as a multi-dimensional construct. Berbegal-Mirabent and Llopis-Albert (2016) considered performance research centres. They found that the attributes of human capital, diversified operations, experience and marketing impacted the income divided by the number of clients: "*Particularly*, *the findings reveal that the availability of human capital, the accumulated experience (mainly papers), the capacity to attract new clients, the non-specialization, the affiliation to a university, and the medium-sized infrastructures are sufficient conditions*" (Berbegal-Mirabent & Llopis-Albert, 2016, p. 1450)

Jacobs et al. (2016, p. 1) explored Belgian fashion designers' self-reported measure of success through QCA. Topics addressed were firms' exploitation and exploration, compliance with dominant business practices and firms' life cycle placement. They found two causal recipes: *"Firstly, a balance between exploitation and exploration is necessary, especially when the fashion design firm is at an early stage in the life cycle or following dominant industry logic. Secondly, no balance is sufficient for low perceived organizational success".*

We finalize 3.3 with a note in that the above-presented literature culminated from a literature review. The literature above illustrates that no configurational *firm* performance research in the energy landscape was identified from the review. However, QCA withholds demonstrated value in the field of renewables. As an example, QCA researchers have explored the political configurations facilitating VRE uptake (e.g., Benney (2021), Pruditsch (2017), Schmid and Bornemann (2019), Wurster and Hagemann (2018)). Moreover, Huarng (2016) explored macro attributes and the linkages between regime switches, carbon emissions and renewable energy consumption. A different paper presented by De Crescenzo et al. (2020) presents a consumer perspective, exploring citizen engagement. As such, a QCA of firm performance of VRE developers contributes by populating the QCA renewable field with a business perspective.

In sum, subsections 3.2 and 3.3 illustrate a range of potential determinants of firm performance. While we do not intend to conclude which attributes best determine firm performance, we note that performance depends on industry, firm and macro attributes and the combination of which. Moreover, the breadth of research, determinants, outcome measurements, and research outcomes suggests that firm performance is complex. QCA, while still developing, may thereby prove valuable for exploring firm performance of the firms engaged in the VRE industry.

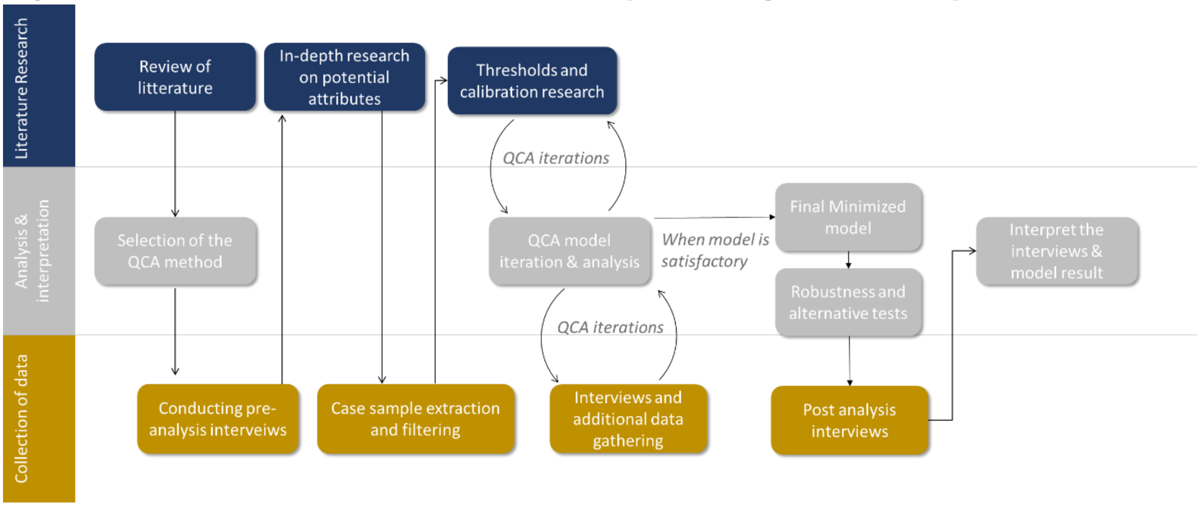
4. Methodology

We suggested above that ambiguous research outcomes illustrate that firm performance is a complex topic and that QCA can be an appropriate method of analysis. In this section, we detail the steps of the methodology whereby an overview is presented in Figure 4. We began with a literature review, mapping theoretical anchors of the to-be conducted master thesis. Next, we conducted initial expert interviews to unravel what may be interesting and meaningful to analyse considering the performance of VRE developers. We subsequently explored different attributes that may impact the performance of VRE developers through a QCA analysis and performed interviews in parallel with the model development. Having built a QCA, we performed robustness tests of which. Lastly, we explored the results of the analysis in posterior expert interviews to obtain another perspective on the performance of VRE developers.

We generally followed the qualitative research principles outlined by Flick (2009) throughout our thesis. As such, we began by designing a research design, taking into consideration (1) the goal, (2) the problem statement, (3) the theory, (4) the data and (5) the method of this study.

(1) We aim for depth rather than breadth. The goal is to explore VRE developers' financial performance and identify which combinations of attributes may impact their financial performance. (2) This guided the iterative process of formulating the problem statement presented in the Introduction. (3) The method consists of an initial literature review, a QCA analysis, and supplementing interview-driven qualitative analysis. We applied an extensive mixed-method to accommodate the complex problem statement. (4) Different data sources were deemed appropriate to enrich the quality of this thesis and accommodate the method. (5) We mapped the theoretical anchors of the to-be conducted master thesis through the literature review.

Figure 4. Overview of the method and steps leading to the analysis and results.



Note: The figure has three levels indicating the type of process conducted. From top to bottom these levels are "Literature research", "Analysis and interpretation", and "calibration of data". Each element in the figure represents a part of the analysis or selection process. Noteworthy, we included the feedback loop termed "QCA iterations", representing the process of building the model.

In the proceeding subsections, 4.1 first describe the conducted literature review. In subsection 4.2, we present the QCA method before we in subsection 4.3 describe the implemented QCA and the expert interviews conducted. We finalize this section with subsection 4.4, reflecting upon the method.

4.1 A semi-structured grounding literature review

Through autumn 2021, in advance of this thesis, we conducted a literature review of VRE developers' business models (BMs). On a side note, we observed a lack of business-centred literature in the renewable landscape. This motivated a review of literature focusing on performance and the performance determinants of VRE.

Through our literature review, we relied on the recommendations of Randolph (2009). We performed a semi-structured search in the acknowledged scientific database Scopus (Elsevier, n.d.). A natural starting point to get an impression of the literature on the topic of this thesis was to first search for "Renewable energ*" and "Firm performance". Quotation marks are necessary to tell Scopus that the words are linked together as two-worded concepts. An asterisk leaves the ending of a word open, e.g., "energ*" captures both "energy" and "energies". The initial search results are displayed in Table 2. An arbitrary selection of the documents in the "firm performance" search was screened to retrieve preliminary insight into the field, supporting the selection of explanatory theories in section 3.1.

To capture the intersection of the two research fields of this thesis, we searched for synonymous framings of "renewable energy" and "firm performance". The search and identification of synonyms-iterations resulted in 2 alternative searches. The first search goes through the abstract, title and keyword of papers. This search searched specifically for *variable renewable energy*, marked in bold for visual purposes in Table 2. The second search only scraped the title of documents but searched for *renewable energy* and included *profitability,* marked in bold in Table 2. We conducted a preliminary screening of the title and abstract to compare the two searches, and while some overlap was detected, the second search was found to be of higher relevance. Therefore, we used the second search as a base for the literature review.

Table 2. Overview of the literature search for renewable energy developers' performance.

Search within	Search	Scopus documents
Abstract, title, keywords	"Renewable energ*"	26 898
Abstract, title, keywords	"Firm performance"	29 502
Abstract, title, keywords	("**variable renewable energ***" OR "Solar PV" OR "Wind" OR "IPP" OR "Independent power producer" OR "VRE") AND ("business performance" OR "company performance" OR "firm performance" OR "marketability")	63
Title	("**renewable energ***" OR "Solar PV" OR "Wind" OR "IPP" OR "Independent power producer" OR "VRE") AND ("business performance" OR "company performance" OR "firm performance" OR "marketability" OR "**profitability**")	71

We then screened the abstract of the 71 documents to evaluate whether the research explored performance determinants and causality and excluded non-relevant papers. In addition, we snowballed through the cited literature of the identified papers and included relevant papers in our final domain of literature. We then carefully reviewed the literature, noting down determinants, causality and theories perceived as relevant in the context of this thesis. The review culminated in the literature presented in 3.2 and the theories presented in 3.1. The literature on performance determinants and causality guided us in what has been explored before, and what may be further interesting to explore. The identified theories served as a foundation for a theoretical discussion of this thesis' research results.

The RE firm performance literature displayed ambiguous research outcomes, motivating us to review literature exploring the complexity of firm performance. We, therefore, decided to review QCA firm performance research. A similar semi-structured search to that of VRE firm performance research was done for configurational firm performance research. A sample of the searches is displayed in Table 3.

We began by searching for QCA and subsequently searched for combinations of QCA and firm performance research. The latter resulted in 139 documents. Including framings of "renewable energy" yielded a single paper, though that paper did not explore renewables but the automotive industry. We, therefore, returned to the domain of all QCA firm performance research, i.e., the 139 documents. The first paper of which was published in 2008, and 127 of the 139 documents were published after 2015, illustrating the novelty of the field. The total of 139 papers illustrates the field of QCA firm performance research as limited. However, the amount was considered too large to cover in this thesis. Moreover, we primarily sought to populate the non-existing field of renewable configurational firm performance research. Rather than covering the domain, we decided to explore a sample of the key configurational firm performance literature, which was detailed in 3.3.

Table 3. Overview of the search for QCA firm performance literature

Search within	Search	Scopus documents
Abstract, title, keywords	("QCA" OR "Qualitative comparative analysis")	26 898
Abstract, title, keywords	("QCA" OR "Qualitative comparative analysis") AND ("business performance" OR "company performance" OR "firm performance" OR "marketability" OR "profitability")	139
Abstract, title, keywords	("QCA" OR "Qualitative comparative analysis") AND ("business performance" OR "company performance" OR "firm performance" OR "marketability" OR "profitability") AND ("renewable energ*" OR "Solar PV" OR "Wind" OR "IPP" OR "Independent power producer" OR "VRE")	1

4.2 About QCA

Qualitative comparative analysis (QCA) is a type of research that seeks to explore casual links of multiple attributes in complex configurations. It is a hybrid method with both qualitative and quantitative elements and is considered appropriate for describing the occurrence of a complex phenomenon: *"QCA starts from the premise that causation is not easily unravelled because (a) outcomes of interest rarely have any single cause, (b) causes rarely operate in isolation from each other, and (c) a specific causal attribute may have different and even opposite effects depending on context" (Greckhamer et al., 2018)*. Formally, (a) displays the equifinality principle of QCA, i.e., more than one path may lead to the outcome (Fitzgerald, 2019). (b) Relates to the configurational causality of QCA, that a combination of attributes (configuration) may lead to the outcome. (c) Emphasize *asymmetry*, i.e., that we need to analyse the presence and absence of the outcome separately. As an example, a QCA analysis might reveal a complex causal link between people where the attributes of being poor and unhealthy are associated with being unhappy. However, we cannot infer from this that the negated configuration of being rich and healthy causes happiness, the negated outcome.

The premises of QCA evolved from two insights first suggested by Ragin (1989), that cases can have multiple relevant attributes, and that causality is complex. The technique found a surge in popularity within the field of strategic management and entrepreneurship research post-2000 (Greckhamer et al., 2008; Kraus et al., 2018). Amongst its applications, Grandori and Furnari (2008) demonstrated the usefulness of configurational QCA research in analysing organizational design. Exploring the effective compositions of organizations is, moreover, related to the composition of factors driving successful firms.

Considering the above, we suggest that the operations and firm performance of VRE developers comply with the QCA premises as described by Greckhamer et al. (2013). Illustratively, Hall and Roelich (2016) use the term *complex value* to emphasize that the operations and value provided by energy suppliers impact different parties in different spaces and times. Moreover, authors within the energy landscape have found potential determinants of firm operations to yield opposite effects in different contexts. An example is the presence of Feed-In Tariffs (FiT), which Tongsopit et al. (2016) found to both acts as a driver and inhibitor of business model innovation (BMI) for energy developers in Thailand. In sum, the complexity of profit generation of energy developers and interdependency of the determinants suggest QCA, in contrast to linear methodologies, as fitting for the purpose of this study.

4.3 The QCA methodology and interview-driven analysis

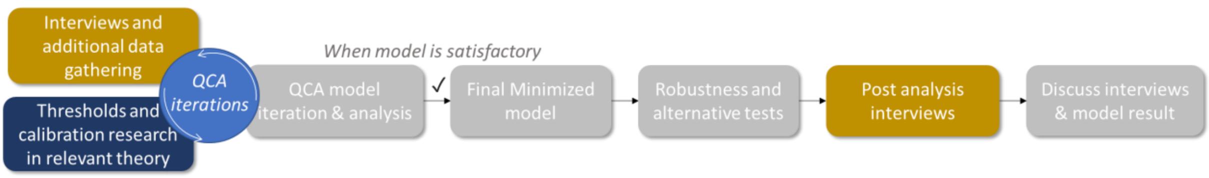
Next, we detail the practical implementation of the QCA method and the conducted interviews. First, we note that QCA may be split into fuzzy(fsQCA), crisp(csQCA), or multivalued set QCA (mvQCA). fsQCA and csQCA are typically used. Rohlfing (2020) suggests that csQCA is appropriate if the concepts to be explored are primarily binary, while fsQCA retains more information and can endure more rigorous tests. We decided to use csQCA, as we (1) employ QCA in a novel field, (2) given that csQCA may more easily allow for human interpretation of concepts underpinning the results and (3) ended up exploring primarily binary concepts. To compensate for the robustness typically associated with *fsQCA*, we nevertheless conducted an extensive robustness test of the *csQCA*.

The csQCA analysis carried out, from now on labelled QCA, generally follows the suggested best practices by Greckhamer et al. (2018) and Duşa (2019). In short, our method and practice are as follows:

1. We first determined the outcome of interest (i.e., superior firm performance) and decided upon the attribute to use as a proxy of the outcome (i.e., ROA).
2. Scoped by the outcome of interest, we identified the domain of possible causal conditions. This was based on literature and qualitative case knowledge gathered through content analysis and interviews.
3. We identified a theoretically relevant sample of cases(firms) and built a configurational model. This is done by populating a database with cases and empirical data on related attributes. The database enabled us to qualitatively compare instances, allowing for qualitative comparative analysis, i.e., QCA.
4. We constructed a *truth table.* This is done through data calibration, i.e., theorizing attributes into sets, and mapping cases' set memberships. As an example, firm size, proxied by the number of employees, may be an attribute. A threshold of 100 employees may be set. *Large firms* are then defined and mapped as the set of firms with 100 employees or more, and *small firms* as firms with less than 100 employees. To ensure valid calibration anchors, we based the calibration on previous theory, case insight and insight obtained through expert interviews conducted parallel to the model construction.
5. We analysed the data by exploring cases and causal recipes linked to the presence and absence of the outcome. Through Boolean algebra and a logical minimization algorithm, we minimized the expression of the causal configurations of the desired outcome.
6. Lastly, we evaluated the findings' robustness and interpreted the resulting causal configurations. In addition, we explored the QCA findings more broadly through supplementing qualitative expert interview-based analysis.

We repeat and emphasize that the methodology was an iterative process, as illustrated in Figure 5. In the subsections below, we detail elements of the process. As a suggestion, a reader unfamiliar with QCA may pause in between the subsections and revisit Figure 5, to maintain an overview of the process.

Figure 5. Overview of the QCA method.



Note: The figure presents the steps of the performed QCA methodology. The colours align with the levels used in Figure 4. For the legends: Gray represents processes with analysis and interpretation, blue represents steps with theoretical research, and orange represents steps with data collection.

4.3.1 Overview of interviews

Sound configurational QCA models are optimally based on attributes anchored in previously identified configurational rationales (Greckhamer et al., 2018). However, as the QCA field in general novel and VRE firm-specific QCA is non-existing, there exist limited amounts of firm-specific configurational theories. This demanded that we explore alternative rationales for the inclusion of attributes. Per the suggestion of Greckhamer et al. (2018), our approach was to supplement the theoretical rationale for selection of attributes with case insight and interviews pre and during model development. In addition, we performed interviews after the QCA to gain a deeper knowledge of what drives the performance of VRE developers. A summary of the interviews can be found in Table 4.

Flick (2009) supports the inclusion of interview-driven qualitative insight for comparative studies. Interviews are argued to be beneficial, as directed questions may yield deeper insights. Moreover, interviews resolve the comparative study pitfall of engaging in a too narrow analysis, neglecting the context of the cases. We decided to use semi-structured interviews, specifically problem-centred expert interviews (Döringer, 2021). Problem-centred expert interviews are characterized by open field questions regarding a specific topic (Döringer, 2021). Following the problem-centred expert interview suggestions of Döringer (2021), an interview guide was constructed. A template can be found in the appendix.

Experts were defined as managers of RE developers, renewable energy analysts, and industry stakeholders. Participants were partially selected and found by convenience through the network of the authors. In addition, we cold-called and e-mailed RE developers. Lastly, we participated and connected with experts through an industry conference, i.e., the Solar Power Summit 2022 (Europe, 2022). Noteworthy, the companies represented by the interviewees have a global reach. 7 out of the 12 companies operate on multiple continents. The companies are mostly operating out of Europe, except for one operating out of Africa.

Most interviews were recorded and performed digitally in Microsoft Teams. During the interviews, both authors participated in the dialogue. We intentionally minimized notetaking not to disturb the interviewee. However, one of the authors was responsible for maintaining the dialogue and the other noted key points. Subsequently, after the interviews, we listened through the records and transcribed highlights of the dialogue relevant to the topic of this thesis. Notably, the intention of this thesis was not to perform traditional, inductive, case-based analysis (Flick, 2009). Therefore, using the terminology of qualitative analysis, *we did not code*, i.e., categorize transcribed text segments into interviews. Rather, we sought to perform a qualitative comparative analysis (QCA). Note, we flag a terminological caution. Coding within the IT terminology is synonymous with programming or writing code scripts, which we, as part of the QCA, *did perform*.

Table 4. Overview of the interviews conducted[3]

Label	Position	Company type	Additional Comment	Date, interview length, format
Pre-analysis & during the data gathering process				
A	C-suit	Global solar PV & low carbon developer and asset owner.	12+ years of industry experience	25.02.2022 45min Digital
B	C-suit	Country specific PV developer & asset owner.	Operates in on-mature market	07.03.2022 45min Digital
C	Top Management	International offshore wind and PV developer with oil & gas legacy.	Previous experience in the onshore wind industry	02.03.2022 45min Digital
D	C-suit	Industrial-scale PV and battery company, emerging markets.	Previous experience in the wind industry	05.04.2022 45min Digital
E	Financial analyst, specializing in renewable energy	Financial Advisor company		24.02.2022 30min Digital
F	Top Management	International renewable energy investor.	12+ years of industry experience	04.03.2022 45min Digital
During analysis, mainly at the Solar Power Summit (conference)				
G	C-suit	EPC contractor, Emerging market	Firm operating in a non-mature market	Conference, 10 min, in person
H	Top management	Consultant, PV industry		Conference, 10 min, in person
I	Team leader	Investment company	Focused on emerging markets	Conference, 5 min, in person
After analysis & After the Solar power Summit conference				
J	C-suit	Interest organization, National	12+ years of industry experience	22.04.2022 45 min Digital
K	Top Management	IPP, Global PV	12+ years of industry & financing experience.	22.04.2022 50min Digital
L	Top Management	IPP, Global PV	Prior engagement in company with wind & solar focus	27.04.2022 1h Digital

[3] The table presents the date, format, and length of the interviews. The table further presents the type of company the interviewees represent, and the anonymized position of the interviewee in the company.

4.3.2 The outcome of interest and number of causal conditions

Following the suggested practices of Greckhamer et al. (2018), the first step of QCA is to build a configurational model, deciding upon the outcome of interest and potential causal conditions. Relevant to the building of the QCA model, we repeat the two folded purposes of this study. First, we intend to populate the research gap on firm performance research of VRE developers and contribute with new industry-specific insights. This suggests that we include novel and industry-specific attributes anchored in the qualitative case and interview-driven insight. Second, a key contribution of this study is to demonstrate the usefulness of QCA and configuration research in the VRE industry. This suggests that we use causal conditions and measures of outcome anchored in previous theory.

Outcome of interest

Several different types of measures of firm performance have been proposed and used by researchers (Albertini, 2013; Greckhamer et al., 2008; Ruggiero & Lehkonen, 2017). This includes market-based indicators, such as price-earnings ratios, organizational measures, and accounting-based measures. Organizational measures are uncommon, while the accounting-based measures are, on one hand, subject to accounting policies and manipulation. On the other hand, they may, like organizational measures, reflect performance which can be attributed to the management of companies. Market-based indicators reflect market responses to shares, which again are impacted by the state of the economy and factors surpassing firms' control.

Considering accounting-based measures, ROA measures the return of firms to total assets. In comparison, ROE measures return on equity, which is volatile to a changing corporate structure (e.g., converting equity to debt). ROA, compared to ROE, also reflects that businesses answers to both shareholders and creditors. This is a possible explanation for why ROA is frequently used and why it has been considered a superior measurement of firm performance (Issah & Antwi, 2017). The experts interviewed also confirmed this as an appropriate measure of success. Therefore, we decided upon using ROA as the outcome and proxy of firm success due to the mentioned. In subsequent analysis, when we use the term firm performance, we refer to ROA.

Regarding the timeframe of measuring ROA, we discovered through the initial research and expert interviews that the profits of VRE developers are volatile. Likewise, authors have argued that financial measures may not capture long-term value creation (Ruggiero & Lehkonen, 2017). To partially account for long-term value creation and volatility of profits, we decided to measure the mean ROA over three years, i.e., 2018-2020.

Causal conditions

After deciding upon the outcome of interest, we had to scope potential causal attributes to use in the model and how many attributes to use. A distinction has been made between the two types of QCA studies. Small-N QCA studies have 12-50 cases and typically 4-8 causal conditions, and large-N studies have more than 50 cases and typically 6-12 causal conditions (Greckhamer et al., 2013). Fewer than 12 cases are undesirable and considered too limited to compare cases and achieve sound causality (Marx, 2010). While small-N and large-N QCA can be used for different purposes, small N studies are better suited for inductive theory building and large-N studies for deductive theory testing (Greckhamer et al., 2013). Moreover, no similar configurational approach to researching VRE developers and firm performance was identified through our semi-structured literature review. Configurational research would enable us to test previously proposed theories and explore a selection of causal conditions broadly on a vast range of firms. The lack of which therefore supports doing a small N QCA, exploring the unchartered causal configurations of VRE developers' performance.

Notably, the decision of the number of causal conditions to use should carefully be selected based on the number of cases analysed. There is a big difference between including 4 or 8 causal conditions in a small N QCA. The number of *K* causal configurations is exponential of the number of *k* causal factors, i.e., $K = 2^k$ (Greckhamer et al., 2018). When the number of *k* causal conditions increases, the number of *K* possible configurations may surpass the number of *N* causal conditions. And when the number of K possible configurations is significantly larger than N, cases tend to be distributed as separate, unique configurations. This opposes the purpose of QCA, making it difficult to compare cases and commonality and rule out non-sensical causation. We thereby select the number of attributes while considering the number of cases to comply with the recommendations of Marx and Dusa (2011) as to ensure sound analysis. In sum, 4 to 5 causal attributes were considered appropriate. Notably, QCA analyses only a limited sample of possible firm performance determinants. The exclusion of possible determinants is purposive due to the qualitative nature of QCA aiming for depth rather than breadth.

4.3.3 Interviews conducted before and during the analysis

We mentioned above that we performed expert interviews pre and in parallel of the QCA. Table 5 summarizes these interviews. The columns represent the different interviews, the rows account for the various attributes of firms, and the intersecting fields display whether the interviewee touched upon the given attribute. Illustratively, experts perceived various combinations of attributes, in addition to single-standing attributes, as important. Based on this, we formulated propositions on configurations that may be associated with superior financial firm performance, to be presented below. The propositions guided the selection of attributes to be explored in the QCA.

Table 5. Performance determinants that were specified to be important by interviewees pre- and during the QCA analysis process.[4]

		Interviewee. See Table 4 *for further details.*								
		A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*
Value chain activities	Engages in Land Seeking/site development	*	*	*		*	*			
	Engages in EPC activities	*X*				*	*X*[5]	*X*		
	Owns the VRE assets						*X*[6]			
Diversification	Is technological diversified	*X*		*X*	*X*	*X*				
	Is diversified across countries	*X*		*X*	*X*	*X*[7]				
	Is diversified vertically (Value chain integration)	*X*			*X*		*X*	~[8]		
Location specifics	Has local connections	*X*	*X*	*X*	*X*		*X*[9]			
	Good Regulatory environment in the countries of operation	*X*	*X*	*X*	*X*[10]		*X*			*X*
	Has great communication with the local community		*	*						*X*
	Low level of variation in the regulatory environment of operation	*X*			*X*[11]					
Company specifics	Obtains a low cost of capital		*X*		*X*	*X*[12]	*X*		*X*	*X*
	Has good insurance deals for the projects								*X*	
	Is large / Size of company	*X*			*X*		*X*	~		
	Has a good quality of management				*X*					
	Good negotiation with external stakeholders			*		*				
	High age of the company			*X*	*X*	*X*				
	Has a strong track record? (Installed MW)				*X*	*X*	*X*[13]			
	Standardization in company activities			*X*						
Market / Industry variables	The company shows high activity while the prices of components are low		*X*							
	Company-operated initially in a market with a low level of competition				*X*					

[4] "X" means the interview object believes that companies with the given characteristic possibly display superior firm performance. "~" is a negation of "X". Interviewee believes that companies <u>without the</u> given attribute may display superior firm performance within a certain context. "" indicates that the interviewee believes that companies described by this attribute have various results, but the companies who excel in the activity likely display profitability. I.e., a subgroup of the companies described by this attribute may display profitability.*

[5] Only in combination EPC & Large-scale company – as these may move "armies of engineers" to where the auctions for PV development is beneficial. This is combination with low cost of capital is great.
[6] Low risk -> low reward element. Highly successful in combination with low capital cost & pooling of several projects (Large players)
[7] Focuses on how the capital costs varies mainly depending on country.
[8] Focused on how specialization is important when being small, so not to compete with potential customers. Special context of emerging market.
[9] If you are in a regime where "local" on ground knowledge is important smaller players thrive.
[10] Mentioned that the installed capacity in the given country at the time of installation might be a proxy for regulations.
[11] Expects high level of volatility in companies engaged in a single regulatory environment.
[12] Focuses on that it is valuable to differentiate across both high maturity markets, where the capital cost is low, and low maturity markets, where the capital cost is high.
[13] Points out that this could be the outcome variable.

Synthesizing expert insights on attributes into propositions
Table 5 illustrates that a reoccurring success determinant is for VRE developers to operate in "good regulatory environments" (interviews A, B, C, D, F, I). Interviewee A elaborates that a market is perceived as "good" when the regulations are both supportive and stable. Markets with varying levels of financial support have a tendency towards boom-and-bust cycles. Our first proposition follows:

Proposition 1: "Good", i.e., stable and mature, regulatory environment in countries of operation → Sustained financial success.

The importance of the market dynamics was further detailed by interviewee F, stating that "... *[the market trend] is moving towards auctions. Large players would find it easier to operate within such a system. They bring low-capital cost, and armies of engineers to develop projects quickly*". The interviewee further stated that a small player with good local knowledge should thrive in markets with low maturity. We used the elements mentioned to synthesize the following configurational propositions:

Proposition 2: Highly regulated markets / mature regulations + large size + low cost of capital → financial success.

Proposition 3: Low maturity of regulations + small size + good local knowledge → financial success.

Related, several interviewees [A, C, D, E, F] focused on the positive impact of country diversification as it de-risks varying regulatory environments, as exemplified by the following: "*If [a company] puts all efforts into one country, it can be hard as the regulations may be changed, for example, on-shore wind in Norway – where the government suddenly doesn't approve new wind parks."* – Translated, interview C.

"*It is sensible to divide the analysis per country or market type, as the different regulatory environments are very different." And "it makes much sense if diversification across countries is positive. I would not be surprised if small companies operating in a single country has an inferior and varying performance*"– Translated, interview D

This yielded the following propositions:

Proposition 4: Small company + not country diversified → Varying or inferior financial performance.

Proposition 5: Diversification across countries → Reduced year-by-year variation in financial outcome.

In addition to the regulatory aspects, several interviewees elaborated on the differences and advantages of different technologies that VRE developers tend to engage with: "*When margins increase for one technology, or in one market, it is viewed beneficial to have more legs to stand on*." (Translated, Interview C)

Proposition 6: Diversification across technology + Diversification across country → Financial superior performance

Lastly, we explored interviewees' perceptions of the different portions of the value chain relevant to VRE development. We separated the chain into three parts, guided by Figure 2 in section 2: 1) Land seeking or site development, 2) EPC (Engineering Procurement Construction) activity, and 3) Asset ownership, including operation and maintenance. An element pointed out by several interviewees was the high risk in the early project development. During interviews A, B, C, E and F, the interviewee discussed how being engaged in the land seeking, and to some extent EPC, resulted in a highly variable financial result. A commonality was that the interviewees focused on how it is important to excel in the early phase activities to achieve superior financial performance: *"If [the VRE company is a] pure developer[14], profits are very volatile. It is a business that can make you very wealthy one year while you have a lack of profits five years in advance."* – Interview A

Proposition 7: Engagement in land seeking/Development of site → High variation in outcome.

Proposition 8: Excelling in land seeking/Selection of site → Financial success

Furthermore, EPC activities were approached in several interviews. The main consideration discussed was that it is a cost-driving activity. This was reflected upon by interviewee A, stating that it is necessary to have many projects to avoid losing money. A similar perspective was shared by interviewee E. Doing EPC activities internally or not was a major differentiating element between companies. Related, we got feedback from interviewee B that it can be somewhat difficult to assess which companies do EPC internally or not. On configurations with EPC, interviewee G focused on how being specialized in EPC, being small, and focused within one market can be beneficial compared to targeting the entire value chain.

Proposition 9: EPC + high level of activity → Financial success

Proposition 10: EPC + small + specialized in one market > Complete vertical integration (Land seeking, EPC, asset ownership) + small + specialized in one market

Insights on the measurements of success discussed during interviews
While exploring possible performance determinants, we also explored what the experts considered an appropriate measure of success. This was done parallel to reviewing the literature, whereas preliminary literature insights presented ROA as a typical performance measure. Per the suggestion of Flick (2009), we performed a directed question and asked whether ROA or alternative measures for success may be appropriate. In sum, ROA was considered appropriate as renewables may be perceived as an infrastructure industry, i.e., a capital-intensive industry. Other measures the experts mentioned were:

1. Growth of the company, indicating a potential for future financial success.
2. Being diversified across countries as this illustrates that the company can comply with different regulations.
3. The company having built well-constructed projects with few complaints from stakeholders.
4. The company having one year of extreme success. For example, if the company sells a large portion of their portfolio (i.e., constructed, or planned projects) in one year.
5. Age of company, as "survival", can be viewed as a success.

The scope of this paper does not allow for an in-depth evaluation of all these different success metrics. However, on a preliminary note, we considered the alternative

[14] I.e., Only engaged in the land seeking & EPC part of the value chain.

outcomes presented by testing the final model with a selection of the alternative metrics to observe if the causal links were consistent with different outcome metrics.

4.3.4 Identifying a longlist of attributes to include in the model

Together with the theory, the interviews guided the selection of a long list of attributes potentially significant to VRE developers' performance. The longlist and parameters upon which we gathered data are shown in Table 6. On a preliminary note, the measurement of attributes is based on 2017, while the outcome measurement is for the subsequent years (i.e., 2018-2020). We will elaborate upon the data extraction and sampling in the next subsection.

Table 6. Overview of attributes for which we collected data.

Attribute	Specification, format	Original Value	Source
Size	*Alt 1:* The number of employees is above a threshold → True	The number of employees employed in the company in 2017	Refinitiv - (Eikon, 2017-2021). In addition, we populated data gaps from supplementing sources (Presented in appendix D).
	Alt 2: The revenue is above a threshold → True	Revenue 2017	
Country diversification	*Alt 1*: The number of countries is above the threshold → True	Countries engaged in 2017.	Annual report 2017. History of the company (website), old version of websites was accessed through the web Archive (Archive, N.d.), and about column Refinitiv (Eikon, 2017-2021).
	Alt 2: The countries of operation are on different continents → True		
Lowest maturity of a country in which the company operates.	One of the countries in which the company operates is below average maturity in 2017 → True	Minimum MW installed (2017) in relevant technology in countries of operation.	Countries as explained above and in addition to sources of capacity installed per country, (e.g., PV: Pvps (2018), wind: Council (2018))
Engaged in land seeking / initial project development	The company is engaged in land seeking or initial land development → True	True / False, manual implementation.	Annual report 2017. History of the company (website) and about column from Refinitiv (Eikon, 2017-2021).
Engaged in EPC (Establishment)	The company states that it is engaged in the construction or establishment phase of the development → True	True / False, manual implementation.	Annual report 2017. History of the company (website) and about column Refinitiv (Eikon, 2017-2021).
Engaged in Asset ownership	The company owns assets → True. *Note: 90% of companies were engaged in asset ownership.*	True / False, manual implementation.	Annual report 2017. History of the company (website) and about column Refinitiv (Eikon, 2017-2021).
Diversified technological	The company is engaged in wind/solar + one more "technology" → True	Manual, mapped if the company is engaged in PV solar, wind,	Annual report 2017. History of the company (website), old version of websites was accessed through the web

		battery, or other relevant activity	Archive (Archive, N.d.), and about column Refinitiv (Eikon, 2017-2021).
Economic development of the market of operation.	*Alt 1*: The company is engaged in a low economic development market → True	GDP (2017) + Countries engaged in 2017.	Countries + GDP 2017, (Bank, 2022).
	Alt 2: The company is engaged in both high and low economic development market → True		
	Alt 3: The company is engaged only in highly developed economic markets → True		
Age of company	The age of the company is above a threshold → True	Year of initiation of company.	Company Website + About data from Refinitiv (Eikon, 2017-2021).
Credit Rating	Data collected, but not included in analysis, as we were uncertain of the data specifications.	Credit Rating (2017)	(Eikon, 2017-2021).
EBIT margin	Data collected, but not included as the data was not complete		(Eikon, 2017-2021).
Net income	Data collected, used as part of ROA.		(Eikon, 2017-2021).

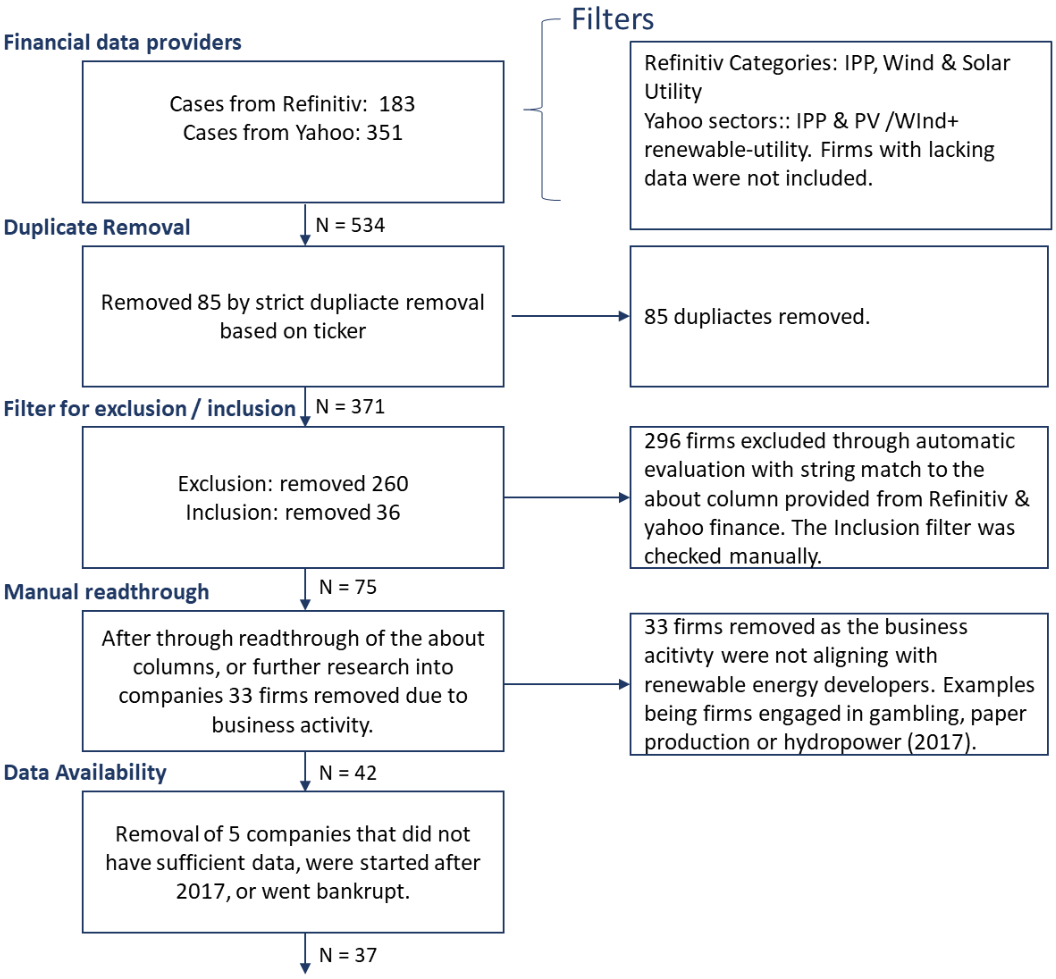
4.3.5 Sampling relevant cases

While building a sound QCA model, a key consideration is to construct a theoretically relevant sample (Greckhamer et al., 2018). This is done through purposive sampling guided by the outcome of interest. For our thesis, the outcome of interest is the ROA of VRE developers, therefore, VRE developers were selected as cases. While we allowed for some degrees of technological diversification, the sample of companies represents pure VRE developers. By this, we mean that we excluded companies engaged in hydro, traditional fossil-fuel based energy sources and major activity in non-related technologies. In addition, we pursued to populate the research gap on international renewable energy firm performance research (Schabek, 2020). Therefore, we included companies across countries. Moreover, we limited the selection of cases to listed companies to ensure comparability, and due to data constraints.

Based on the sampling principles above, and the long list of attributes and parameters presented in Table 6, we constructed a unique dataset. This was accomplished through extensive programming, including (1) data extraction from Refinitiv and Yahoo, (2) data preparation and transformation (i.e., cleaning the data and transforming raw data into valuable data), (3) data merging (i.e., merging country-specific factors with the firm-specific dataset), and finally (4) data loading (i.e., exporting the final data to excel, allowing for analysis and inspection). The programming culminated in a notebook with more than 3 000 lines of written code, which due to the size is not appended. However, the principles of the data extraction, preparation, merging and loading will be presented below, and the complete database can be found in the appendix.

We used the programming language Python for data extraction and transformation. Code scrips were written in a collaborative cloud-based programming notebook named Deepnote (Deepnote, n.d.). In addition to the programming-based data extraction, case knowledge was extracted through inspection of cases' websites and annual reports. Summarized, the data was gathered from the sources presented in Table 6, and the sampling of cases was as follows:

Figure 6. Overview of the sampling process of companies in the QCA analysis.



Note: The figure displays the selection process where the initial number of firms engaged in renewables (534) was reduced to 37 companies through duplicate removal, various filters and manual exclusion. The right side indicates the filter and the number of cases excluded in each step. The input data from yahoo was pre-filtered to only include firms with available data.

Step 1&2:
First, we extracted an excel sheet with 183 companies meeting the criteria of being in the Refinitive defined categories of electricity producer: IPP and Utility: Solar, Wind (Refinitiv, n.d.). Furthermore, to supplement the Refinitive output, we extracted open data from Yahoo finance. We extracted 351 listed companies[15] from Yahoo for the sub-sectors: IPP and Renewable – Utility (Yahoo!, n.d.). Of the two databases, we observed 85 duplicates. After duplicate removal, we ended up with a list of 371 companies extracted from the two services.

Step 3:
We filtered the data using the "About" column from yahoo finance and Refinitive. The "about" columns were string matched to look for excluding words determined to be: Oil, Gas, Hydro, Coal. I.e., companies engaged in technologies that would heavily impact the

[15] The extraction

comparability of the companies in the sample. The about column was also string matched to look for inclusive words, such as Solar, PV, and Wind.

Wind Works Power Corp. is a Canada-based zero emission company. The Company is engaged in designing, large-scale wind farms. The Company is developing a pipeline of projects in Germany and has project pipeline in the United States. The Company has its projects in Ontario, Germany and in the United States of America. The Company's project in Ontario includes Capstone Infrastructure JV and Skyway 126. The Company's project in United States of America includes Big B and Buffalo Ridge. The Company is developing an approximately 50-megawatt (MW) pipeline of wind farm projects in Germany. The Company is also developing a solar pipeline of about 100 MW in the United States of America.

The above example would give a positive string match for wind and solar while not triggering the "oil", "gas", "coal", or "hydro" filters.

Following this filter, the number of applicable firms was reduced to 101 (After exclusion filter) and further down to 75 (After inclusion filter). We conducted an additional readthrough of the about columns of companies not included in either filter. This yielded five companies added to the inclusion filter.

Step 4:
After the initial automated screening we manually screened the remaining 75 companies. This was done to capture elements not excluded during step 3. For example, companies engaged in VRE *and* steel production/gambling. To accomplish this the about columns of the firms were thoroughly read, and where the business focus was found to be incompatible with the analysis, a manual filter (0/?/1) was applied. This further reduced the number of cases to 42.

Step 5:
Thereafter, we used the Eikon Refinitive service to extract the following values for all possible companies, the comment in parentheses represent an indication of the completeness for the values from the database (Eikon, 2017-2021):

1. Net Operating Assets (low coverage)
2. Total Assets (good coverage)
3. EBIT margin percentage (low coverage)
4. Credit structure rating (good coverage, but only for year 2021)
5. Total debt percentage of Equity (low coverage)
6. Return on Equity (low coverage)
7. Net Property, plant and equipment (PPE) (low coverage)
8. FTE (Full Time Equivalents) (acceptable coverage)
9. Net income after tax (good coverage)
10. Net income before tax (acceptable coverage)

Step 6:
To supplement the automated data extraction, we performed a manual data gathering process evaluating the annual report for companies lacking parts of the data. For five companies, this was not possible as the annual report was not available. After a thorough examination, we believe 3 of these companies to be bankrupt. 2 of the companies started reporting financial data after 2017 and are therefore not comparable with the other cases.

Step 7:
The final extraction, transformation and loading of data resulted in the sample of cases used for this analysis.

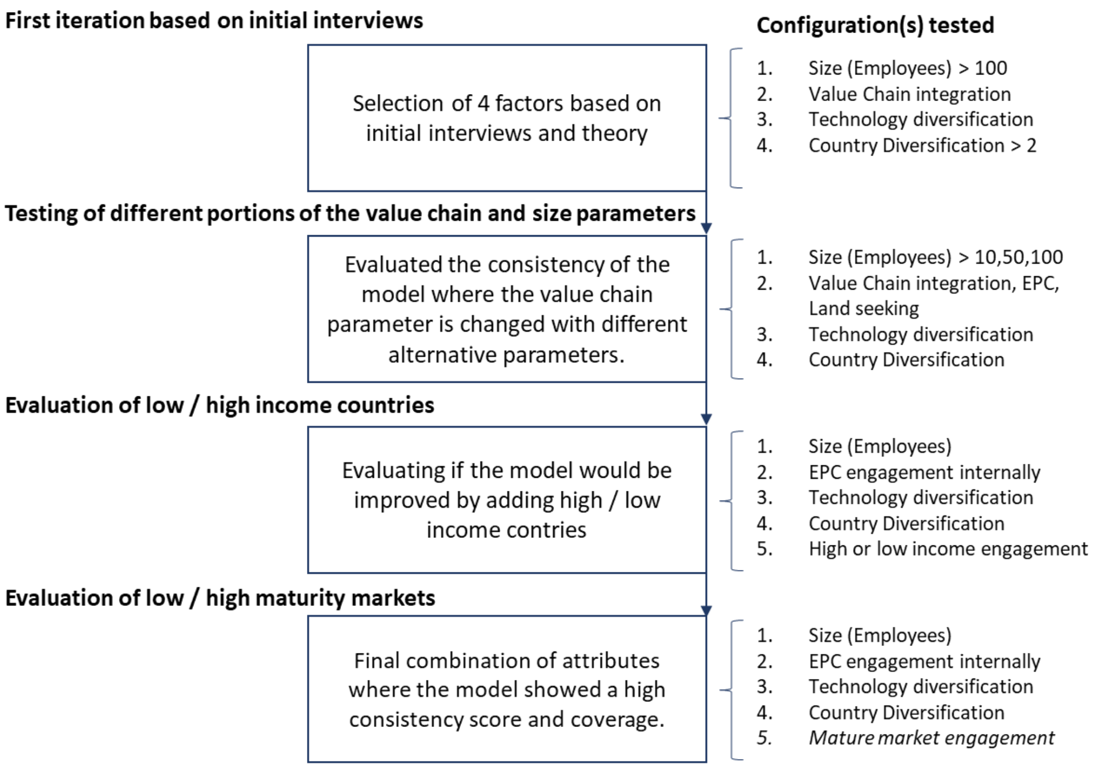
4.3.6 Iterative model development

Having constructed a database of cases and attribute values, we next calibrated the data, i.e., conceptualized attributes into sets and mapped cases' set memberships (Greckhamer et al., 2018). We repeat that the model development in QCA is an iterative process. Notably, the initial calibration thresholds are not finite and may change through model development. Nevertheless, according to Greckhamer et al. (2018), sound models anchor sensible calibration thresholds empirically and theoretically.

The base of our calibration was (1) theoretical insights from our literature review, (2) qualitative insights from expert interviews and websites of major analytics companies, and (3) case and distribution-specific knowledge as the last resort. The smaller the N of the QCA, the higher the intimacy of the researcher to the cases analysed. Therefore, the more should thresholds be anchored in case-specific knowledge (Greckhamer et al., 2018; Greckhamer et al., 2013). However, our analysis compromises 37 cases, not far from what may be classified as large N QCA. This suggests less intimacy with cases and more holistic based calibration as appropriate.

Through the iterative model development, we evaluated different combinations of attributes from Table 6, with various thresholds, i.e., calibration anchors. Figure 7 presents an excerpt of the iterative steps. Each permutation of attributes displayed a different set distribution of companies and different QCA metric scores, to be detailed in 4.3.7.

Figure 7. Sample of permutations tested.



Note: The figure illustrates a sample of the permutations we have tested. During the process of the QCA iterations, we have tested all the presented permutations and several others. The right side of the figure displays attributes present in a specific iteration, and the text box capture the motivation of a specific iteration.

In sum, the model iterations, further guided by the literature and expert interviews, culminated in a final model with the attributes and calibrations anchors presented below. Note that while we decided upon appropriate calibration thresholds, we programmed Python and R code scripts which executed the data calibration.

Size
Berbegal-Mirabent and Llopis-Albert (2016), in their study, employed *"Business-unit size",* measured as annual net sales of a business unit, as a proxy of size. Morina et al. (2021), analysing the firm performance of listed renewable energy companies, argue that size is an important determinant. Moreover, they state that market capitalization was an appropriate proxy of size, as they analysed listed firms. However, Becker-Blease et al. (2010, p. 11) argue that these measurements are not suitable for organizational theory research: "*With these theories, the primary concern is with how transactions, agency and span of control costs affect profitability – costs that are associated primarily with how the organization is controlled through a hierarchy rather than with the value and number of physical assets."* We synthesize that size is an important attribute. Moreover, we observed that Frambach et al. (2016) echo the rationale of Becker-Blease et al. (2010, p. 11) in that number of employees is an appropriate proxy, for which we thereby decided to use.

Referring to previous QCA firm performance research, Berbegal-Mirabent and Llopis-Albert (2016) employed a threshold of 103 employees. While we acknowledge that various literature suggests different thresholds as appropriate, the threshold of 100 employees, close to 103, was set. An inspection of the distribution of employees of firms, and conversations with interviewees, suggested no need to adjust this threshold further.

Technological diversification
Diversification is related to the BMs of firms, synergies (Kulins et al., 2016), and corporate development and technology orientation (Balodi & Prabhu, 2014; Frambach et al., 2016). Greckhamer et al. (2008) also explored diversification, specifically "*Corporate diversification"* through the distribution of sales per business unit and "*Industry sector",* mapping firms into four different industries. Motivated by previous literature, we decided to use tailored versions of the mentioned proxy. VRE (solar and wind) may be interpreted as a set of different technologies, representing different industries. In addition, after examining the case sample resulting from the filtering in Figure 6, we found that some VRE developers operate in non-excluded industries with potentially different ROA than VRE development. This includes energy storage, energy consultancy and other non-VRE development (i.e., hydro and fossil fuel-based energy development). In sum, we, therefore, mapped whether VRE developers operated in "wind", "solar PV", and "other related technologies" technologies. VRE developers that were operating in more than one of the mentioned, e.g., "wind" and "solar PV", were set as technological diverse. The initial interviews suggested this as a reasonable calibration.

National diversification
As emphasized in Literature and Theory, national diversification is another conventional diversification type. The concept relates to how firms capture synergies and knowledge spill-over effects (Kulins et al., 2016; Stanko & Olleros, 2013). The impact of diversification may further depend upon the types of businesses analysed. We found through our literature review that limited research has explored the effect of national diversification on the ROA of RE developers (Li et al., 2016; Westerman et al., 2020). However, we synthesize from the reviewed literature that national diversification is an

important attribute, and we want to contribute with research exploring the impact of which.

Some research has explored diversification by measuring the distribution of a company's sales per country in which they operate (Capar & Kotabe, 2003; Geringer et al., 2000; Hitt et al., 1994; Hitt et al., 1997; Tallman & Li, 1996) However, due to a lack of available data, we calibrated national diversification based on the number of countries where the company showed current or planned activity in 2017. These sets of companies represent what Guisinger (1973) defines as multinational corporations (MNCs), i.e., firms operating in more than one country and firms that do not.

EPC internally

Value chain integration has been found to potentially impact firm performance (Sharma & Gadenne, 2002; Swafford et al., 2006), which is further related to the design of BMs (Kulins et al., 2016). Westerman et al. (2020) also call for firm performance research exploring the energy value chain. Moreover, we performed explorative interviews suggesting that different segments of the RE value chain may exhibit different ROA. Interviewees emphasized in particular that the choice of integrating the ECP part, or not, may impact the VRE developers' profits. Therefore, the companies in our sample mapped to be doing EPC were set to 1, i.e., illustrating the membership in the EPC set, and those who were not were set to 0.

Operates in the non-mature market

From a firm point of view, contextual attributes (macro, national and industry attributes) are hard to eliminate or control (Morina et al., 2021). However, we emphasized in section 2 that the contextual environment is significant for VRE developers' operations. Illustratively, there already exists rich research on FiT and support regimes (Abbasi et al., 2020; Pakulska, 2021; Paun, 2017; Sun & Nie, 2015; Zhang et al., 2014). Interviews with VRE developers also revealed that they monitor support regimes and that the regime constructs determine their region of operations. Therefore, we sought to expand on the support-regime research by evaluating whether companies, with their respective technologies, operated in non-mature markets in 2017. Notably, while the location of operation is related to national diversification, companies may not be diversified but still operate in immature markets. As such, we consider it important to differentiate between the concepts.

The total national renewable electricity share has been used as a proxy of market maturity before by Luts et al. (2021) and Schabek (2020). However, they measured the share of the aggregated amount of renewables in a market. As we employ technological diversification as an attribute and evaluate whether companies are engaged in either wind, solar or both, we consider an increased granularity on the attribute of market maturity as beneficial. E.g., a market with a high maturity of wind may not be perceived as a mature market by a pure solar PV developer. As to calibrate maturity, we calculated the installed capacity of wind and solar in a country and the mean installed capacity of the technology across all countries in the sample. We then mapped whether companies, with their technology focus, operate in countries with a *below* mean existing capacity of the respective technologies. If they do so, the company is included in the "operates in non-mature markets" set. The above-presented proxy for maturity was considered reasonable by the experts. However, they pointed out that more granular data with the distribution of sales per country of operation would strengthen the model.

Final remarks on the iterative model development

Up until now, we have presented iteration steps and the theoretical anchors of calibration focal in the development phase. Though, this does not illustrate the entire process of the iterative model development. To elaborate upon the selection of attributes present in the final model, consistency, and coverage metrics, per the recommendation of Greckhamer et al. (2008), guided the iterative model development. The metrics will be presented in 4.3.7. In addition, we repeat that expert interviews guided us in the development phase. Based on the interviews pre - and during the model development, we developed propositions on what combinations of attributes may be interesting to explore. A visualization of this assessment is further presented in Table 7.

Table 7. Relevance and feasibility of exploring different propositions

Proposition	Proxy / Reason for exclusion / Consideration
Relevant, but not feasible.	
8. Excelling in land seeking / Selection of site → Financial success	Difficult to differentiate companies that excel at activity from others.
Attribute: local knowledge	We did not find a data source or proxy for this attribute.
Attribute: Good communication with the local community	We did not find a data source or proxy for this attribute.
Attribute: Negotiation with external stakeholders	We did not find a data source or proxy for this attribute.
Attribute: Low cost of capital	We found ways to measure this but lacked data for several companies. The attribute was therefore dropped due to lack of data.
Feasible, but not relevant or out of scope.	
5. Diversification across countries → Reduced year-by-year variation in financial outcome.	We did not focus on the variation of financial success.
7. Engagement in land seeking / Development of site → High variation in outcome.	We did not focus on the variation of financial success.
9. EPC + high level of "activity" → Financial success	We did not measure activity (Which could be measured by MW constructed), as this would demand a great deal of additional data gathering.
Attribute: Has a strong track record	We did not directly include track records as this would require additional manual data gathering. It is indirectly included through attributes such as age, size and diversification.
Attribute: Low level of variation in the regulatory environment	Variations in each regulatory environment were considered out of scope for the thesis.
Relevant, feasible and included	
1."Good" regulatory environment in countries of operation → financial success.	Investigating a specific regulatory environment is not part of the scope of this thesis. However, we included proxies based on 2017 values for "emerging" vs "developed" markets and "mature" vs "not mature" markets.
2. Highly regulated markets / mature regulations + large size + low cost of capital → financial success	Investigated through proxy: The market has <u>above</u>-average renewable energy deployment (2017) + Company had more than 100 employees (2017) We did not find sufficient data for the cost of capital for all the companies.
3. Low maturity of regulations + small size + good local knowledge → financial success.	Investigated through proxy: The market has <u>below</u>-average renewable energy deployment (2017) + company had less than 100 employees (2017) We did not find data or proxy variables for local knowledge.
4. Small company + not country diversified → Varying or inferior financial performance.	Investigated through proxy: The company had less than 100 employees (2017) + Company is engaged in only one country (2017)
6. Diversification across technology + Diversification across country → Financial superior performance	Investigated through the proxy: The company is engaged in more than one technology or industry aspect (solar, wind, battery, other relevant activity) (2017) + Company is engaged in more than one country (2017)
10.EPC + small + specialized in one market > Complete vertical integration (Land seeking, EPC, asset ownership) + small + specialized in one market	*Partially included, measured through the proxy:* Engaged in EPC activities (Binary, content analysis) + Company had less than 100 employees (2017) + Company focused on only one country (2017) We did not compare the different configurations in absolute terms.

4.3.7 Analyzing the data

In 4.3.5, we elaborated upon a notebook covering the code scripts written to extract and manipulate the data subject of analysis. In addition, we wrote a second Notebook with code scripts executing the key analytical work of this thesis, namely a QCA. The latter notebook includes code scripts covering the calibration presented above. In addition, amongst other scripts, it covers the robustness tests performed subsequent of the model development, to be presented in 4.3.8. We provide a link to the notebook covering the QCA in the appendix and, on a high level, explain the procedure of analysis here.

The sampling and calibration, presented in the previous subsections, yield a dataset which consists of cases with different set relationships. Using the QCA terminology, a specific composition of set membership represents a unique configuration. Different cases may display the same set of memberships and adhere to the same configuration (Greckhamer et al., 2018). The table of cases and set memberships can therefore be transposed into a truth table. A truth table consists of a mapping of all cases into the 2^N possible configurations *(Duşa, 2019; Greckhamer et al., 2018; Greckhamer et al., 2013)*. The truth table, subject to be presented in the analysis, can finally be interpreted and interrogated and is the subject of QCA analysis using Boolean operations.

The principle of analysis with QCA is an evaluation of whether the configurations found in the truth table are associated with the presence or absence of the desired outcome (Greckhamer et al., 2018). The result of the analysis is a minimized Boolean expression of the different configurations present in the truth table, i.e., a short format of the inferred causality of the model.

The causation analysis of QCA can further be split into an analysis of *necessity* and *sufficiency* (Duşa, 2019; Greckhamer et al., 2018; Greckhamer et al., 2013). To illustrate, in a setting where all, or almost all, cases associated with an outcome have the same causal configuration, this configuration would be defined as a *necessary* condition to the outcome. Alternatively, if the configuration is a subset of the outcome, i.e., all cases or almost all cases of a configuration display the outcome, the given causal recipe is deemed as a *sufficient* condition of the outcome. There may exist several sufficient casual configurations. In the case of our analysis, later presented in section 5, no necessary conditions appeared. Due to lacking presence of which, we, therefore, limited our analysis to analysis of sufficiency.

Moreover, configurations where all, or almost all, cases displays either the presence or absence of the outcome are said to show a high consistency using the QCA terminology. The strictness of what is deemed as sufficient or necessary is given by the consistency thresholds defined by the researcher. A high consistency suggests a possible causal link, and the configuration may be interpreted as a “causal recipe” of the presence or absence of the outcome. In other words, a high consistency suggests a strong causal link, and a low consistency rather deems the grounds of a causal link inconclusive (Benoît Rihoux, 2009; Marx & Dusa, 2011). Researchers should strive to generate models with high consistency. To infer a possible causality, Greckhamer et al. (2018) suggest 0.8 as a minimum threshold for consistency and Marx and Dusa (2011) provide guidance as to the consistency threshold considering the number of cases and causal attributes of the model. Perfect consistency does not always occur. Per their suggestion, we use 0.8 as a consistency threshold of causal linkages.

In addition to the consistency metric accounting for the share of cases of a configuration displaying the same outcome, the coverage metric of QCA accounts for the degree of clustering of cases. The coverage metric measures positive 'the number of cases in a specific configuration displaying the outcome relative to the total number of cases. These configurations can thereby be interpreted as more important than those with low coverage. Coverage is typically used to evaluate the final outputted and minimized configurations of QCA and covers both *raw coverage* and *unique coverage* (Duşa, 2019; Greckhamer et al., 2018; Greckhamer et al., 2013). As for the solution, unique coverage account for the number of cases explained uniquely by the configuration, while raw coverage entails the share of cases of the configuration displaying the outcome without considering the overlap of configurations.

In sum, configurations with high coverage are more important than those with low coverage. The higher the consistency of a configuration, the stronger the causal link of the specific configuration is. Moreover, we note that a low consistency across configurations suggests a poor model (Greckhamer et al., 2018). The researcher may then revisit the calibration and the included causal attributes and evaluate whether important conditions are omitted. Thereby, the consistency of intermediate models such as those presented in Figure 7 guided our iterative model construction work. We generally let an inclusion score, represented by the number of cases included in "valid" categories given the consistency score cut-off, guide the process.

QCA researchers may also rely on simplifying assumptions, i.e., providing a rationale for overlooking cases to improve the model quality. But due to the exploratory nature of this study and the novelty of QCA firm performance research in the renewable landscape, we did not include any simplifying assumptions. We instead improved the consistency and coverage metrics by revisiting the included attributes and calibration thresholds during iterations.

Lastly, we need to set a *frequency* threshold for the number of cases a given configuration represents to be considered relevant for analysis (Greckhamer et al., 2018). For small-N QCA studies with <50 cases, due to the (1) intimacy with cases, (2) the exploratory nature of such studies, and (3) the low number of cases, the frequency threshold is typically one or two (Greckhamer et al., 2013). We set the frequency threshold to two as the number of analysed cases is in the upper part of small N QCA studies.

In sum, considering consistency, frequency and coverage, we quote Greckhamer et al. (2018, p. 491) that "*Taken together, these parameters provide fine-grained ways to not only interpret the causal complexity underlying the outcome but also to distinguish the importance and validity of each of the equifinal configurations identified, which is a key advantage of QCA vis-à-vis cluster analysis or other correlational methods*"

4.3.8 Robustness tests

Importantly, QCA is an analytical technique influenced by the research design and the researcher's decisions on analytical thresholds (Greckhamer et al., 2018). Robustness tests evaluate the impact of the researcher's decisions. We generally adhere to the QCA analysis recommendations of Greckhamer et al. (2018) and Duşa (2019). However, Oana and Schneider (2021) subsequently discussed and sought to advance robustness test protocols of QCA. Therefore, for the robustness test of our analysis, we follow Oana and Schneider's suggestions. More cases analysed implies less intimate case knowledge. As in our case, this suggests systematic robustness tests as appropriate. However, we note that robustness tests are typically designed for large-N and fuzzy-set QCA studies and that conceptual insight may overrule robustness tests (Oana & Schneider, 2021).

In short, the proposed robustness tests which we follow evaluate the sensitivity of the final model results to calibration, consistency, and frequency adjustments (Oana & Schneider, 2021). Empirically derived sensitivity tests assess the change limits of the attributes (e.g., size threshold) and parameters (e.g., frequency threshold), which will change the Boolean causal expression of the initial solution (IS). New causal solution sets are produced when constructing new models with attribute and parameter thresholds that surpass the lower and upper limits. The new models represent the robustness tests. Oana and Schneider (2021) further point out that conceptually plausible changes may overrule and "harden" the upper or lower limits. As an example, of the present threshold of 100 employees, an upper limit of 108 employees may be found, which may change the model. But conceptual insight suggests that a firm of 150 employees may likewise be considered a reasonable threshold for a large firm. Authors may thereby construct tougher tests surpassing the *conceptually* proposed thresholds, e.g., new models with 200 employees instead of 109 employees, whereby the latter barely surpass the empirically derived limit. Constructing tests with thresholds surpassing that of the empirically derived tests are called hard tests, and as suggested by Oana and Schneider (2021), we executed hard tests (see the Appendix for details upon the implementation).

All new solutions produced by the alternative models are appended into what is called the maximum threshold set (maxTS). The intersection, i.e., the commonality of all the alternative solutions produced, is likewise aggregated into what is called the minimum threshold set (minTS). Finally, an intersection between the alternative solutions of the minTS and the current solution, i.e., "the Robust Core"(RC), is found (Oana & Schneider, 2021). The RC represents the part of the solution that bypasses all robustness tests.

The initial solution can now be compared to the minTS, maxTS and RC. The comparison can be made in two ways. First, one may consider the fit parameters of QCA, i.e., consistency and coverage scores, of the RC relative to that of the IS through "Fit-Oriented Robustness" tests. The initial solution may be equivalent to be compared to considering the overlap and movement of cases between the alternative minTS, maxTS and RC sets, i.e., "Case oriented Robustness". Cases from the initial model represented by new configurations in the alternative models are defined as *shaky cases*, and those that withstand the tests are called *robust*. *Possible* cases denote cases for which the alternative models find as part of the solution set but which were not present in the initial solution. The output of the tests will be presented 4.3.8, and the complete details of the conducted steps and the written R code can be found in appendix A. For additional details, we refer the interested reader to the work by Oana and Schneider (2021).

In addition to what is mentioned, as an alternative analysis or robustness test, we assessed the how industry experts reflect on the VRE industry, and after the analysis how the industry experts reflect upon our model and model results. Yet another alternative robustness test was performed by changing the firm performance outcome proxy (i.e., changing ROA to growth). This yields insight into the applicable scope of the resulting configurations.

4.3.9 Reporting and interpreting findings through theory and interviews

After the model development and robustness tests, the next step is to report the method and findings. Transparency is encouraged (Greckhamer et al., 2018). We, therefore, emphasize that we include the data, the truth table, the casual configurations and the code in this thesis's method section, the analysis section and the appendixes.

The last step of QCA is to interpret the results of the final model (Greckhamer et al., 2018). In this phase, we explored the sufficient and minimized configurations associated with the presence and absence of the outcome. The purpose may be for QCA researchers to expand or propose a new configurational theory by exploring why combinations of attributes cause an outcome (Greckhamer et al., 2018). Greckhamer et al. (2018) suggest that authors in this phase return to case data and, as an example, select one or two cases representing the causal configurations for which to explore in-depth. We followed this recommendation and returned to selected cases for more insight into the configurational causality. In addition, we interpreted the causality more holistically.

First, causal configurations were explored in three interviews after the model was completed. Details of the post-analysis interviews are provided in Table 4. The main goal of this process was to evaluate if the QCA results correspond with industry experts' understanding of the industry. The expert interviews may be perceived as an external interpretation of the QCA results. The procedure of the post-analysis interviews was as follows: (1) We presented a configuration, (2) paused to hear the interviewees' thoughts on the configuration, and then (3) presented the causal results of the model. To minimize the priming of interviewees, we explicitly stated that we wanted to explore any potential causal linkages opposing their understanding. We explained that we sought to take notice of the perceived weaknesses of the model through the eyes of the experts. I.e., we neither stated the results of the QCA model nor the interviewees' perceptions as "correct". Notably, we also explored a contradicting configuration from the truth table due to its prevalence, being represented by 6 cases.

We attempted to maintain a neutral approach. We presented a configuration, listened to their thoughts on the specific configuration, and presented the result according to the model and discussed the validity.

Second, we interpret the QCA results and expert insights through the explanatory theories presented in 3.1 and previous literature on RE developers' performance determinants presented in 3.2. The theoretical base interpretation will be covered in the Discussion.

The holistic interpretation was based on the note that the field of QCA firm performance research is developing. An illustrative example of this is that in the sample of QCA firm performance literature we reviewed, limited interpretations on the existence of causal configurations were provided. Another illustrative example is that Oana and Schneider (2021), subsequent to Greckhamer et al. (2018), sought to augment the robustness protocols. Returning to the suggestion of Greckhamer et al. (2018), in-depth exploration of a selected case limits the interpretation of causality to the specific configuration for which the case represents. However, several configurations may be sufficient and associated with the outcome, which holistic interpretation may simultaneously address. Moreover, case-based interpretation set aside that configurations may be represented by several cases. Thereby, the interpretation becomes sensitive to the in-depth insights found in the selected case. Lastly, we point out that industry experts are another source of information and may provide another perspective. All in all, we believe that more insight into causality may be uncovered using our approach, compared to only in-depth exploring specific cases for which we already have a degree of insight from the data gathering process. Notably, for the purpose of this thesis, we do not intend to conclude on how to interpret best and explore causality in-depth. Nevertheless, we perform supplementing interpretation of the case-based suggestions by Greckhamer et al. (2018). This may demonstrate alternative interpretation as fruitful in the field of QCA.

4.4 Reflection upon method

We finalize the methodology section with a reflection upon the methodology of this thesis. On a general note, we followed the qualitative research and research design principles outlined by Flick (2009). As to the specific method of this thesis, we followed the QCA suggestions by Greckhamer et al. (2018). The practical implementation of which is guided by Duşa (2019). For the robustness tests, we executed the steps proposed by Oana and Schneider (2021). In sum, we generally follow best practices described in the literature, suggesting that the conducted method is sound. Moreover, the subsections of the Methodology put forward details of our decisions, with references to literature. This may illustrate that we reflected upon decisions made throughout this thesis. Nevertheless, we supplement the reflections present in the previous subsections with some remarks on triangulation, elements of the QCA, and the interviews.

Triangulation

While we generally followed best practices described in literature, to some degree, we deviated from the method of interpretation proposed by Greckhamer et al. (2018). Greckhamer et al. recommend that authors return to cases in this step, while we also explored causal configurations in depth through expert interviews. This was done purposively as we already withheld insight into cases following the data gathering process. The expert interviews pre, parallel and post of the method were also a means of quality checking the method and results. Experts were assumed to yield another perspective than what may be found by only exploring the data of the cases analysed. This is an example of *triangulation*. Flick (2009) describes triangulation as an approach which researchers may employ to enhance the rigour of qualitative research. It is synonymous with extension or combination and may in four ways: by using different types of *data*, *methods*, *theoretical perspectives* or *investigators* (Flick, 2009).

Triangulation can prove valuable. But before triangulating, Flick (2009) suggests researchers reflect upon whether (1) the study requires several methodological approaches and types of data, (2) whether there exist different theoretical views and (3) whether the timeframe and available resources allow for triangulation. As for (1), this study is novel, and no QCA firm performance research in the renewable field was found. The lack of previous literature suggests that we employ different data and methodological approaches to ensure sound research upon which further work can build. Considering (2), our literature review revealed the existence of different theoretical views from the fields of economics and management explaining firm performance. As for (3), the timeframe of 5 months is narrow. However, the scope of the study was perceived as feasible for two motivated authors. We thereby triangulated in the four possible ways:

The expert insights are *primary data*. This complements and triangulates the secondary data with (1) financials from Reuters and Yahoo Finance and (2) text from Annual reports, LinkedIn, and company websites, used to construct and analyse the database of companies. In addition to the conducted data triangulation, we perform *investigator* triangulation by being two authors. This enables us to control and minimize research biases. Moreover, we approached theoretical triangulation by presenting different explanatory theories in 3.1, which subsequently were employed to interpret our results in 6.2.1. Lastly, Flick (2009) exemplifies methodological triangulation as when a survey is combined with interviews. A QCA combined with expert interviews represents a methodological triangulation in our case.

In sum, triangulation promotes the quality of this thesis. Triangulation, together with the extensive details of the methodology, further promotes the credibility, applicability, confirmability, neutrality, and thus trustworthiness of this study (Lincoln & Guba, 1985).

QCA and methodological specifics
Considering the specifics of this study, extensive programming and manual content extraction yielded a unique database of listed VRE developers and firm/industry/national attributes. Notably, this thesis explored the performance of listed VRE developers through the period from 2017 to 2020. The comparability of listed firms goes at the cost of the generality of the findings to listed stocks, as stock exchanges have admittance processes limiting the firm types. Moreover, by the nature of stock exchanges, the firms have more ways of raising capital.

Further related to the selection of firms, we performed an extensive exclusion process for firms not engaged in VRE, but we included both wind and solar PV developers. Notably, the technologies possess similarities but are not equivalent. For example, Schabek (2020) found solar power producers to be more profitable than wind. Moreover, we included firms of all sizes engaged in different parts of the value chain presented in Figure 2. Nevertheless, this was a cross-country study of a specific industry, and we suggest that the cases display sufficient comparability.

To further reflect upon the outcome measure, we used the mean ROA as a proxy of firm performance. Notably, having gathered, inspected, and calibrated data, we found a threshold of 0 as appropriate. Thus, the measurement of ROA in this study became synonymous with measuring the profitability of firms, distinguishing between profitable and unprofitable VRE firms.

Furthermore, we measured the mean ROA over three years to account for long-term value creation and the perceived volatility of VRE developers' profits. Three years were employed due to data constraints, while we note that investments may take a longer period to materialize properly. For the measurement period, we also include ROA of 2020, while the spread of covid-19 pandemic this year is to be perceived as a one-off macro-event that may cause deviant ROA. Nevertheless, industry experts perceived the mean ROA of 2018-2020 as an acceptable performance measure that, to a certain extent, accounts for long-term value creation and volatile profits. But due to the mentioned, future research may replicate this study across different or longer periods. The dynamic trait of the renewable industry also suggests this as fruitful. This also applies to the attributes upon which we only managed to gather data for one year. In addition, we emphasize that the timespan of measurement more generally relates to the concept of risk. This was indirectly approached by the measures of size, maturity of markets and diversification. An in-depth exploration of the relationship between the *level* of risk and profitability may complement this study.

Next, we note that both literature and industry experts suggested that different performance proxies, and multi-dimensional constructs of which, may be used. ROA was selected due to being a highly regarded and frequently used measurement (Issah & Antwi, 2017). The experts interviewed also confirmed this as an appropriate measure of success, and while we did consider growth as an alternative measure, literature has suggested "*that the inter-temporal (year-on-year) persistence of performance above or* *below the norm should be stronger when measured using a profitability performance indicator than when measured using a growth indicator*;"(Goddard et al., 2009, p. 498) Lastly, insights into the profitability of firms are deemed key to promote renewables and ensure the industry as financially sustainable.

We do not intend to reopen the fundamental debate(Miller et al., 2013) on the most appropriate performance proxy for firm performance. However, we noted in section 2 that the energy business is a business with prevalent stakeholders. The ROA does not reflect that the industry is complex, with stakeholders to which the developers answer, in addition to shareholders and creditors. Therefore, using a proxy accounting for both the financial and environmental performance may also be appropriate. But what constitutes environmental performance is not easily unravelled. It may be interpreted as a reduction/increase in carbon emission. It may also be interpreted as a reduction/increase in air, water, and land pollution. The business of VRE developers may also disturb wildlife, indigenous people and inhabitants living nearby developed VRE infrastructure. As part of the debate upon how to best measure firm performance, we, in sum, leave for other researchers to further address the consideration of renewables. Nevertheless, future replicable studies employing different performance measures may be valuable.

Lastly, we emphasize that data quality was a focus area throughout the QCA, illustrated by the amount of code written to extract and handle data. We relied upon financial data from Refinitiv, as presented in Table 6. In addition, we gathered data manually by inspecting websites and annual reports, allowing for human errors. We emphasize the EPC attribute, whereby the industry experts echoed our perception that it can be difficult to separate between firms with EPC in-house and those who sub-contract.

Interviews

Lastly, we reflect upon the performed interviews. Industry experts were purposively selected as interviewees, as performance of VRE developers is not general knowledge.

First, we conclude that the pre-analysis interviews went well, in that the interviews culminated in valuable input used when building the QCA model. We attribute this to the interviewees' different backgrounds and areas of in-depth knowledge. As illustrated in Table 4, some interviews were shorter than others, while these interviews proved valuable for exploring specifics related to VRE developers' methodology and performance.

Second, we explored the minimized solutions in the post-analysis interviews. We conclude that also these went well in that valuable insight into the causality of causal recipes was provided. However, time proved to be a constraining factor, and we did not get to explore all causal recipes in depth. In addition, we strived to present the different minimized causal expressions without the corresponding outcome to minimize confirmation bias. Though, we experienced that some of the interviewees struggled to grasp the abstract configurations differentiating one configuration from another. Consequently, we sometimes found it necessary to prompt the identified causality and provide some visual aids to unravel more insights. Ideally, we would not have asked the interviewees for a specific outcome, but QCA displays complex causality, which can be difficult to interpret.

5. Analysis

Next, we present the results and robustness tests of the QCA analysis. As presented in 4.2 About QCA, the result emerges from the final minimized model. Thereafter, we detail industry experts' interpretation of the QCA results. Lastly, we present the results of alternative QCA analyses performed.

5.1 Resulting truth table

QCA analysis explores the causality of a combination of different attributes associated with the presence or absence of an outcome. The truth table presents a complete overview of the configurations included in the final analysis, the related inclusion score for each configuration, and the attributes native to each configuration. Table 8 explains the different columns of the truth table, i.e., Table 9.

Table 8. Truth table column explanations

Truth table column	Explanation
OUT	1 if the outcome of the configuration is successful 0 if the outcome of the configuration is unsuccessful C if the configuration does not reach the needed consistency or the needed quantity.
N	Quantity of cases per configuration
Incl.	The portion of cases in configuration yielding positive outcomes.
Cases	The specific companies are included in the given categories.
*	Configuration number
DIVERSIFIED_TECHNOLOGY, EPC_INTERNALLY, SEVERAL_COUNTRIES, LARGE_FIRM, OPERATES_IN_NON_MATURE_MARKET	Firm attributes (see Table 6 and 4.3.6 *Iterative model development* for attribute details)

Table 9. Truth Table

*	DIVERSIFIED_TECHNOLOGY (1)	EPC_INTERNALLY (2)	SEVERAL_COUNTRIES (3)	LARGE_FIRM (4)	OPERATES_IN_NON_MATURE_MARKET (5)	OUT	n	incl
1	0	0	0	0	0	C	6	0.5
32	1	1	1	1	1	1	4	1
17	1	0	0	0	0	0	3	0
25	1	1	0	0	0	1	3	1
30	1	1	1	0	1	C	3	0.67
9	0	1	0	0	0	0	2	0
10	0	1	0	0	1	0	2	0
13	0	1	1	0	0	0	2	0
18	1	0	0	0	1	0	2	0
27	1	1	0	1	0	0	2	0
3	0	0	0	1	0	1	1	1
5	0	0	1	0	0	1	1	1
6	0	0	1	0	1	1	1	1
11	0	1	0	1	0	0	1	0
21	1	0	1	0	0	1	1	1
22	1	0	1	0	1	1	1	1
24	1	0	1	1	1	1	1	1
29	1	1	1	0	0	1	1	1
2	0	0	0	0	1	?	0	-
4	0	0	0	1	1	?	0	-
7	0	0	1	1	0	?	0	-
8	0	0	1	1	1	?	0	-
12	0	1	0	1	1	?	0	-
14	0	1	1	0	1	?	0	-
15	0	1	1	1	0	?	0	-
16	0	1	1	1	1	?	0	-
19	1	0	0	1	0	?	0	-
20	1	0	0	1	1	?	0	-
23	1	0	1	1	0	?	0	-
26	1	1	0	0	1	?	0	-
28	1	1	0	1	1	?	0	-
31	1	1	1	1	0	?	0	-

5.2 Interrogating the truth table

The distribution of cases per configuration is shown in Table 10. The list is sorted by the number of cases, noted in column "n". A more detailed overview of the companies and data is available in appendix E for the interested reader.

Table 10. Overview of the individual cases per the corresponding N configuration.

*	n	cases
1	6	7C Solarparken AG, EAM Solar ASA, WAA Solar Ltd, NZ Windfarms Ltd, R Energy 1 SA, Aega ASA
32	4	Energiekontor AG, Thai Solar Energy PCL, Scatec ASA, Eastern Power Group Public Company Limited
17	3	Westbridge Energy Corp, Ind Renewable Energy Ltd, Indowind Energy Limited
25	3	Naturel Yenilenebilir Enerji Ticaret A.S.,Galata Wind Enerji Anonim Sirket,Ningxia Jiaze Renewables Corp Ltd
30	3	Enlight Renewable Energy Ltd,Energix - Renewable Energies Ltd,Neoen S.A.
9	2	Advanced SolTech Sweden AB (publ), Oceanic Wind Energy Inc.
10	2	OY Nofar Energy Ltd, Meshek Energy-Renewable Energies Ltd
13	2	Arise AB,Orient Green Power Company Ltd
18	2	Solegreen Ltd,Figene Capital SA
27	2	Nyocor Co Ltd,Adani Green Energy Ltd
3	1	Xinyi Energy Holdings Ltd
5	1	Edisun Power Europe AG
6	1	Solaria Energía Medio Ambiente, S.A.
11	1	Azure Power Global Ltd
21	1	Greencoat Renewables PLC
22	1	Fintel Energija ad Beograd
24	1	Encavis AG
29	1	SAAM Development Public Company Limited

We observe that 18 out of 32 configurations have a corresponding case. As expected, cases tend to cluster and display similar combinations of attributes (Duşa, 2019). E.g., firms may copy the construct of competing firms. Moreover, we observe that 8 out of 18 included configurations represent a single case. This is related to the relatively high number of attributes included in the analysis compared to the number of cases. According to Greckhamer et al. (2013), the higher the number of casual conditions, the greater the tendency of cases to be distributed into separate unique configurations.

The frequency cut for small N QCA can be 1 and 2 cases (Greckhamer et al., 2013). As the case quantity of our model is close to a large N QCA, which we touched upon in 4.3.7, we use 2 cases as the minimum cut-off for a significant configuration. Eliminating the eight configurations represented by one case allowed for more in-depth exploration of the remaining causal configurations in interviews. However, we note that this decision reduces the total amount of cases associated with the presence or absence of the outcome. Nevertheless, the final set captures configurations with satisfying consistency and causality, relevant for further interpretation.

The “incl” column in the truth table displays the consistency. “1” indicates that the configuration has a perfect consistency with the presence of the outcome, i.e., positive ROA. “0” likewise displays a perfect consistency with the absence of the outcome, i.e., negative ROA. We repeat from 4.3.7 that we use a consistency threshold of 0.8, implying a maximum negative value of 0.2, indicating “no membership”. In practice, this results in replacing all the inclusion (incl.) scores between 0.2 and 0.8 with inconclusive (noted with “C” in the “out” column in the truth table).

5.3 Analysis of configurations

In this section, we further analyse contradicting and causal configurations.

5.3.1 Contradicting configurations

Before exploring the configurations linked to the presence or absence of the outcome, we sought to explore and potentially resolve the two contradicting configurations present in the truth table. These cases are defined as *deviant cases*, in contrast to *typical cases*. According to Benoît Rihoux (2009), this is beneficial as the researcher gains a more thorough knowledge of cases and may develop a more coherent body of evidence.

In our case, configuration number 1 is prevalent. This configuration captures non-diversified, small VRE developers in mature markets. In essence, specialized niche companies. This configuration is inconclusive yet represents the largest number of cases. Of the six firms, 3 of which show a negative ROA. A first glance of the truth table, displaying the configuration with most empirical evidence as contradicting, may suggest a revisit of the configurational model. However, a more considerate look reveals that the consistency and coverage of the remaining configurations, and thus the model, is satisfying. Moreover, during the post-analysis expert interviews, we discovered that a contradictory result of this type of firm was expected. The contradiction capture an important trait of this type of firm. Therefore, further model development may have increased the QCA consistency metric but shrunk the quality of the model in the eyes of the industry experts, i.e., its ability to capture causality. We will return this configuration in 5.5 . But, on a preliminary note, no further “resolvent” of this contradiction was deemed necessary.

Moreover, configuration number 30 was found to contradict, showing a consistency score of 0.67. The configuration reflects two cases with a positive ROA and one case with a negative ROA. Careful inspection displayed that the latter, Enlight Renewable Energy Ltd, showed positive ROA in 2018 and 2019 but a negative ROA in 2020 as presented in Table 11.

Table 11. Overview of net income, total assets, and ROA for Enlight Renewable Energy

Financials/Year	2017	2018	2019	2020
Net income after tax	-	22,134	12,030	-141,030
Total assets	1,988,662	3,038,466	4,460,698	5,841,403
ROA (after tax)	-	0.5%	0.2%	-2.7%

An initial hypothesis was that Enlight was severely impacted by the outbreak of the global covid-19 pandemic. Other companies were also observed to display different outcomes in 2020, and a possible impact may be various national restrictions and financial easing policies caused by the pandemic. However, an investigation of the annual reports and available content upon Enlight did *not* provide evidence of this hypothesis.

However, we observed a significant growth in total assets over the period, and we have previously noted that capital intensive growth may come at the cost of short term profitability. As such, we did not alter the case sample, i.e., in QCA terminology, we did not resolve the contradiction. But the mentioned potential impact of covid motivated supplementing model tests to be detailed in 5.6. First, we conducted an equivalent analysis but with growth as the outcome proxy. Second, we explored the impact of covid-19 by employing the mean ROA of 2018 and 2019 as the outcome. As expected, in the latter analysis, we saw that configuration 30, first including Enlight, now showed a 100% inclusion.

5.3.2 Causality of the outcome

Having disqualified the two configurations with insufficient consistency, the eight configurations represented by one case and the 14 configurations not represented, eight configurations remain subject to further analysis.

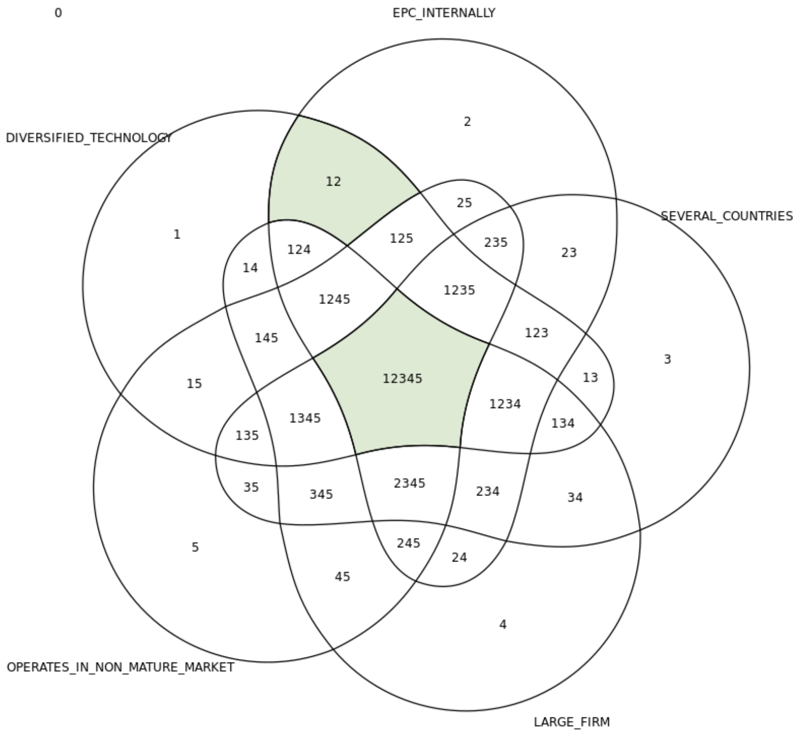
Analysis of sufficiency emphasizes the different combinations of parameters associated with the presence or absence of the outcome. Two of the eight remaining configurations are associated with the presence of the outcome. The minimization process revealed that two configurations associated with the presence of the outcome. Based on the previously introduced filters for consistency and frequency, the minimization yielded Table 12, displaying the consistency and raw coverage of the expressions. Notably, we observe that the minimization algorithm does not further simplify the expression of the configurations. Thus, minimization 1 (M1) in Table 12 is equivalent to configuration 32, and minimization 2 (M2) to configuration 25. The sufficiency coverage(raw coverage) of M1 is higher than that of M2, as configuration 32 consists of 4 cases, and configuration 25 consists of 3 companies (4 positive cases out of the total 19 positive cases yields 4/19= 0,211, likewise 3/19=0,158)

Table 12. Minimization result for the positive outcome.

N*	Minimization	Inclusion Score	Sufficiency Coverage
M1	DIVERSIFIED_TECHNOLOGY*EPC_INTERNALLY*SEVERAL_COUNTRIES*LARGE_FIRM*OPERATES_IN_NON_MATURE_MARKET	100%	0.211
M2	DIVERSIFIED_TECHNOLOGY*EPC_INTERNALLY*~SEVERAL_COUNTRIES*~LARGE_FIRM*~OPERATES_IN_NON_MATURE_MARKET	100%	0.158

The first minimized configuration associated with superior performance, M1, captures companies diversified across countries and technologies, that conducted EPC, and operated in a non-mature market in 2017. The second configuration of companies associated with a positive financial outcome is diversified technologically, engaged in EPC internally, but small companies not engaged in multiple countries or any non-mature market. The two configurations, marked in green, are visually presented in Figure 5.

Figure 5. Visual presentation of the configurations with superior firm performance.



Note: The figure illustrates what combinations of attributes show superior firm performance when considering a consistency filter of 0.8 and a frequency cut-off of 2 cases. Green colour is to indicate the presence of positive consistency for the configurations. The numbers inside the individual shapes indicate the presence of a specific attribute (see Table 9 *for attribute labels).*

5.3.3 Causality of the negated outcome

On the opposing side, we want to minimize the causal expressions of the absence of the outcome. After minimizing the six configurations with negative ROA, we got the expressions in Table 13.

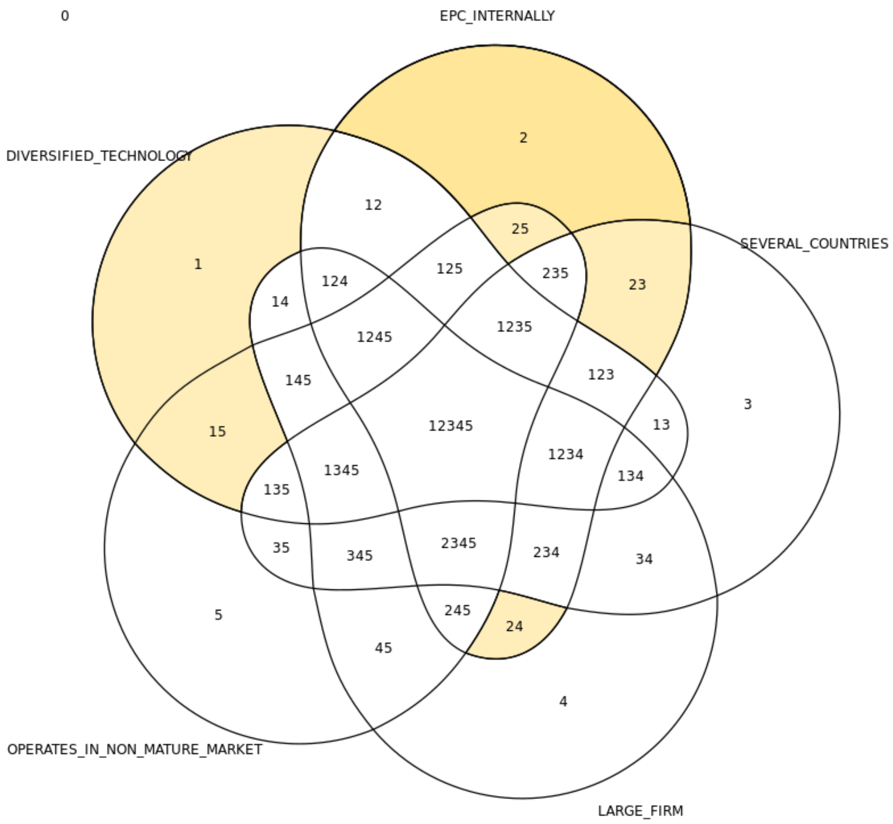
Table 13. Minimization of negated outcome (negative outcome)[16]

N*	Minimization	Inclusion score for negated outcome	Sufficiency Coverage
M3_n	~DIVERSIFIED_TECHNOLOGY*EPC_INTERNALLY* ~LARGE_FIRM*~*SEVERAL_COUNTRIES*	100%	0.22
M4_n	~DIVERSIFIED_TECHNOLOGY*EPC_INTERNALLY* ~LARGE_FIRM*~*OPERATES_IN_NON_MATURE_MARKET*	100%	0.22
M5_n	EPC_INTERNALLY*~SEVERAL_COUNTRIES* LARGE_FIRM*~OPERATES_IN_NON_MATURE_MARKET	100%	0.167
M6_n	DIVERSIFIED_TECHNOLOGY*~EPC_INTERNALLY* ~SEVERAL_COUNTRIES*~LARGE_FIRM	100%	0.278

[16] The labels on the left side, i.e., M1_n, are used to reference the different minimizations (M1_n refers to "negated minimization 1").

In contrast to the causal expressions associated with superior ROA, the expressions of inferior ROA are minimized by the algorithm to a combination of 4 attributes. Minimization 3 (M3_N) captures configuration 9 and 10, and M4_N express the causality of configuration 9 and 13. M3_n and M4_n thereby capture a similar configuration, configuration 9. M5_n reflects configuration 27, M6_n reflect configuration 17 and 18. Figure 8 visualizes the configurations causal of inferior ROA, in sum covered by the minimized expressions.

Figure 8. Visual presentation of the configurations with inferior firm performance.



Note: The figure illustrates what combinations of attributes show inferior firm performance when considering a consistency filter of 0.8 (or alternatively 0.2) and a frequency cut-off of 2 cases. The orange colour indicates the presence of negative consistency for the configurations. The numbers inside the individual shapes indicate the presence of a specific attribute (see Table 11 for labels).

We noted that M3_n and M4_n overlap. However, they differ in two attributes, namely "SEVERAl_COUNTRIES" and "LOW_MATURITY_MARKET", as visualized in bold in Table 14. There are four different combinations of values of these two attributes: "00", "01", "10" and "11". Keeping in mind the common attributes of M3_n and M4_n, the first three combinations, "00", "01", and "10", reflects configuration 9,10 and 13, covered by M3_n and M4_n. The latter combination of "11" refers to configuration 14 from Table 9. Configuration 14 is not represented by any case, and given that the remaining configurations are associated with inferior ROA, a reasonable adjustment to the implemented algorithm would minimize the expression of M3_n and M4_n into M34_n. Moving forward, we thereby analyse M34_n in place of M3_n and M4_n.

Table 14. Minimization of M3_n and M4_n

N*	DIVERSIFIED_TECHNOLOGY	EPC_INTERNALLY	SEVERAL_COUNTRIES	LARGE_FIRM	LOW_MATURITY_MARKET
M3_n	0	1	0	0	**0 / 1**
M4_n	0	1	**1/0**	0	0
M34_n	0	1	1/0	0	0/1

5.4 Robustness test results

We repeat from the method section that our study compromises a small-N QCA case sample size while approaching the size of a large N analysis. Duşa (2019) flags caution while considering robustness tests of small-N studies, as the purpose is to advance qualitative insights and not withdraw statistical inferences. We note this but decided to perform the systematic robustness tests described by Oana and Schneider (2021) to explore the model's sensitivity to changes in calibrations, consistency, and frequency thresholds. The concept of the steps of robustness tests was introduced in 4.3.8 Robustness tests. Per the proposal of Oana and Schneider (2021), the results of the systematic robustness test are presented concisely in Table 15. The complete table and parameter explanations can be found in the appendix. Likewise, the complete steps and written code scripts of the systematic robustness tests can be found through a link in the appendix A and appendix B.

Table 15. Brief Robustness Report.[17]

Robustness report			
Fit Oriented parameters			
RF_{cons}: 1	RF_{COV}: 0.859	RF_{SC_minTS}: 0.462	RF_{SC_maxTS}: 0.412
Case oriented parameters			
RCR_{typ}: 0.375	RCR_{dev}: 0	RCC_RANK:4	
Worst performing model			
The worst performing hard test model showed a rank of 4 (worst possible), illustrating low case robustness outside of the calibration range. This was significantly improved by setting n.cut to 1, yielding rank 2 (second best)			

All robustness parameters, except the RCC_RANK, yielded values between 0 and 1. From Table 15 we observe based on the fit oriented parameter RF_{cons} that the *robust core* is as consistent as the IS, from RF_{COV} that RC cover much of which IS covers, and that the overlap of minTS and maxTS to the IS are close to half. At the time of writing, the work of Oana and Schneider (2021) has recently been published, and we note that the field of systematic robustness tests of QCA is developing. Therefore, limited guidance into what parameter scores to be perceived as robust IS exists. Nevertheless, we conclude that the fit oriented parameters, not far from 1, suggest the model is reasonably robust. Notably,

[17]*A lower and upper limit of the thresholds of selected attributes and parameters were identified. Models with attribute and parameter thresholds that surpass the lower and upper limits produce new causal solution sets. Alternative solutions are aggregated into a set called maxTS. The intersection of the alternative solutions is appended into a set named minTS. The part of the initial solution (IS) that withstands all robustness tests, i.e., found present in the minTS, is deemed as the robust core (RC). Alternative solution sets are then compared by the parameters or the cases to the initial solution.. "Cons" is short of consistency, "Cov" of coverage, "SC" of set coverage, "typ" of typical cases and "dev" of deviant cases.*

RF_{SC_minTS} and RF_{SC_maxTS} are below 0.5, but the value of which depends on the hardness of the performed robustness tests. Equivalently, a low value indicates that hard tests have been performed, which Oana and Schneider (2021) recommend.

Compared to the satisfying results of the fit-oriented robustness test parameters, we note from the case-oriented tests that neither the typical nor deviant cases are robust, i.e., RCR_{typ} and RCR_{dev} returned values far from 1. Likewise, the test produced the worst possible case-oriented rank. Notably, the worst-performing model illustrates that the model is sensitive to the frequency cut, which conservatively was set to 2. As to improve the robustness of the model, an easy adjustment would be to set the threshold to 1. But the purpose of this thesis was to gain deeper insight into causality, not to construct a model with the highest possible robustness.

In sum, we observe acceptable robustness of the model, while the case-oriented tests emphasize the significance of our decisions made during model development. This underpins the importance of exploring the model and the results through expert interviews. The post-analysis interviews will next be presented, while we finalize this subsection by repeating that the fruitfulness of the robustness concept is debated within the field of QCA.

5.5 Post-analysis Expert Interviews

As detailed in the Methodology, we sought in post-analysis interviews to evaluate if the QCA results correspond with industry experts' understanding of the industry. Moreover, the expert interviews may be perceived as an external interpretation of the QCA analysis or as an alternative analysis. We will here elaborate on the key insights from the interviews post the QCA. Details on the background of the interviewees can be found in Table 4.

We begin by returning to the first configuration of the Truth Table. We observed this configuration to be inconclusive, yet it represents the largest cluster of cases. Therefore, we present experts' interpretation of the minimized causal expressions of superior and inferior ROA, respectively.

5.5.1 Experts' perception of the first contradicting configuration from the Truth Table

We repeat that Configuration 1, displayed below, was found inconclusive.

Table 16 Overview of attributes of configuration 1

DIVERSIFIED_TECHNOLOGY	EPC_INTERNALLY	SEVERAL_COUNTRIES	LARGE_FIRM	LOW_MATURITY_MARKET
0	0	0	0	0 (1)
Model Output: Non-conclusive. Included in interviews as the configuration contains many cases.				

An expert aligned with the ambiguousness and emphasized that this is a high-risk configuration, which captures firms at both ends of the spectrum of ROA. Surprisingly, while still a risky configuration, the expert also echoed the QCA in that this is a popular construct in the world of VRE developers.

"It is an awful lot of companies doing it… Some of these are rubbish, and some of them are great [… It is] hard to evaluate this category. It is a high-risk configuration … Volatility does relate to profits." -J

Furthermore, the industry expert mentioned that the outcome metric for success might not be suitable for this category. In contrast to large and diversified firms, the revenues of small and non-diversified firms can be highly dependent on individual sales of projects or parts of the project portfolio. Resultingly, these firms may have negative profits for several years, followed by a single year of extreme success. Average profits over a longer time span, or growth of assets, could thus be a better outcome metric to capture the performance of these types of firms. It was further noted that these companies usually apply different strategies for mature and non-mature markets.

Another expert likewise echoed the inconclusive results of this type of firm:

> *"This is not surprising. [Pause] There is always the little jewel. If they are operating in a good market, they may be successful, but they are not very many. If the market is sufficiently developed, larger players consolidate things. Although I would guess that the companies engaged in the development would show great results, as some markets really favour local knowledge." – K*

The latter quote emphasizes the interrelation between the "development" or maturity of the industry, the size of companies, and the local knowledge. I.e., the expert expects large companies to be predominant in mature markets. However, a few, small, companies with a narrow focus and local knowledge may also perform well.

5.5.2 Experts' interpretation of minimization 1

Next, we return to the experts' perception of the first minimized causal expression with superior ROA. Minimization 1 (M1), from Table 12 is displayed below.

Table 17 Overview of attributes of minimization 1 (M1)

DIVERSIFIED_TECHNOLOGY	EPC_INTERNALLY	SEVERAL_COUNTRIES	LARGE_FIRM	LOW_MATURITY_MARKET
1	1	1	1	1
Model Output: Superior ROA				

When asking what the interviewees thought about this configuration, we found an alignment between the experts' perception and the outcome produced by the QCA:

> *[After being presented the outcome] "Not surprising. I assume it is easier to find companies that are both diversified in terms of the value chain, country and technology, as you tend to enter one of the steps on the value chain and then grow either upstream or downstream when growing in that market."*
> *"You can start to develop in a new country and may leverage the strengths that you have developed in different parts of the organization." – K*

> *"If you have a spread of markets, you are spreading your risk, and you can allocate the team to the best markets."*
> *"Yeah, it would not surprise me that companies that integrate both vertically and horizontally make money … You see that they have good credit ratings, and it will unlock doors for you. They also have*

bargaining power and connections and are well networked. They are not equipped to move fast but have money to R&D". – J

We synthesize from interview K that large VRE developers accumulate knowledge and capabilities by diversifying the value chain, technologies, countries, and non-mature markets profits. As for interview j, we synthesize that large and diversified VRE developers may have connections and bargaining power advantages. In addition, they are perceived from an outside perspective as "low risk" and consequently enjoy good credit ratings and capital access. In sum, this yields profitability.

The experts further detailed specific attributes related to this configuration. Interviewee J emphasized how internal EPC activity is a risk hedge, i.e., that large companies may reduce risk by having the capabilities for EPC internally at the cost of a lower rate of return. Related, on a general note, interviewee J emphasized that expansion can happen too quickly. Similarly, Interview K noted that EPC typically is partially or fully outsourced. K further detailed that the learning advantages or economies of scale of diversification depend upon how firms diversify:

"The reasoning for EPC integration is basically that there are not enough EPC contractors out there … Larger companies tend to be risk-averse, and usually accept a lower rate of return. "
"On the other hand, say you have Australia and US, you have the time-zone issue. And many variations that you must be able to accommodate for." [Talking about a specific company] International expansion happened too quickly. You need to have some flexibility in terms of being able to withdraw from a market." – J

"A lot of companies choose to develop and operate, but EPC is where they outsource" […] "With regards to the technological element, it is quite interesting. Suppose it is, for example, wind + storage, solar + hydrogen or solar + whatever. That resonates very well with me. If the diversification starts being solar + wind, I am not that convinced." – K

Lastly, interviewee K challenged the causality by pointing out that a successful company, due to growth and profitability, likely explores new challenges. I.e., the outcome may predict the configuration:

"I would read your outcome as a company that progressively introduces new technologies … There is an element of growth and progressive diversification." -K

5.5.3 Experts' interpretation of minimization 2

The second minimized causal expression of superior ROA was M2, displayed below.

Table 18 Overview of attributes of minimization 2 (M2)

DIVERSIFIED_TECHNOLOGY	EPC_INTERNALLY	SEVERAL_COUNTRIES	LARGE_FIRM	LOW_MATURITY_MARKET
1	1	0	0	0
Model Output: Superior ROA				

For this configuration, we found conflicting views regarding causality. Interviewee J suggested that these companies may have found a niche within a specific market. Through market specialization, in mature markets, together with the diversification of technology and the value chain focus, these firms may be profitable:

"Yeah, it does in the sense that these companies are specialized and go from the cradle to the grave of the project. They will always be constrained by growth potential, but their faith is in their own hands." – J

"I suppose it is a specific model of success… Obviously, the EPC is a huge cost component, so I suppose if you have the EPC in house, you can manage this cost a bit more." - J

Interviewees L and K opposed the view of interview J. We have touched upon the risk of EPC, and being a small firm also managing multiple technologies but only in a single immature market may be perceived as a risky recipe:

[When seeing the result] "Small firm that is operating as EPC and is engaged in several technologies surprises me. That sounds like a very risky strategy."
[Considering immature markets] "It also impacts the cost of insurance, which is very important" – L

"This is interesting… [With a slightly sceptical note]" – K

Simultaneously, K emphasized the attribute of being engaged in a mature market as a counterweight to the risk of these firms. Moreover, we note that K interpreted this type of firm as somewhat similar to J. It was pointed out that this type may be a sweet spot for niche firms. Small firms in one mature market may manage the technological diversification and value chain integration:

[for the mature markets attribute] "Being in a mature market, I agree. The level of uncertainty and risk in markets that are not mature are often underestimated. Not necessary in terms of outcome, but in terms of how long it does take."
"To me, it is interesting if they can internalize certain key skills. It is a sweet spot where you have enough employees to internalize important skills … I do not know if 100 employees is the right threshold. "– K

5.5.4 Experts' interpretation of M34_n

Next, we present the expert interview findings of the minimized casual expressions of inferior ROA. We repeat that time-constrained us in prioritizing between exploring the breadth or depth of causal recipes across interviews. We chose the latter and prioritised exploring the M34_n displayed below, as this expression only consisted of 3 attributes and withheld the largest aggregate coverage. In sum, we saw a consensus from the industry experts that this configuration likely reflects unprofitable firms, as suggested by the QCA.

Table 19 Overview of attributes of negative minimization 34 (M34_n)

DIVERSIFIED_TECHNOLOGY	EPC_INTERNALLY	SEVERAL_COUNTRIES	LARGE_FIRM	LOW_MATURITY_MARKET
0	1	0 / 1	0	0 / 1
Model Output: Inferior ROA				

First, K elaborated that specialization, for small companies, may be important. L more generally perceived specialization as a market trend. The appropriate form of specialization may further be given by the type of market environment companies operate in:

"I think we are seeing specialization in the current market." – L

"It is not surprising if this [configuration] is unsuccessful unless they have a very strong niche in the market – for instance, if they are in a special environmental element … I think they can be successful if they only focus, for instance, on the asset ownership side of things." – K

The interviewees further suggested that small, non-diversified, EPC focused developers in a single market may struggle with necessary overhead and find it necessary to sub-contract. This may deteriorate the ROA:

"EPC requires a lot of manpower. If you have less than 100 employees, you have to sub-contract as well."– L

"For a small company stretching their competence across different technologies, it might be stretched a bit too far. They will rely a lot on consultancies … Yeah, this [combination] is not going to fly. The big guys will always win. It is a matter of scale and how they handle supply chain … Because the business of construction is an overhead heavy, it makes sense that a small company that is engaged in EPC in general [shows inferior performance]" – K

Notably, a lack of scale in combination with EPC being a hindering factor relates to M2, presented above.

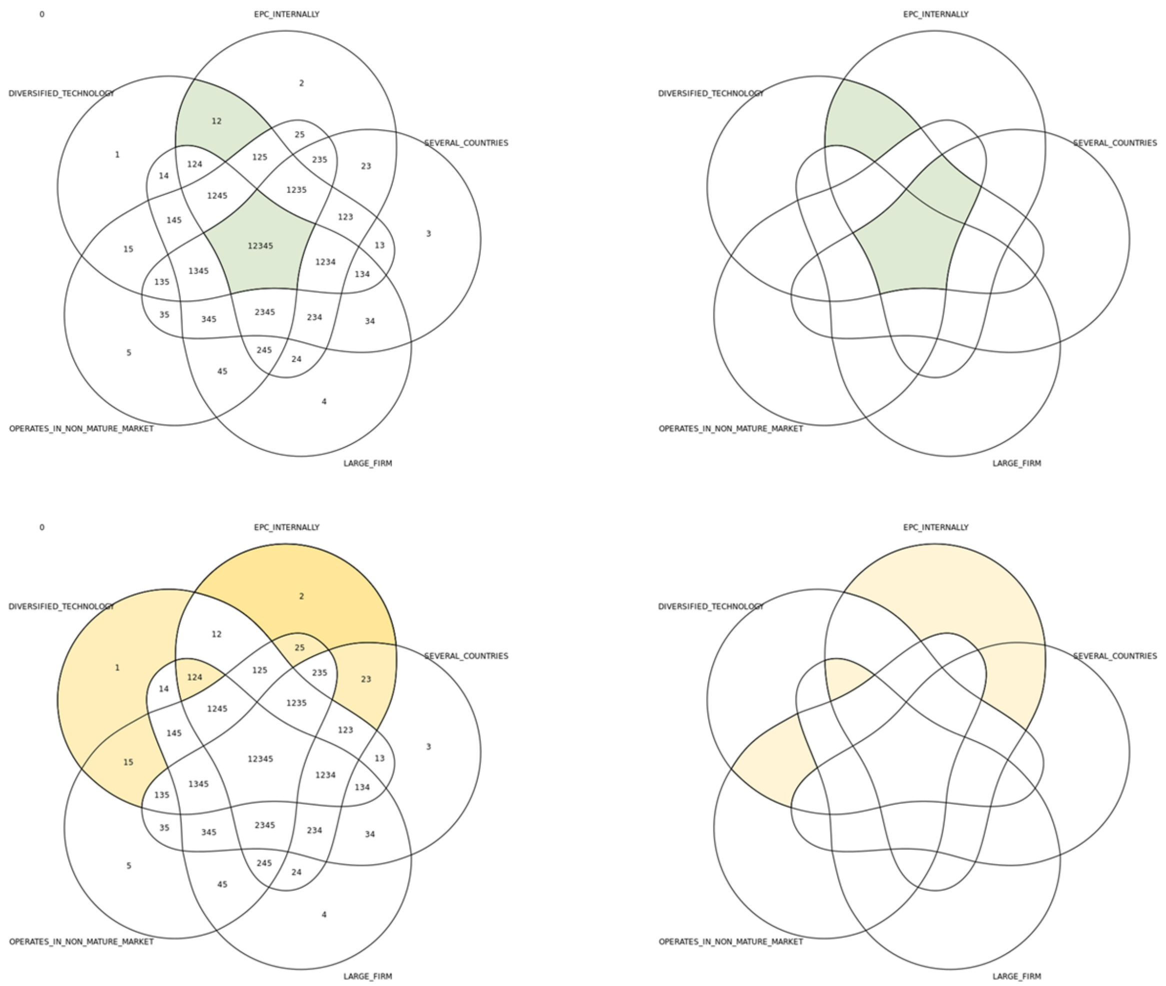
5.6 Alternative metrics for success

In Table 15, we presented the robustness tests and the sensitivity of the QCA model to changes in parameter and attribute thresholds. Complementary, we explored the causality of QCAs with different outcome measures. QCAs with alternative outcome metrics may be viewed as either robustness tests of the initial QCA solution or as alternative analyses. Alternative QCAs give insight into the applicable scope of causality identified in the initial model.

First, to adjust for the impact of Covid-19, we excluded the ROA of 2020 from the outcome. Second, we performed a QCA with growth as a performance proxy, as growth is a popular performance metric second to ROA.

Excluding pandemic years from the outcome metric
Per the suggestion of interviewees, we performed a test with ROA of 2018-2019 as the outcome of a QCA. That is, excluding ROA of 2020, as 2020 is assumed to reflect the impact of the outbreak of the COVID-19 pandemic. Figure 9 illustrates that there were only minor alterations from the original output, whereby the test reflects one additional configuration of profitability. The test further reflects the assumption in that there would be fewer configurations showing negative outcomes. In sum, this suggests the initial QCA model is, to a certain extent, robust when considering covid impact.

Figure 9. Visual presentation of original solution (left) and solution excluding 2020 (right).



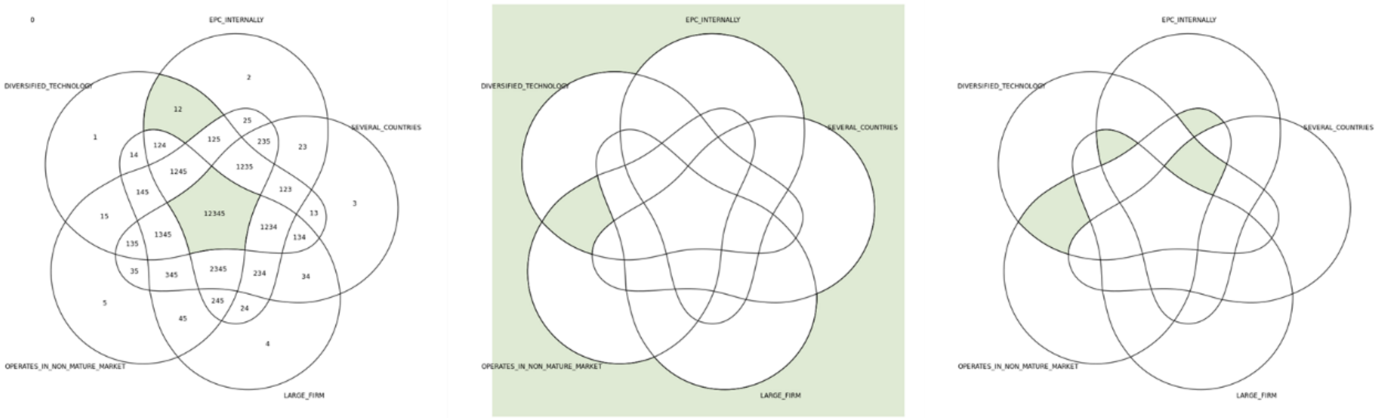
Note: Visualization of difference between with and without 2020. The figure displays the final minimized results with and without COVID impact. Greens indicates the presence of sufficient consistency for positive outcome for the configuration, orange indicates sufficient consistency for negative outcome. The minimized positive (top) and negative (bottom) indicate the results for different timeframes used for the outcome metric being 2018-2020 (left) and 2018-2019 (right).

Utilizing growth as an outcome metric

When evaluating the final outcome with growth as an outcome measure, we first employed the percentage growth in revenue as a proxy, using Siegel et al. (1993) definition of growth as 25%. Secondly, we employed total assets growth as a proxy, thus considering that RE is an asset-heavy industry. On a side note, the latter test revealed significant growth in total assets across cases, with a median yearly growth of 26%. Young companies displayed superior growth in terms of percentage.

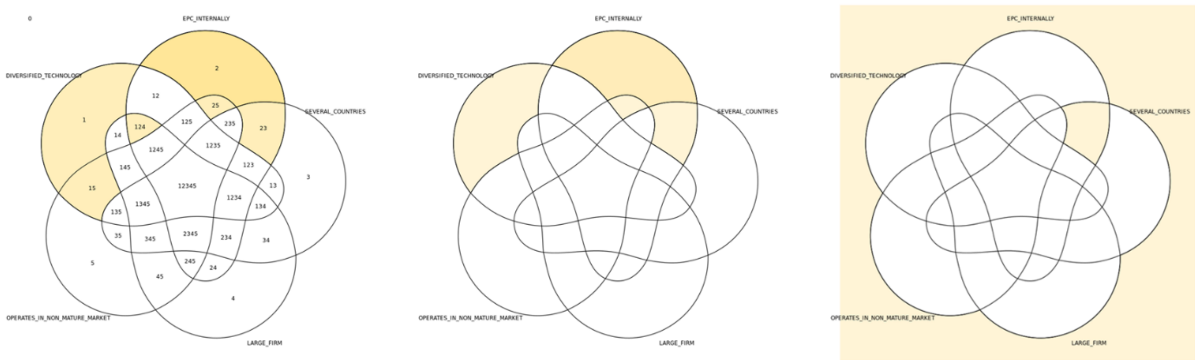
In the alternative analyses, we employed a growth threshold of 25% for superior and inferior performance. The results of the test are illustrated in Figure 10 and Figure 11. From Figure 11 we observe that there is some overlap in the causal expressions of inferior ROA. In particular, configuration 13, reflecting small firms operating in several mature countries, performing EPC and not being technologically diversified, is mirrored in the tests as a recipe for inferior performance.

Figure 10. Minimization for the positive outcome for original and alternative (growth) analysis.



Note: From left to right, we see the original solution, the positive minimized solution when evaluating 25% revenue growth, and finally, the positive minimized solution when evaluating 25% average growth of assets. Green colour indicates that the configuration has sufficient consistency.

Figure 11. Minimization for the negative outcome for original and alternative (growth) analysis.



Note: From left to right, we see the original solution, the negative minimized solution when evaluating 25% growth of revenue, and finally, the negative minimized solutions when evaluating 25% average growth of assets. Orange colour indicates that the configuration has sufficient consistency for the negative outcome.

In sum, we observe from Figure 10 and Figure 11 different causal expressions of superior and inferior performance in the tests when compared to the initial QCA. The tests are naive because they do not represent sound QCA models with satisfying cross-case consistency and coverage. Nevertheless, the results indicate that our solution's scope is limited to ROA, and thus does not reflect how the configurations fare with other outcome metrics.

6. Discussion

We approach the problem statement *"How do combinations of attributes explain VRE developers' performance?"* by evaluating the subordinate research questions. Firstly, approaching RQ1 and RQ2, the attributes and combinations of attributes impacting the performance of VRE developers will be summarized in 6.1. Secondly, we approach the focal point of the discussion, namely RQ3 and *why* combinations of attributes may impact performance in 6.2. Answering RQ3 includes interpreting the QCA results, i.e., the ultimate step of a QCA study following the outlined best practices by Greckhamer et al. (2018). We finalize the discussion with 6.3, whereby we (1) map the work of this thesis considering previous firm performance literature and (2) provide some suggestions for further work.

6.1 Attributes and combinations of attributes impacting firm performance

Answering RQ1 "What attributes may impact the performance of VRE developers?", we refer to the details in 3.2 and 4.3.3. Table 2 summarize attributes identified in literature, and Table 5 presents the attributes synthesized from industry expert insights. The sum of which constitutes the attributes which we have identified that may influence the performance of VRE developers.

Answering RQ2 "What combinations of attributes may explain VRE developers' performance?" we refer to the results of the analysis presented in 5. The Truth Table, the minimized causal expressions repeated in Table 20, and the causal details uncovered during the post-analysis interviews constitute our answer to RQ2.

Table 20 Summary of both positive and negative casual expressions

N*	DIVERSIFIED_TECHNOLOGY	EPC_INTERNALLY	SEVERAL_COUNTRIES	LARGE_FIRM	LOW_MATURITY_MARKET
M1	1	1	1	1	1
M5_n	0/1	1	0	1	0
M2	1	1	0	0	0
M34_n	0	1	1/0	0	0/1
M6_n	1	0	0	0	0/1

Note: The table showcases an overview of both the negative and positive minimizations resulting from the QCA analysis. For ease of referencing, minimization 1 is labelled M1 and negative minimization 6 is labelled M6_n.

6.2 Exploring configuration through theory and industry experts' comments

We finalize the answer to the problem statement by approaching RQ3: *"Why do different combinations of attributes impact the VRE developers' performance?"*. To explore RQ3, we first present and explore the causal expressions for large firms, and second the causal expressions of small firms.

An answer to RQ3 first requires an interpretation of the QCA results. Greckhamer et al. (2018) consider interpreting results, the last step of QCA, synonymous with capturing the essence of causal linkages. Notably, the Analysis section has surfaced the QCA interpretation step described by Greckhamer et al. (2018). To elaborate, in 5.3.3, we minimized the expressions M3_n and M4_n into the expression M34_n, capturing the essence of the causal link of the former. In 5.5, we detailed industry experts' interpretation of the minimized QCA expressions. The industry experts contributed with an external perspective on the causality, or equally important lack of, causality for the configurations displayed. The mentioned processes constitute a partial answer to RQ3. To complete the interpretation step, we return to case-specific knowledge and holistically interpret the causal expressions considering the theories presented in section 3 and industry experts' insights introduced in 5.5. A discussion of which at the same time answer RQ3.

6.2.1 Causality of M1 and M5_n

The first minimized configuration displayed that large companies diversified across technologies, the value chain, and markets, including low maturity markets, showed superior ROA. Following the suggestion of Greckhamer et al. (2018), we inspected the cases represented by M1 to gain insight into the configuration. We found that each case engages in land seeking, EPC, and asset ownership, i.e., all phases displayed in Figure 2. In other words, these firms manage large parts of the value chain for VRE firms, limiting the risk of being interdependent upon counterparties not under management. Moreover, in contrast to a small and integrated firm, a large integrated firm may possess the resources necessary for effective supply chain management.

The industry experts echoed the causal implications of QCA in that M1 developers perform well. First, the experts suggested that the firm will likely have bargaining power and an extensive network it may leverage as a result of being large and operating across markets and technologies. The inferior performance of firms of M5_n supports this rationale. While both M5_n and M1_n represent large firms performing EPC in-house, firms of M5_n are not diversified across markets and thus may result in inferior networks and bargaining power compared to firms of M1.

We infer that the construct of M1 companies warrants superior *networks,* a type of *knowledge-based resource*, as a competitive advantage yielding superior performance, aligning with the findings of Goddard et al. (2009). Moreover, the *bargaining* power of these companies suggests that the companies can push down prices from their suppliers and increase the margins of their installations, aligning with concepts from SCP (Porter, 1979). Thus, related to the combinations of size and national diversification, firms of M1 are relatively better positioned than competitors such as firms of M5, a possible explanation for their superior ROA. A firm construct with superior network and bargaining power may also yield reduced overhead and time spent on interacting with the surrounding environment, i.e., a minimized transaction cost aligning with TCT (Williamson, 1981). Due to their network and bargaining power, we infer that large VRE developers in the M1 category may easily interact with stakeholders such as governments, NGOs and the communities surrounding developed renewable infrastructure. Thus, compared to smaller competitors with less network and bargaining power, they have low transaction costs that positively impact ROA and potentially allow for allocating resources to other value-creating operations.

Second, industry experts suggested that this type of firm's size and degree of diversification yield lower operations risk. Low risk is synonymous with a good credit rating which causes ripple effects and "unlocks doors". I.e., firms of M1 with excellent credit ratings enjoy superior access to capital and lower capital costs than firms of M5_n. The experts noted capital cost as important to the ROA of VRE developers, as the industry is capital intensive, i.e., capital costs constitute a large share of total costs. Moreover, the experts emphasized that large, diversified firms may dynamically allocate resources *where* needed. Related to the capital access and the cost of capital, this type of firm may also allocate or raise capital *when* needed. Interviewee J emphasized, as an example, that these firms *"have money for R&D"*. We infer, from RBT and TCT, that this type of company has capabilities such as superior internal resource allocation and capital access.

Moreover, we interpret developers of M1, who can quickly raise and allocate capital, as a good fit for survival. Building on this, the firms have assets in multiple countries, thus the firms are less sensitive to destructive changes to regulations in a single market. As such, the firms are better situated for survival through the perspective of evolutionary economics (Schumpeter, 2010). On the other hand, large size may, to some extent, inhibit a firm's agility and ability to adapt to disruption. However, capital access and the low risk of operations seemingly counterweight the negative implications of the large size. In addition, the capital access, combined with the resources available due to their size, may enable firms to perform research and development (R&D) and *cause* creative destruction. This ability to conduct R&D can be viewed in relation to organizational ambidexterity and the dilemma of exploration and exploitation (O'Reilly & Tushman, 2013). To elaborate, we suggest that by combining the capital access, superior network, internal resources and R&D activity, M1 developers are fit to navigate the dilemma. As a result, the firms can manage the dilemma by performing exploration and exploitation activities simultaneously.

Additionally, we interpret that the well-diversified M1 firms can exploit market imperfections and technologies. In other words, development can be shifted towards markets and technologies found to be the most attractive at a given point in time. This represents a competitive advantage over the firms of M5_n, which are constrained by the market of operation. Repeating the rationale for country diversification presented in 3.1, we interpret that the firms can focus on the markets that are the most attractive, as defined using the SCP explanatory theory.

Interpreting the negative expression for large firms, labelled M5_n, we attribute the inferior performance to the lack of diversification. One way to explain the difference between the configurations of M1 and M5_n is, as recommended by Greckhamer et al. (2013), to examine the specific cases. We find that the companies represented by M5_n include Adani Green Energy Ltd, showing an impressive growth of 55% annual growth rate in the last five years (Adani, 2022), and Jinkai New Energy (Former Nyocor Co Ltd), displaying a similar impressive growth including a near doubling of capacity installed in 2021 (Nycor, 2022). This finding may relate to Goddard et al. (2005) findings, stating that costly expansion may deteriorate the short-term profits. The outcome may be related to the stage the companies are in, where the firms will later reap profits and diversify towards other countries, including low maturity markets. Thus, implying that these companies may, at a later stage, align their attributes with the companies in the M1 configurations.

6.2.2 Causality of M2, M34_n and M6_n

Next, we discuss the causality of M2, M34_n and M6_n.

M2 is the second minimized expression of superior ROA, and like M1, M2 captures VRE developers diversified across technologies and the value chain. However, developers native to this configuration are small and operate in a single, mature, market (see Table 20). Per the suggestion of Greckhamer et al. (2018), we returned to details upon cases of M2 for the interpretation. We found that two developers engage in both wind and solar, while one of the companies engages in solar + other. Generally, the industry experts' perceptions were divided on the performance of this configuration. Specifically, EPC activities in-house and technological diversification were noted as a risky strategy for small firms, and one expert opposed the result related to technological diversification. The risk of this configuration was further amplified by how the firms only operate in a single country.

Through inspection, we found that all of these developers were engaged in all value chain phases. One of the industry experts noted that these firms "*go from the cradle to the grave of the project*" and thus manage more of the risk associated with a fractioned supply chain. Moreover, an expert suggested that this configuration may capture a sweet spot for specialized niche firms. An interpretation of this configuration through the RBT (Goddard et al., 2009) may echo this suggestion. Small VRE developers may profit from being nimble and being capable of quickly seizing opportunities present in a changing market. As an example, they may experience enhanced profitability related to the opportunity of providing additional value through, for example, battery installations - potentially increasing the yield per project or by having the flexibility of selecting the most profitable technology for the sites available. The opportunity of which may simultaneously represent a two-edged sword. Diversification in a small firm may constrain the potential standardization and economies of scale, deemed important in the VRE industry by some industry experts as reflected in 5.5.1.

Moreover, as a result of not diversifying across countries, these firms may possess superior local knowledge. Related, they may rapidly comprehend critical changes impacting the national VRE industry by engaging in different technologies. Related, industry experts noted that local knowledge is an important attribute for the success of small firms.

However, while theory and the QCA may suggest and explain the M2 configuration as a causal recipe of superior ROA, we note that industry experts painted an ambiguous picture of the causality. Causality not reflecting industry experts' perception of the industry may be perceived to show weak implications for managers in the field. A nuanced picture of the causal link of M2 may thereby be appropriate.

Further elaborating on small firms, we suggest that a small and technologically diversified firm may incur high transaction costs of operation due to increased overhead and friction arising from the prioritization and allocation of resources between technologies. This interpretation implicates a high transaction cost for these developers, aligning with the explanatory theory of TCT (Williamson, 1981). Moreover, the developers not diversified across markets remain exposed to destructive market-wide changes in the operating environment. Illustratively, we observe that M6_n displays inferior performance with a similar combination of attribute values as M2 as both M2 and M6_n represent small developers engaged in multiple technologies within a single market. However, the inferior performance of M6_n could also be related to the lack of economies of scale of small VRE developers, further amplified by the engagement in various technologies and the risk of operating in a single country.

The riskiness of the configuration of M2 and M6_n further suggest that some small firms perform well while other do not. Notably, this QCA covers only listed VRE developers. As a result, there may be several companies with similar attributes to firms in M2 that never reach the stock exchanges and therefore are not included in this analysis.

Finally, comparing the combination of attributes of the successful M2 to that of the unsuccessful M34_n flags caution. We interpret the causality of M34_n as significant as the configuration shows inferior performance both in the original analysis and the alternative tests. Related, the experts emphasized that firms of M34_n may display inferior performance unless they find a niche, i.e., a specific sub-segment of the market, in which the firm can dominate and thrive. Nevertheless, we echo the industry experts that economies of scale are constrained for the small EPC providers of M2 and M34_n. Given that the EPC business is "overhead heavy, " small firms may struggle to manage the overhead. EPC is a heavy personnel industry, and small firms possess limited personnel per the definition of the size used in this thesis.

In sum, we interpret the combination of being a small EPC provider, displayed by M2 and M34_n, as challenging. Nevertheless, there exists a small number of firms mastering the challenge. Likewise, we infer from the commonality of M2 and M6_n that the construct of small and technological diversified VRE developers, operating in a single market, as risky.

6.3 Implications and further work

We synthesise from the discussion above that large and well-diversified firms thrive in the VRE industry. These firms are exposed to limited risks, yielding ripple effects such as superior networks, bargaining power, reduced costs, and capital access and opportunities. However, being large is not identified as a necessary condition of superior performance. Small players may find success in a niche, if their focus and strategy is well crafted and specialized. However, an overweight of causal recipes of inferior performance suggests that the path to profitability for small firms is more stringent. A quote by one of the industry experts summarizes this well:

" There is always the little jewel… but they are not very many." - K

Having interpreted and discussed the QCA results, we next provide implications for managers and researchers in the VRE landscape.

6.3.1 Implications for managers and legislators

This study supports VRE managers' work of adapting profitable strategies. First, the findings indicate that large firms could benefit from approaching the strategy incorporated by the firms in the minimized configuration M1. Second, small firms specializing in a carefully selected niche may be profitable. Moreover, this thesis may represent a guiding framework for managers in the VRE industry on how QCA methodology can be used to analyse the link between different firm configurations and a desired outcome. We argue that the thesis, and insights into the effects of the combination of attributes, can help managers unravel strategies that may lead to desired results.

Moreover, the thesis illuminates' parts of the picture of firm configurations and performance, which investors interested in renewables may use as a supportive tool. Furthermore, the map and insight into configurations and performance may guide legislators upon VRE developers in need of support and the reasoning for why. However, we believe that future investigations are needed to fulfil the above-presented use cases.

6.3.2 Implication for researchers

In 3.2, we presented previous firm performance literature in the renewable landscape, and in 3.3 we introduced previous QCA firm performance research. Simultaneously, we noted in 4.1 that we identified no configurational firm performance research in the renewable field. As such, a major implication from this thesis, for renewable and QCA firm performance researchers alike, is that:

1) QCA can prove valuable in the field of renewable firm performance research.

The second implication relates to how this study contributes to the literature in 3.2, namely the firm performance of renewable energy developers. Gupta (2017) found VRE developers successful in well-developed technological markets. Schabek (2020), analysing the isolated effects of variables, indicated that industry maturity harmed performance. On the contrary, Luts et al. (2021) found that market maturity positively influenced ROA. This thesis employed a more granular metric of industry maturity, measuring the maturity of *different* VRE technologies, while Schabek (2020) and Luts et al. (2021) measured the aggregated share of renewables. In addition, our research results explain the ambiguous research results of the influence of industry maturity, in that the impact of which is complex. Different causal recipes of both inferior and superior ROA were identified, covering both mature and immature markets.

Moreover, Zhang et al. (2022), Guaita-Pradas and Blasco-Ruiz (2020) emphasized that country risk may negatively influence developers, and Li et al. (2016) found international diversification as a beneficial for firm performance while finding a negative influence from industrial diversification. In contrast, Westerman et al. (2020) found a negative impact of international and industrial diversification. In addition, Morina, 2021 #147@@author-year}, as Schabek (2020), found a positive influence of size on the profitability of renewable developers, while Luts et al. (2021) found a negative impact. Zhang et al. (2022) found the effect of size to be ambiguous, noting that the impact of the attribute may depend on the state of other attributes.

Our study further nuances the picture upon the effect of both size, industrial and international diversification. While we find that large, technological, and internationally diversified firms perform well, our results suggest that while challenging, small firms with risky recipes may find a niche and exhibit superior performance. Moreover, we present insights that, to some extent, expand the argument by Li et al. (2016) that investors typically prefer *diversified industrial firms*. Based on the QCA and the expert interviews, we provide supplementing implications that firms of the M1 configuration enjoy superior capital access. As such, we extend the findings of Li et al. (2016 by implying a potential investor preference for *large firms with an integrated value chain, diversified industrially and nationally across both mature and immature markets*.

In sum, this thesis research results support the premises of QCA and QCA firm performance research by illuminating that firm performance is complex. Illustratively, this thesis found that a combination of attributes impacts firm performance, and that single attributes, in different configurations, can cause opposing effects. This paint a second implication, namely that:

2) The topic of firm performance is complex. As a result, the firm performance literature in the renewable landscape may benefit from more configurational research.

Insight into the joint effects of the combination of attributes may further explain why the previous results related to single determinants have been found ambiguous. Extended, we did not find any single attribute necessary for the outcome, further illustrating that single attribute impact exploration is insufficient.

Finally, as explored in 3.3, we contribute to the configurational firm performance research gap. As presented in 4.2 *About QCA,* it is advantageous to have previous configurational research that may aid in building a QCA model. Therefore, our thesis may contribute to future researchers utilizing configurational research to explore firm performance.

6.3.3 Suggestions for future work

While exploring the configurations of firm performance of VRE developers, we identified several areas that may be the subject of further work.

Firstly, our thesis is an exploratory QCA study that aims to identify the association between combinations of attributes and firm performance. Future studies may in-depth explore the identified configurations and the causality. For example, a researcher may reach out to developers and gather more case-specific data. Close collaboration with the case firms would enable the firms to correct and expand the analysed data. However, such a collaboration could increase the bias of the researcher. Related, the study can be expanded to a Large-N QCA by adding more cases to the case sample. This may be accomplished by including listed and non-listed VRE developers. Alternatively, the nuances of the result may be in-depth evaluated by replicating the study with only wind or only solar PV developers, thus providing insight into the applicable scope of this QCA.

The purpose of this thesis was to explore why configurations yield superior or inferior ROA. Further work may elaborate upon the degree of profitability by employing a fuzzy set QCA, at the cost of complicating the interpretation. As an example, a replicable finance-oriented fuzzy set QCA may enhance insights into the relationship between risk and profitability of VRE developers.

Secondly, we answered RQ1 by mapping potential VRE developers' performance determinants. This thesis explored the combinations of 5 attributes, constrained by the number of possible attributes relative to the number of cases of a sound QCA model. Researchers able to obtain needed data may perform a QCA with different attributes, thereby contributing to configurational VRE firm performance research. For example, we suggest that researchers include financial attributes such as debt level and capital access of VRE developers. Industry experts advised that capital cost is vital for the capital-intensive VRE industry. This insight would complement the suggestions provided by this thesis in that superior capital access is a competitive advantage of large and well-diversified firms. Likewise, this thesis explores the impact of national diversification and the maturity of markets. However, a researcher may explore and provide insights into the impact of national differences. As an example, a researcher may find interesting implications of capital access for firms in mature and immature markets. Related, researchers able to obtain the needed data may augment the study by incorporating a longer time span of measurement of both the attributes and the outcome.

Thirdly, this study explored profitability and tested the QCA results against the results of naive QCA models with other performance metrics. As reflected in 4.4, future studies may explore the complex causality of VRE developers through sound QCA models with different performance outcomes. We emphasize that growth may be a topic for further work, as causal recipes for growth and profitability may differ.

Fourthly, we synthesized in 4.4 that the methodology of this study is sound, while a future replicable study may cover areas of improvement. We noted that the mapping EPC operations of firms in 2017 was a tedious, difficult, and manual process where we screened the websites and annual reports of firms. During the discussion, we noted that the EPC attribute relates to what extent VRE developers control the risks of the supply chain. A future study may employ an attribute that can be withdrawn from databases and captures the degree of outsourcing of firms. This would improve the scalability of this study and the researcher would thereby have the opportunity of performing a large-N QCA.

7. Conclusion

This master thesis sought to explore the performance of VRE developers by answering the following problem statement:

How do combinations of attributes explain VRE developers' performance?

We approached the problem statement by first answering RQ1, i.e., "*What attributes may impact the performance of VRE developers?".* More generally, we noted that firm performance literature suggests that a multitude of *firm, industry and country*-specific attributes may impact the performance of firms. Considering VRE developers specifically, a semi-structured literature review and expert interviews unravelled a smaller set of possibly influential attributes. The set of attributes, answering RQ1, is the sum of the attributes displayed in Table 1 and Table 5.

Having identified a set of attributes that may impact VRE developers' performance, we then approached RQ2, "*What combinations of attributes may explain VRE developers' performance?"*. To answer RQ2, we find that a selection of influential attributes combines in different ways, yielding different outcomes, as displayed in the Truth Table. The minimized causal expressions, represented in a compressed format in Table 20, capture the essence of configurations which may explain VRE developers' performance. Lastly, causal details uncovered during the post-analysis interviews complete the answer to RQ2. In short, we find that large, technologically, and internationally diversified firms, operating in markets of different maturity, show superior performance. Meanwhile, we interpret from our results that being a small VRE developer is generally risky. However, we infer that small firms may find a niche and exhibit superior performance.

Finally, we conclude the problem statement by approaching RQ3, "*Why do configurations of attributes impact VRE developers' performance?*". We answer RQ3 by interpreting the identified causal recipes through case-specific insights, qualitative insights from interviews and explanatory theories. In sum, we first synthesize that large and well-diversified firms withhold superior networks and learning capabilities. The superior financial performance of these firms may be attributed to their bargaining power, yielding reduced costs. Superior financial performance may also reflect that M1 firms have minimised the risk exposure through their size and degree of diversification. This may yield ripple effects such as superior capital access and opportunities. However, being large was not a necessary condition for superior performance. We interpret from the interviews and QCA results that small players may find success if their focus and strategy are well crafted and specialized. We conclude that small firms may benefit from being somewhat diversified, if this enables them to sense changes in the markets and if they can seize these opportunities and identify niches in which they may dominate. However, an overweight of causal recipes of inferior performance suggests that the path to profitability for small firms is challenging.

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