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Determinants of Materiality of Non-Financial Disclosure and

Implication on Information Asymmetry

A study of environmental disclosure of environmentally sensitive industries

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Abstract

This study explores the influence of non-binding guidelines published by EU Directive to the materiality of companies' non-financial reports. In order to identify the materiality level of NFR, the authors manually assess the materiality level of each report by giving scores according to the materiality disclosure quality (MDQ) index. This study investigates how the level of materiality may be determined by firm-level and market-level factors. Additionally, this study also investigates the materiality effect on information asymmetry. The targeted observations are the environmental disclosures of environmentally sensitive industries which consist of oil and gas, mining, and utilities. The results of this study indicate that companies in developed markets tend to disclose higher levels of materiality of environmental information. We also find that the materiality level of NFR is highly affected by which industry the company belongs to. However, the finding does not indicate that levels of materiality have significantly influenced information asymmetry.

Keywords: Non-financial report, materiality, information asymmetry, Materiality Disclosure Quality (MDQ)

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1. Introduction

In 2014, the European Union (EU) issued the Directive 2014/95/EU which requires large public companies listed in EU stock exchanges to report disclosure which intended to provide investors with more holistic and relevant information on companies' non-financial outcomes regarding environmental issues, social and employees matters, human rights, and anti-corruption policies (Grewal et al. 2019). Although the Directive is mandatory to report the non-financial report (NFR)[1], it was not sufficient in order for companies to provide the stakeholders with relevant information. Therefore, the EU published sustainability reporting guidelines in 2017 to increase the quality of NFR (i.e. materiality and assurance). Thus the information provided in the disclosure will be more beneficial to all the stakeholders' decisions. However, the guidelines are non-binding which means the materiality of NFR depends on the companies' discretion. This study explores factors that may influence the level of materiality of environmental information in NFR reported by companies in environmentally sensitive industries, typically companies that are subject to report NFR according to EU Directive. Additionally, this study also investigates how the level of materiality may be associated with information asymmetry in the market.

The first key principle of the EU's NFR guideline is disclosing material information (European Commission, 2017). The guideline also refers the definition of material to Article 2(16) of the Accounting Directive (2013/34/EU) on the annual financial statements, consolidated financial statements and related reports as following:

> *"the status of information where its omission or misstatement could reasonably be expected to influence decisions that users make on the basis of the financial statements of the undertaking. The materiality of individual items shall be assessed in the context of other similar items"* (European Commision, 2013, p. L182/27)

The definition of materiality given by European Commission shares some similarities with materiality definitions given by other standard setters and regulators that a piece of information is determined to be material if the omission or misstatement of such information can affect the decision of the user (Mio, et al., 2019). However, the definition has evolved to include broader

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[1] We found that the term non-financial report, non-financial disclosure, sustainability report, and integrated reporting are used interchangeably by several papers (e.g. Wu, et al., 2018; Ferrero-Ferrero, et al., 2020). Therefore, in this paper we also use these terms interchangeably. Additionally, where it does not specify whether it is non-financial or financial kind of disclosure, we mean both.

aspects besides the financial information by considering materiality of stakeholders rather than only shareholders or investors, hence the definition mentions "users" instead of "investors or shareholders" and "decisions" other than "investment decisions" (Mio, et al., 2019).

The challenges in measuring materiality of NFR are twofold. First, the concept of materiality stems from the financial disclosure realm, which has a longer and more extensive development of practical implications on how to measure materiality compared to NFR (Eccles, et al., 2012). Secondly, different reporting initiatives (i.e. Global Reporting Initiative - GRI, International Integrated Reporting Council -IIRC, and Sustainability Accounting Standards Boards - SASB) subjectively assess materiality which subsequently leads to selective reporting and a loss of credibility in NFR (Ferrero-Ferrero, et al., 2020). Since there is a lack of operationalization in non-financial materiality assessment, therefore, in this paper, we implement materiality disclosure quality (MDQ) index based on Gerwanski et al. (2019) which provide a more elaborated practical instruction on how to present relevant non-financial information no matter which standard reporting followed by companies. The content analysis is carried out according to the MDQ index but with a particular focus on environmental issues.

The materiality of the NFR may differ upon the type of industry (Fasan & Mio, 2017) as also suggested by Eccles, et al. (2012), "materiality must be defined on a sector-specific basis" (Eccles, et al., 2012, p. 65). Therefore, we seek to evaluate the materiality of the non-financial disclosure by focusing on environmental issues of oil and gas, mining, and utility industries and compare the results between them because these industries are likely to receive more pressure from stakeholders and regulations for the communication of their environmental performance due to the inherent nature of being environmentally sensitive (Mas et al, 2018). Moreover, the production chain from upstream to downstream of the industries resulting in massive pollution of air, water, and soil, and therefore the firms from those industries with a higher environmental impact tend to make more extensive disclosures (Da Silva Monteiro & Aibar-Guzmán, 2010, Patten, 2002, and Hassan & Ibrahim, 2012). On the other hand, these firms can also be reluctant to provide information that potentially has negative economic and environmental consequences and strategically disclose only information that is mandatory by regulations or standards which may not yield materiality to stakeholders (Paananen, et al., 2020). Determining environmental disclosure of these industries also addresses the call for more research that could focus its attention beyond the level of general disclosures by distinguishing the specific type of environmental information being disclosed (Hassan & Ibrahim, 2012).

In addition, non-financial information can contribute to a company's value (Arvidson, 2011) because it is believed that the investor no longer solely relies on the financial number as a factor of investment decision but also other non-financial information such as the sustainability performance to be considered. The demands for financial disclosures stemmed from the problem of information asymmetry and agency conflict between the management and the principal (Healey & Palepu, 2001). In the similar way, disclosing non-financial information can lead to a decrease of information asymmetry and it lowers the information cost for investors to assess the systematic risks of the companies (Cormier, et al. 2011a). Another purpose of disclosing the information is to maintain legitimacy to the stakeholders (Deegan, 2019). Investors would be more interested in the companies which are able to disclose their private information to the public. An extensive environmental and social disclosure could increase the firm's reputation which will then be valued by the investors (Qiu et al., 2016). However, an extensive disclosure does not completely refer to the high-quality disclosure and reduces the information asymmetry because the extended disclosure may also hide the actual information, increase ambiguity, and result in information uncertainty (Glendening, Mauldin & Shaw, 2019). In this paper, bid-ask spread is the measure of information asymmetry. If the statement about high quality disclosure reducing the information asymmetry holds, the companies that score the high level of materiality, should have low level of bid-ask spread, hence, low level of information asymmetry.

Moreover, the relationship between materiality of NFR and information asymmetry was studied in two dimensions, corporate and macroeconomic. First, previous study suggested that the factors that are at corporate level including operating opportunity (return on assets), firm size, leverage, among others, are significant explanatory factors (Qiu, et al., 2016). Another research stream includes macroeconomic factors such as the level of financial markets development and institutional depth which may affect institutional and public pressure and degree of regulations enforcement, and indirectly influence the quality of NFR (Piñeiro-chousa, et al., 2019).

Although there have been several research findings that the existence of disclosure has a value relevant to the company's financial performance in the stock market (Saudagaran & Biddle, 1992; Baiman & Verrechia, 1996; Healy & Palepu, 2001), there is still a lack of research identifying the materiality of NFR and its implication toward the company's value in the stock market (Fasan & Mio, 2017). Moreover, the relationship between disclosure and companies' stock price can shed light on how the investors value the information given by the companies

(Qiu, et al., 2016). If the investors care about ethics, they would principally avoid investing in the questionably unethical sectors (i.e. alcohol and gambling) (Renneboog, et al., 2008). Likewise, investors who are concerned about environmental issues would be inclined to invest in the companies that are in green sectors (i.e. renewable energy technology) rather than companies that are environmentally sensitive industries. Thus, the assumption that environmental information potentially has an impact on investors' decisions may not always hold.

We expect that market types and industry types have significant relationships with MDQ scores. Our results suggest that companies in developed markets tend to disclose higher levels of materiality of environmental information. Among three sectors, we found that the utilities sector has the highest average MDQ score. Meanwhile, we found that the firm-level factors such as company size and leverage have stronger association to the materiality level of NFR than the external factors such as types of industries and levels of market development. We also expect that high MDQ scores will result in reduction of information asymmetry. However, the result does not indicate that levels of materiality have significantly influenced information asymmetry.

The rest of the paper is organized as follows: the next section briefly presents the literature review and the construction of the hypotheses on the relationship between different levels of the materiality of NFR and the bid-ask spread and analysts' forecast dispersion which are proxies for determining information asymmetry. The research design, including research methodology, sample selection, and variables, is described in the third section. In the fourth section, we present and discuss our results, including both the descriptive analysis and the testing of our hypotheses. The final section summarizes the main conclusions of the study, with a discussion of its limitations and implications for future research.

2. Literature review

2.1 The conceptual framework of materiality in financial reporting

Materiality is an essential concept in both theory and practice of accounting (Messier et al., 2005). The definitions of materiality given by standard setters and regulators have been evolving throughout the decades. For example, the following definitions of materiality are given by the International Accounting Standards Board (IASB).

The original version of materiality definition:

"[i]nformation is material if omitting or misstating it could influence decisions that users make on the basis of the financial information of a specific reporting entity. In other words, materiality is an entity-specific aspect of relevance based on the nature or magnitude of the items to which the information relates in the context of an individual entity's financial report" (IASB, 2017, p. 6)

The updated version of materiality definition applied in 2020:

"[i]nformation is material if omitting, misstating or obscuring it could reasonably be expected to influence decisions that the primary users of a specific reporting entity's general purpose financial statements make on the basis of those financial statements". (IASB, 2018, p. 2)

There are three major alterations of materiality definition which are addition of the concept of "obscuring", adding the phrase "could reasonably be expected to influence" and changing to focus to "primary users". The first change is to address the problem of inclusion of immaterial information that may affect the ability to understand the financial statement. The second change is to lever the threshold of the materiality from "could influence" to be "could reasonably be expected to influence". And lastly, by addressing primary users, the definition becomes more specific rather than answering to any type of users. (Ernst and Young, 2018)

The evolution of materiality definition seems to mainly address the concerns relating to financial statements rather than NFR as it then narrows the definition from influence of general users to primary users. Moreover, in the case of financial reporting, there has long been development for operationalizing materiality by using quantitative methods such as numerical materiality threshold (Rose et al., 1970). Additionally, the regulation for materiality in financial reporting is already in place and enforced by authoritative agencies such as the Securities and Exchange Commission (SEC).

2.2 Materiality of non-financial report

The definitions of materiality in the non-financial realm can be categorized into two streams. First, the definition is borrowed from the financial realm such as the materiality definition for NFR of European Commission as follows.

"*the status of information where its omission or misstatement could reasonably be expected to influence decisions that users make on the basis of the financial statements of the undertaking. The materiality of individual items shall be assessed in the context of other similar items*" (European Commision, 2013, p. L182/27)"

Mutatis mutandis, the definition of materiality for NFR are modeled on the definition of materiality for financial information (Eccles et al., 2012; Fasan & Mio, 2017) which more emphasize on the user of information such as "stakeholders" rather than "shareholders" and include other types of decision besides investment decisions has the same purpose to materiality definition given by other accounting standard institutions regarding the omission or misstatement and the influence to users' decisions (Mio, et al., 2019).

The second stream of materiality definitions are given by reporting initiatives such as IIRC and GRI which directly address sustainability issues as shown as follows

Definition of materiality by IIRC:

"*An integrated report should disclose information about matters that substantively affect the organization's ability to create value over the short, medium and long term*". (IIRC, 2021, p.8)

Definition materiality by GRI:

"*Material topics are those that reflect an organization's significant economic, environmental and social impacts; or that substantively influence the assessments and decisions of stakeholders*". (GRI, 2016, p.6)

The issues about materiality in non-financial reporting are twofold. First, so far there has not been generally accepted methods in assessing non-financial materiality which sustainability issues (environment, social and governance) have the most impact towards their business value. (Eccles et al., 2012). Second, the guidelines for NFR issued by different international initiatives (i.e. European Commission, GRI, and IIRC) have less authoritative power than the accounting standard regulators (i.e. FASB and IASB) (Wang, et al., 2016). Therefore, scholars attempt to operationalize the definition for materiality of non-financial disclosure. For instance, Eccles et

al., 2012 proposed that materiality should be defined on a sector-specific basis and Gerwanski et al. (2019) examines determinants of materiality disclosure quality (MDQ) in integrated reporting (IR) on a basis of a systematic analysis of the IIRC's materiality principle and previous literature (Eccles & Krzus, 2015).

The increasing number of empirical studies that address sector-specific approaches show clear evidence of a lack of rigorous process for determining sustainability report content (Ferrero-Ferrero, et al., 2020). The use of sector-specific information as the key performance indicators (KPIs) for materiality measurement based on the logic that companies in different sectors/industries would face different types of sustainability issues and the companies that are in the same industry usually have similar business models and are exposed to the same risk profile and regulation environment. For instance, the financial services industry is more socially-sensitive than being environmentally-sensitive (Seguí-mas et al., 2018). Likewise, while the extractive (oil & gas and mining) and utilities may contribute to some social issues, the environmental issue has higher levels of relevance and may have a direct effect on these companies' finances too.

A study by Lydenberg et al., (2010) proposed five criteria for prioritizing sector-specific sustainability disclosures: Financial impact/ risk; peer-based norms; stakeholder concerns; legal/regulatory/political drivers; and opportunity for innovation. This approach provides a way to identify sustainability issues that are important to a reasonable investor and allow the users to make peer-to-peer comparisons between companies' sustainability performance within the same industry (Lydenberg et al., 2010; Ferrero-Ferrero, et al., 2020). However, these studies did not provide detailed instructions on how to measure materiality as precisely as found in the literature of Gerwanski et al. (2019).

Gerwanski et al. (2019) offer another approach to determine the materiality of non-financial disclosure. They apply content analysis to capture and operationalize major characteristics that determine the quality of integrated reporting (IR) using MDQ score. The scoring components consist of (a) materiality section (emphasizing the importance of materiality concept and offering a concise and unambiguous information), (b) identification process (evaluation of the impact of potential issues on the value creation by senior management), (c) description of material aspects (the level of detail, conciseness, and usefulness of the information), (d) time horizon (forward-looking information for the assessment of strategic decisions), (e) materiality matrix (transparently prioritize issues according to relevant dimensions), (f) risks and opportunities (company specifically connects both risks and opportunities), and (g) mitigation

actions (evaluated according to their degree of detail). (Gerwanski et al., 2019) The latter approach incorporates the guidelines from the International Integrated Reporting Council (IIRC) framework and Eccles and Krzus (2015).

2.3 Determinants of materiality disclosure quality in environmental issues
2.3.1 Firm-level factors

According to Cormier, et al. (2009), firm financial conditions can indicate the firm's willingness to release their proprietary information. Usually, only firms with financially stable conditions are willing to trade off between the benefit and the cost of disclosing information that could risk the business.

The results of the relationship between profitability and NFR from previous studies show variation due to the content of disclosure. For instance, Qiu et al. (2016) found that firms with high profitability tend to disclose social-related information but not the environment-related information. Likewise, Cormier, et al. (2009) find significant associations between profitability and social and human capital disclosure. Accordingly, Cormier, et al. (2011a) shows insignificant positive relationship of profitability with paper-based environmental disclosure and significant negative relationship with press release environmental disclosure.

Leverage is one of the proxies to measure the financial conditions of a firm. Leverage measures the debt level by the total equity and commonly used to assess the firm's ability to meet its financial obligations. Higher leverage indicates higher financial risk (Cormier, et al. 2009) which is as a result of a poor financial performance. Firms with poor financial performance are rarely willing to take extra risk of disclosing information that is potentially damaging. However, some companies are actually aiming for high leverage because of its purpose of utilizing some benefits such as cheaper source and tax shelter (Saeed, 2007). Such conditions of high leverage might be categorized as normal for certain industries due to the firm's characteristics (Saeed, 2007) which means that the companies still disclose their information even though they have high leverage.

Previous literature shows positive results regarding the association between size and disclosure quality (Cormier, et al.2009; Saeed, 2007). According to (Saeed, 2007), theories based on information asymmetry state that bigger firms have more responsibility to inform their investor. This statement is then strengthened by (Cormier, et al. 2009) that says the bigger size of the firm is usually followed by the extended number of analysts which somehow put pressure on the firm in order to disclose the information accurately.

According to the literature review of corporate responsibility reporting and its determinants by Fifka (2013), the majority of empirical studies on this topic examined the firm level (internal) determinants, however, external factors such as industrial type and market development have hardly been examined.

2.3.2 External-level factors

2.3.2.1 Industrial factor

Oil and gas, mining and utilities sectors are considered as environmentally sensitive sectors (Seguí-mas et al., 2018). GRI's sustainability guidance provides Sector Supplements or Sector Disclosure which also cover oil & gas and mining sectors. Within the supplement, there is also an overview of the environmental issues that are likely material to these sectors such as Greenhouse gas (GHG) emissions, water and effluents, and closure and decommissioning (GRI, 2020). However, the review of material items for the utilities sector has not yet been provided by GRI. In the academia setting, there is several research on the environmental impact of these sectors: oil & gas (e.g. Anifowose et al., 2016) , mining (e.g. Fugiel et al., 2017; Yıldız, 2020), and utilities (e.g. Brammer & Pavelin, 2006; Arena et al., 2019). The summary of common and specific environmental issues will be tabulated in methodology.

Anifowose et al. (2016) developed the environmental impact assessments (EIAs) to determine the quality of environmental impact statements (EISs) which report anticipated impacts of projects, their mitigation and management plans. Their study is the first to qualify the EISs for both onshore and offshore oil & gas projects. Their results showed that the majority of EISs of oil & gas projects have done well in explaining in the areas of project description and communication of results. On the other hand, they suggest that EISs of oil & gas projects should improve in the area of environmental impact prediction and project decommissioning. They argued that the unsatisfactory result in impact prediction reporting is mainly due to the majority of sampled EISs relying on expert opinion and past experience in assessing the impact significance which tend to be subjective and inadequate to the constantly changing environment. Dealing with project decommissioning impacts had the worst performance among other review areas due to the substantial project lifespans. They suggest that to improve the quality of reporting decommissioning impacts to the environment is to treat EISs as living documents that allow updates to the decommissioning impacts as technology and science evolve. (Anifowose et al., 2016) Therefore, during the content analysis, the issues of the timeliness prediction of the environmental impact, and the detail of decommissioning should

be addressed, not particularly to oil & gas industry, but also materials (as in mining) and utilities that have decommissioning activities as well.

Another environmentally sensitive industry is mining. The mining and quarrying sector impacts the environment with air pollution and waste disposal. Mining operations raise multiple environmental concerns such as the depletion of non-renewable resources, a negative impact on natural habitats, a visual impact on the landscape and effects on groundwater levels, noise pollution, and harms to surrounding ecosystems (air, soil, and waters) (Fugiel et al., 2017). Due to serious implications on the environment, a high number were failed in EIAs causing huge investment loss (Yıldız, 2020). Despite a lack of study that focuses on quality of disclosure in mining industries, the highly regulated industry such as mining would put their attention in disclosing environmental impact information in their other publications for stakeholders who are likely to be the same group who assess the EISs.

Brammer and Pavelin (2006) found that the utilities sector is not particularly likely to voluntarily disclose, but do tend to make disclosures of a particularly high quality. Arena et al. (2019) analyzed the relevance of the coexistence of different institutional pressures in informing the corporate social responsible (CSR) strategies. Their results showed that CSR reporting strategies are heterogeneous due to divergence of institutional logics. If the companies adopt market and professional logics, they tend to disclose their CSR information in a form of integrated reporting for financial investors for legitimacy reasons and to comply with standards and practices (Arena et al., 2019). On the other hand, if the companies adopt the state and community logics, the reporting strategy will be based on the reason to comply with mandatory disclosure and to monitor the issues that are relevant to the community which results in ad-hoc and simpler forms of reporting (Arena et al., 2019). This may explain the heterogeneity of quality of environment impact disclosure even within the same industries.

Fasan and Mio (2017) studied the determinants of materiality disclosure among companies in different industries. Their results showed that industry plays an important role in materiality disclosure. When looking into details, they also showed that the utilities industry has the highest average score compared to oil & gas, and materials (Fasan & Mio, 2017). Even though oil & gas, materials, and utilities sectors all belong in environmentally sensitive categories, the level of exposure to regulations, public pressure, media coverage, and state influence may differ which results in heterogeneity in quality of disclosure across industries.

These arguments indicate that the type of industry may indicate the level of materiality of non-financial reports. The hypothesis can be formally stated as:

H₁ₐ: The levels of materiality of NFR regarding environmental issues differ across industries.

2.3.2.2 Market development factor

According to Eulaiwi, et al. (2016), corporate governance practices are different between the developed and emerging economies due to the country's legal structure and its institutional and cultural setting. These factors are similar to external determinants for determining corporate responsibility reporting reviewed by Fifka (2013). Fifka (2013) explains that the external determinants for corporate responsibility reporting mostly are socio-economic factors such as regulation, public pressure, or stakeholders' attitudes. However, none of the literature that they reviewed compared those factors between different market development. Building on Fifka's (2013) argument, Piñeiro-chousa, et al. (2019) proposed that the companies in higher levels of market development are more committed to standardized reporting. However, their results show that companies in both developed and emerging markets have high commitment to standardized reporting, only if the countries have high income (Piñeiro-chousa, et al., 2019).

These arguments indicate that the type of market development may indicate the level of materiality of non-financial reports. The hypothesis can be formally stated as:

H₁ᵦ: The levels of materiality of NFR regarding environmental issues differs across different level of market development

2.4 Information Asymmetry

Information asymmetry is a problem as a result of unevenly distributed information between management and stakeholders (Akerlof, 1970). The differences of information are associated with different interests between those parties while management has better information about the business value than the stakeholders. Such situations could injure the efficiency of resource allocation in the capital market because management may intend to overstate and stakeholder tend to understate the business value (Healey and Palepu, 2001). While financial statements were considered insufficient to properly disclose the value creating assets (Chen and Lin, 2004), Voluntary Non Financial Disclosure is believed to be one of the remedies to mitigate the problem. According to Mavrinac and Siesfeld (1997, p. 3) "future financial performance is often better predicted by non-financial indicators than by financial indicators". The increasing need for non-financial disclosure these days is affected by the change of business model which

focuses more on value creation. However, corporate value is insufficiently elaborated in financial statements due to its inability to capture the value stemming from intangible assets (Ardisson, 2011) which is evidenced by the difference between book value and market value that could not be properly explained in the balance sheet. In other words, by enclosing non-financial disclosure, the company would be able to generate more complete information in an attempt to reduce information asymmetry and enable the external party to fairly evaluate the company's performance and predict its future.

Some studies have shown that voluntary disclosure has an impact in reducing the cost of capital (Kristandl and Bontis, 2007; Sengupta,1998) and bid-ask spread (Welker,1995; Petersen and Plenborg, 2006), where the latter is the common proxies for measuring information asymmetry between manager and investors in the stock markets (Leuz, 2003; Chang, et al., 2008; Paananen, et al., 2020). More voluntary disclosures which are provided by companies will lead to reducing hidden information. This situation enables the investor to access management superior information regarding the business value which also means reducing investors' risks to invest their money on a business. Nonetheless, when disclosure is less informative, the investors might bear higher risks to predict the future payoff and thus they would request for incremental return for bearing such risk (Healey and Palepu, 2001).

Correspondingly, Healey and Palepu (2001) argued that firms with a high level of disclosure can increase the investor's confidence regarding any kind of transaction that occurred at a fair price in the stock market. When the public can access the important and relevant information of the business, the public is literated and thus both management and investor have relatively the same level of information. With both parties in a relatively equal bargaining position, there will rarely occur an over value done by the management and under value by the investor which result in lower bid-ask spreads.

On the contrary, the information asymmetry might not be affected by the voluntary disclosure, as such information may not be of value for investment decisions. As mentioned by Renneboog, et al. (2008), the investment behavior of socially responsible investors (SRIs) is different from that of conventional investors. They argue that SRIs base their investment decisions on different types of non-financial information (Renneboog, et al., 2008), which implies that the conventional investors may base their investment decisions primarily on financial information. By the same logic, since our study addresses only the materiality of environmental information in environmentally sensitive industries, therefore, it is possible that the environmental disclosure does not impact the investment decision if the majority of investors are conventional.

Investors do not give value to environmental information hence it is not associated with information asymmetry.

These arguments indicate that there may be a negative relationship between the level of sector-specific materiality in non-financial reporting and the level of information asymmetry. The hypothesis can be formally stated as:

H$_2$: The high level of materiality of disclosure will help to reduce the information asymmetry

3. Research Design

3.1 Data sample

Table 1 presents the companies listed in the stock market within European countries. We choose to analyze this area particularly because of the EU directive new guidelines of sustainability reporting apply to all the companies in European countries. Furthermore, the sample focuses on solely identifying environmental disclosure and therefore there are three kinds of industries operating in mining, oil and gas, and utility industries which are known as the environmental sensitive industries as our research sample. All firms listed in stock markets of EU's member countries or wider European Economic Area (EEA) were identified and extracted from the CapitalIQ database. We use several criterias to eliminate the sample such as only including the large companies according to the EU requirement of minimum 500 employees, the missing annual report, and the missing filing date. Throughout sample elimination as illustrated in *Table 1*, the sample was reduced from 614 firms or 1,842 firm-year to the final sample of 125 firms or 296 firm-year.

Table 1: Sample Elimination

Elimination criteria	Firms	Firm-Year
Firms listed in Capital IQ	614	1,842
Companies with employee <500 and inactive (zero total asset)	(444)	(1,332)
Annual Report missing	(35)	(161)
Filing date missing	(10)	(53)
Final Sample	**125**	**296**

Note: Table 1 shows the sample selection process.

Our sample consists of companies listed on the stock markets of 28 EU country members, as well as 2 additional countries from the wider European Economic Area (EEA): Iceland and Norway who also join the EU's NFR initiative (EU Non-financial Reporting Directive Implementation, 2021). Industries represented in the sample are the following:

1) Energy: Oil, Gas and Consumable Fuels
2) Materials: Metal and Mining
3) Utilities: Electric Utilities, Gas Utilities, Multi-Utilities, and Water Utilities

Our sample selections are categorized into two panels by market development (MarketType) and by industry as illustrated in *Table 2*.

Table 2: Observation Panels

Panel A: Observation per MarketType per year

Market Type	Year	N	Total
Panel A: Market Type			**296**
Developed	2017	79	
	2018	74	
	2019	80	233
Emerging	2017	20	
	2018	23	
	2019	20	63
Panel B: Industrial sector			**296**
Energy	2017	28	
	2018	30	
	2019	28	86
Materials	2017	44	
	2018	44	
	2019	45	133
Utilities	2017	27	
	2018	23	
	2019	27	77

Note: Table 2 shows the sample distribution by the market type in Panel A and industry types in Panel B.

3.2 Content Analysis

Hooks and Staden (2011) agreed that most of the methods used to define the level of the disclosure are part of content analysis. Content analysis is described as:

"technique for making inferences by objectively and systematically identifying specified characteristics of messages" (Carney, 1972) p.25

The methods used to identify the disclosure are categorized into quantitative and qualitative. Quantitative analysis is conducted by measuring the extent of narrative which usually uses a proxy of word count and pages count while qualitative analysis is based on the index or specific words that are relevant according to the topic. Through different proxies used in each method, the result of disclosure level quality from a report can be different based on the standard unit of each proxies.

3.2.1 Quantitative Analysis

Content analysis using the quantitative method has been widely used in prior research (Milne & Adler, 1999; Bozzolan, Favotto, &Ricceri, 2003; Trotman, 1979; Unerman, 2000). Quantitative methods count on the number of words, sentences, and pages without considering the meaning of each word represented in the report. Through this analysis, it results in an implication that the higher the number of words and/or pages, the better information disclosed. While those statements are not false because more information is correlated with more words used in the report and therefore volume of disclosure can be used to measure its quality, Toms (2002) argued that by solely investigating the quantity of the disclosure and neglecting the measure of quality can be misleading. The contradictory argument is supported by the fact that some high quality reports are brief and effective which do not require a long paragraph and thus those proxies are debatable.

3.2.2 Qualitative Analysis

Qualitative method is the most recent method to identify the quality of non financial disclosure. The narrative of disclosure can be evaluated through index and specific words in relation to the business and companies (Hooks and Stedan, 2011). The assessment using index is conducted by making a list of items using a benchmark for example from Global Reporting Initiative (GRI). Through the selection of items, a report is assessed by giving a score from the number of items represented in the report. This method results in a hypothesis that the more relevant items in the report, the better quality of the report. Even though this method is seen to be more precise than only counting the word or page numbers. It still can not look into a specificity and

quality of information. Therefore, a more complex qualitative method is necessary to assess the quality of disclosure for instance materiality disclosure quality (MDQ). Gerwanski et al. (2019) explained that MDQ Score is defined by seven substantial elements of materiality disclosure that presents more detailed information and knowledge concisely to the reader. The seven indexes of MDQ Score not only use a checklist of the existing information but also have points that are used by assessing how detailed information is disclosed in the report.

In this study, we found that to measure the materiality of non-financial information, the qualitative approach by using indexes is more suitable than quantitative which tends to mislead the results due to heterogeneity of formats in annual reports. In some annual reports, the environmental impacts are represented as separate topics, in others may dispersedly show up throughout the report. The search terms that were written the same but have different meanings may also mislead the score results (for example, material can either mean raw material or materiality which have different contexts) and cause higher differences of results between two authors compared to conducting index content analysis.

3.3 Variables

3.3.1 Materiality Disclosure Quality (MDQ)

The MDQ score is the dependent variable in hypothesis 1a and 1b, and later is an independent variable in testing hypothesis 2. The scores of each index and the total MDQ are derived from the content analysis. The content analysis technique used in this paper follows an unweighted MDQ developed by Gerwanski et al. (2019) to measure the materiality of the environmental information disclosed by sample firms. The original MDQ includes other sustainable aspects besides environmental issues such as employee treatment and social aspects. In order to capture and operationalize the determination of the quality of materiality of environment information, the additional explanations and examples based on previous research (Hassan & Ibrahim, 2012; Da Silva Monteiro & Aibar-Guzmán, 2010) were adopted to provide clear guidelines for MDQ assessment. The MDQ index comprises seven scoring components; 1) materiality section, 2) identification process, 3) description of material aspect, 4) time horizon, 5) materiality matrix 6) risk and opportunities, and 7) mitigation action. We conducted the content analysis to construct a MDQ score for each hand-collected annual report. Moreover, in order to reduce the subjectivity, both authors analyzed the same number of reports and compared the results. These are also illustrated in *Table 3* with additional explanations of the scoring components. The total scores range from a minimum of 0 to a maximum of 12 (see appendix 1 for example of the assessment).

INDEX	0	1	2
1. Materiality section (If companies include environmental aspect within materiality section)	No materiality section at all	Materiality section included	Materiality section in table of content
2. Identification process (If there is any stakeholder interaction, periodic conference regarding the value of company-related to environment aspect i.e. NGOs, environment protection organization, or local communities)	No information disclosed	Identification process mentioned	Identification process mentioned with detail stakeholder interaction
3. Description of material aspect	No issues or impact mentioned	Issues or impact mentioned with less explanation (Environmental impact mentioned but not in numeric information)	Issues or impact mentioned with good explanation (Specific environment activities with numeric information)
4. Time horizon	No time reference	Boilerplate reference	Specific time reference (short, medium, and long term impact or specific years)
5. Materiality matrix (likelihood and impact)	No matrix at all	Matrix	
6. Risk and opportunities	Not mentioned at all	Mentioned	
7. Mitigation action	Not mentioned at all	Brief explanation	Detail explanation

Note: Table 3 shows the criteria of scores given to each of seven components of Materiality Disclosure Quality (MDQ) index.

Index 1 *materiality section* emphasizes the importance of the materiality concept. The difference from Gerwanski et al. (2019) is that even there is a materiality section included in the disclosure; if it does not include the environmental aspect, 0 points are given.

Index 2 *identification process* is often mentioned in the risk assessment section, but sometimes it can be found in the stakeholder engagement section (Hassan & Ibrahim, 2012). If there is mention about the requirement of senior management to identify the risks including risks

related to the environmental issues, 1 point is given. If it includes active and ongoing stakeholder interaction in identifying the environmental risk factor, 2 points are given). Again, the only difference from Gerwanski et al. (2019) is that there must be environmental issues involved.

Index 3 *description of material aspect* is the level of detail, conciseness, and usefulness of the information (Gerwanski et al., 2019). Companies disclose this type of information in various sections in the annual reports. Since Gerwanski et al. (2019) did not give a detailed explanation on how to determine the level of detail, conciseness, and usefulness of the information, we borrow the specific environmental activities checklist from Da Silva Monteiro and Aibar-Guzmán (2010) which include waste management, water management recycling, climate change risk, climate change activities, and carbon footprint activities. The process of determining the score is that, first, to determine whether there are specific environmental activities directly related to their operation will imply the usefulness of the information. Second, such environment activities are determined to be in detail and concise if the information is given in statistical terms. Therefore, if there are none of the environmental activities directly related to the firm, 0 points are given; 1 point is given if issues or impacts are mentioned but not in detail, and 2 points are given if there are tables and figures showing impact in the statistical terms.

Index 4 *time horizon* represents the strategic decisions and future prospects. A maximum score of 2 was given if the environmental issues are described according to their short-, medium, and long-term strategic plan or given a specific time frame to achieve their environmental impact goal. Originally, the score of 2 for this item would be given if material matters are categorized and described according to their short-, medium-, and long-term impact (Gerwanski et al., 2019). We expand the criteria to include the environmental strategic goals that are measurable and provide specific timeframes to receive a score of 2 as well. Scores of 1 and 0 are as mentioned in Table 2.

Index 5 *materiality matrix* constitutes transparency of prioritizing issues according to relevant dimensions such as the likelihood of impact or the relevance for internal (external) stakeholders (Bertinetti & Gardenal, 2016; Gerwanski et al., 2019). Materiality matrix has similar characteristics to the risk profile or heat map in the risk management section. Therefore, when there is no materiality matrix specified but there is a diagram of risk profile or heat map that includes environmental-related risks, a score of 1 is given.

Index 6 *risk and opportunities* of environmental-related issues are mostly mentioned separately in annual reports. We follow the criteria set by Gerwanski et al. (2019) strictly for this item, if there are only environmental risks mentioned without opportunities about environmental activities anywhere in the annual report, no score is given in this index.

Index 7 *mitigation actions* were evaluated according to the degree of detail in mitigation action. Gerwanski et al. (2019) did not give enough detail to operationalize the assessment of this index. There was a 2-step assessment process used for this index, first, if there is mitigation action mentioned regardless of the degree of details given, score of 1 is given. As more annual reports were assessed, we then were able to compare the difference in degree of details of mitigation actions between these reports. Score of 2 is given when the mitigation actions have page references for more information in other sections of the report.

Panel data of the MDQ score is presented in *Table 4*, there are three panel data of MDQ score based on time, market type, and sector. Panel A shows the MDQ score over time, 2019 has the highest average of materiality score by 6.310 while 2017 has the lowest average score by 5.919. Within those years, we see the improvement of the materiality score of the NFR every year. Panel B shows the MDQ score by market type, developed market has a higher mean score by 6.305 than the emerging market which means that the companies that are listed in the developed market are keen to produce better quality information than the companies listed in emerging markets. Lastly, Panel C shows MDQ score based on industry sector, Utilities sector has the highest average score by 7.039 compared to energy and materials which has average score of 5.791 and 5.692 respectively.

Table 4: MDQ over time, market type, and sector

MDQ score	N	Mean	Median
Panel A: Time			
2017	99	5.919	6
2018	97	5.979	6
2019	100	6.310	7
Panel B: Market Type			
Developed	233	6.305	7
Emerging	63	5.206	5
Panel C: Sector			
Energy	86	5.791	6
Materials	133	5.692	6
Utilities	77	7.039	8

Note: Table 4 shows the mean and median of total MDQ scores by year (2017-2019) in Panel A, by market development in Panel B, and by industry type in Panel C.

3.3.2 Bid-Ask Spread

The observations' bid and ask prices for bid-ask spread calculation are collected from the S&P CapitalIQ database. We measured the information asymmetry by using a proxy of bid-ask spread. The bid-ask spread (BidAsk) as the dependent variable in hypothesis 2 is calculated by the average difference between a firm's daily closing bid and ask price divided by the average bid and ask price over $n+4$ trading days following the firm's annual filing date (Paananen at el, 2020). To reduce the noise, we focus on the short window (5 days since the filing date) as a measurement period.

We follow the bid-ask spread formula used by (Boone, 1998) to calculate each of five-days window spread as shown as follows.

$$\text{BidAskSpread}_{in} = \frac{(Ask_{in} - Bid_{in})}{(Ask_{in} + Bid_{in}) \div 2}$$

Then, the average of bid-ask spread of five-days window is calculated by :

$$\text{BidAskSpread}_{i} = \frac{\sum_{n=1}^{5} (BidAskSpread_{in})}{5}$$

Where,

BidAsk Spread$_{in}$	=	Bid-ask spread of each i and by n
BidAsk Spread$_{i}$	=	Average five-days window bid-ask spread of each n
Ask$_{in}$	=	the ask price of each i and by n
Bid$_{in}$	=	the bid price of each i and by n
i	=	firm-year
n	=	no. of day since the filing date, where $n = 1$ is the first day that annual report is published

3.3.3 Other variables

To analyze the relationship between dependent variables (*MDQScore* and *BidAskSpread*) and independent variables, we included two types of control variables. The first type is firm-level variables including return on assets (*ROA*), *Leverage*, and *Size*. The second type is external factors which are *MarketType* and *eSECTOR* variables. The previous literature has shown that these variables are associated with disclosure quality and information asymmetry (Cormier, et al., 2009; McGuire et al, 1988; Pineiro, 2019; Eccles, 2012).

ROA is used to identify a firm's profitability which represents the firm's financial condition. Firm's financial condition may affect the willingness to disclose sensitive information (Cormier, et al., 2009). While financially stable firms can afford to be more transparent regarding their internal activities. The transparency induced higher market valuation which compensated any fallout from disclosing potentially damaging information (Cormier, et al., 2011b). Thus, *ROA* should have positive associations with *MDQScore* and negative associations with *BidAskSpread*.

Leverage is used to see the capital composition by measuring total debt over total equity. The leverage level between industries varies and is affected by factors such as firm characteristics (Saeed, 2007). Even though majority companies aim to control their debt ratio due to the financial risk as a consequence of higher leverage (Cormier, et al., 2009), some companies are naturally intended to have high leverage. We predict a negative relationship between firm's leverage and materiality of NFR as companies with high leverage may not be able to stand a negative impact from disclosing proprietary information. Since the high leverage firm is more reluctant to increase transparency, we therefore expect the positive association between *Leverage* and *BidAskSpread* (Cormier, et al., 2009).

Size is also used as a firm-level control variable and derived by inserting the natural logarithm of total assets at the end of the financial year. Firms with larger size are more incentivized to

disclose information because of the higher number of investors compared to small firms which implies higher liquidity. Therefore, it is expected that *Size* is positively associated with *MDQScore* and negatively associated with *BidAskSpread*.

MarketType is used to highlight the difference between developed and emerging markets by using dummy variables , 0 is for emerging markets, 1 is for developed markets. As mentioned by (Pineiro, 2019), the companies in developed markets tend to earn more support from institutions in order to follow standardized reporting hence it is expected that developed markets may result in a higher material of information in the NFR.

eSECTOR is used to differentiate the materiality standard for companies in each specific sector. Eccles (2012) argued that each sector has different standards counted as materials for its business thus should impact the information asymmetry as well.

Lastly, D_Utilities is used to indicate sector-specific to the company. Based on MDQ score in Table 3, we found that the Utilities sector has the highest average score compared to Energy and Materials sectors. Thus, we create the dummy variable between companies in the Utilities sector and those that are not. ***Table 5*** depicts the definitions of all variables that are included in the regression models.

Table 5: Variable Definition

Variables	Definition
MDQScore	Materiality level of non financial disclosures
BidAskSpread	Proxy of information asymmetry, calculated by average difference between a firm's daily closing bid and ask price
MarketType	Dummy variable indicating the location of the company, 1 is for Developed Market, 0 is for Emerging Market
Size	The natural logarithm of total assets
ROA	Return on Assets for the fiscal year, calculated as net income over total assets at the beginning of the year
Leverage	Total Debt over Total Equity
eSECTOR	The industry sector the company belongs to
D_Utility	Dummy variable indicating sector specific of the company, 1 is for Utilities sector, 0 is for both Energy and Materials sectors

Note: Table 5 shows the description of the variables used in the regression models. eSECTOR is included as an encoded variable of three industries types (energy, materials, and utilities). Utility was chosen to be the dummy variable based on eSECTOR because utilities have the highest mean total MDQ score compared to other industries.

3.4 Model Specification

There are two main linear regression models (OLS) in this study. The first regression is to find out the determinant of MDQ and the second one is to find out the relationship between MDQScore and information asymmetry.

In order to estimate the effect from the determinant of *MDQScore*, the model is formulated as the following:

$$\textbf{MDQScore}_{it} = \beta_0 + \beta_1\textbf{ROA}_{it} + \beta_2\textbf{Leverage}_{it} + \beta_3\textbf{Size}_{it} + \beta_4\textbf{MarketType}_{it} + \beta_5\textbf{D\_Utility}_{it} + \varepsilon_{it}$$

In order to estimate the effect of MDQScore to information asymmetry, the model is formulated as the following:

$$\textbf{BidAskSpread}_{it} = \beta_0 + \beta_1\textbf{MDQScore}_{it} + \beta_2\textbf{ROA}_{it} + \beta_3\textbf{Leverage}_{it} + \beta_4\textbf{Size}_{it} + \beta_5\textbf{MarketType}_{it} + \beta_6\textbf{D\_Utility}_{it} + \varepsilon_{it}$$

Where:

BidAskSpread$_{it}$	=	Average 5 days BidAskSpread for firm i in year t
MDQScore$_{it}$	=	Total score of materiality disclosure quality from seven indexes for firm i in year t
ROA$_{it}$	=	Return on Asset for firm i in year t
Leverage$_{it}$	=	Leverage for firm i in year t
Size$_{it}$	=	The natural logarithm of total asset for firm i in year t
MarketType$_{it}$	=	Dummy variables indicated by 1 for firm in developed market and 0 for firm in emerging market for firm i in year t
D_Utility$_{it}$	=	Dummy variables indicated by 1 for firm in Utility sector and 0 for firm in Energy and Material sector for firm i in year t

4. Result

4.1 Descriptive statistics and correlation analysis

Table 6 presents descriptive statistics for all variables used in the research. There are two dependent variables for two different data regression which are *BidAskSpread* and *MDQScore*. *BidAskSpread* has a mean value of 0.0067 while its median value is 0.0027, it indicates that the majority *BidAskSpread* value of most companies are higher than the half of the overall value. For another dependent variable, *MDQScore* has a mean value of 6.0709 from the maximum score of 11 which means that the average of the companies report reached just half of the highest score. Average *ROA* is 0.0345, and average *Leverage* is 0.6130. *Size* as the natural algorithm of total asset has a mean value of 8.7715 that is slightly higher than its median of 8.6380. *MarketType* has an average value of 0.7872 which indicates that the majority of data are from companies in the developed markets, and *D_Utility* has an average value of 0.2601 which means the sectors are not dominated by Utilities.

Table 6: Summary statistics

Variables	N	Mean	sd	Min	Median	Max
BidAskSpread	296	0.0067	0.0105	0.0002	0.0027	0.0723
MDQScore	296	6.0709	3.2902	0	6	11
ROA	296	0.0345	0.0676	-0.4592	0.0311	0.2970
Leverage	296	0.6130	2.5859	-27.8824	0.6429	4.8186
Size	296	8.7715	2.0285	4.3479	8.6380	15.4511
MarketType	296	0.7872	0.4100	0	1	1
D_Utility	296	0.2601	0.4395	0	0	1

Note: Table 6 presents the descriptive statistics for all variables.

Table 7 shows the statistics for each component of the materiality index. There are five indexes of materiality section, identification process, description, time horizon, mitigation action that have a maximum score of 2, and two indexes of materiality matrix, and risk and opportunities with maximum score of 1. While the maximum total score of MDQ is 12, none of the companies reached the full score and only few companies got a score of 11. Throughout the seven components, description has the highest average of 1.527 of maximum score of 2, which means that the majority of companies deliver information better regarding their environmental impact than the rest of the materiality components. Meanwhile, the materiality matrix component has the lowest average by 0.297 which indicates that only 30% of the companies have the matrix or heat map to visualize their business risk in the report.

Table 7: Summary statistics of (MDQ) components

MDQ components	N	Mean	sd	Min	Median	Max
1. Materiality Section	296	0.692	0.734	0	1	2
2. Identification process	296	1.128	0.829	0	1	2
3. Description	296	1.527	0.717	0	2	2
4. Time horizon	296	0.750	0.562	0	1	2
5. Materiality matrix	296	0.297	0.457	0	0	1
6. Risk and opportunities	296	0.388	0.488	0	0	1
7. Mitigation actions	296	1.287	0.746	0	1	2
MDQScore total	**296**	**6.070**	**3.290**	**0**	**6**	**11**

Note: Table 7 presents the mean, standard deviation, minimum, median, and maximum score of each components of all observation. None of observation has score the possible maximum score of 12.

Pearson correlation matrix in ***Table 8*** delivers a preliminary result of relationship between variables. *MDQScore* (-0.1324) by its individual correlation with *BidAskSpread* are negatively correlated at 10% significance level, which means the higher *MDQScore* is associated with the lower *BidAskSpread*. Also, *MarketType* (-0.3272), *D_Utility* (-0.1272), *ROA* (-0.1398), and *Size* (-0.4138) altogether are negatively associated with *BidAskSpread*. Meanwhile, *MarketType* (0.1369), *D_Utility* (0.1747), *Leverage* (0.1617), and *Size* (0.2804) are positively associated with *MDQScore*. These results are expected since *MDQScore* and *BidAskSpread* have an inverse relationship, thus the relationship between other control variables to *MDQScore* and *BidAskSpread* should show the opposite direction of association.

However, the negative correlation between *ROA* (-0.1613) and *MarketType* is somewhat surprisingly negative which means that the *ROA* of the companies in emerging markets is relatively higher than the developed market. Also, *Leverage* and *Size* are positively correlated with *D_Utility*, which indicates that the debt ratio and companies' size in the utilities sector are relatively higher than both energy and materials sectors.

Table 8: Correlation Matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) BidAskSpread	1.0000						
(2) MDQScore	-0.1324*	1.0000					
(3) MarketType	-0.3272*	0.1369 *	1.0000				
(4) D_Utility	-0.1272*	0.1747*	0.0449	1.0000			
(5) ROA	-0.1398*	-0.0379	-0.1613*	-0.0553	1.0000		
(6) Leverage	-0.0359	0.1617*	0.0335	0.1265*	-0.0297	1.0000	
(7) Size	-0.4138*	0.2804*	-0.0386	0.2876*	0.0702	0.0765	1.0000

Note: Table 8 presents the Pearson correlation for all variables. * indicates that the coefficient is at least significant at 10% level.

4.2 MDQ score and its determinants

We separated the regression into three models. Model (1) and (2) are based on the type of factors affecting the materiality report individually, and Model (3) using both internal (firm-level) and external (market-level) factors as the variables as depicted in *Table 9*.

The first regression model using internal factors including *ROA*, *Leverage*, and *Size* of the firm as independent variables. Model (1) shows that *Leverage* and *Size* are significantly affecting the materiality of NFR at 1% level. The result of *Leverage* is not aligned with Cormier, et al. (2009) while it was negatively associated with quality information. *Size,* on the other hand, positively affects the *MDQScore*. This result is aligned with Cormier, et al. (2009) that the larger total assets of the company result in better quality disclosure.

Model (2) uses the company's external factors such as *MarketType* and *Sector*. The result shows that *MarketType* and *D_Utility* significantly affect the quality of report at 5% and 1% level respectively. This result supports our hypothesis of 1a and 1b which says that the level of materiality is affected by the type of market development as well as the industry sector.

Model (3) is the best fit model with adjusted R-squared of (1.252). The result model (3) shows that *Leverage* and *Size* are positively significant to the level of materiality in the report, however, *D_Utility* is no longer significant as it was in model (2). The significant level changes of the *D_Utility* variable may be affected by the firm-level factors which are seen to have more influence on the level of materiality, also the individual correlation between *Leverage* and *D_Utility* and *Size* and *D_Utility* presented in Pearson Correlation Matrix in **Table 8**. To support the analysis, we have provided additional regression in *Appendix 2*.

Table 9: Results for determinant of materiality disclosure quality (MDQ) score

Variables	(1)	(2)	(3)
ROA	-2.5773	-	-1.2651
	(2.6394)	-	(2.7613)
Leverage	0 .1771***	-	0.1616***
	(0.0556)	-	(0.0498)
Size	0 .4435***	-	0.4142***
	(0.0876)	-	(0.0909)
MarketType	-	1.0374**	1.0816**
	-	(0.4847)	(0.4645)
D_Utility	-	1.2648***	0.5819
	-	(0.4385)	(0.4557)
Constant	2.1603***	4.9256***	1.3794
	(0.7809)	(0.4423)	(0.9203)
R-squared	0.1012	0.0472	0.1252
No.Observation	296	296	296

Note: Table 9 presents the regression results for the determinants of MDQ score models,
where the first three independent variables represent the firm-level determinants and the rest of
represents the external factors which are the main independent variables to answer the hypothesis
1a and 1b. Model 1 and model 2 respectively examine the firm-level determinants and
external determinants in separation. Model 3 examines all determinants together.
Robust t-statistics are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

4.3 Bid-Ask Spread and Materiality Disclosure Quality (MDQ)

The regression results for Bid-Ask Spread models are presented in **Table 10**. There are three models of regression, Model (1) uses only the *MDQScore* as the independent variable, Model (2) as our best fit model with adjusted square of (0.3183) has the MDQScore as the independent variable followed by several control variables such as *ROA*, *Leverage*, *Size*, *MarketType*, and *D_Utility*, and Model (3) has the *MDQScore* as the independent variable and use only fim-level factor as the control variable such as *ROA*, *Leverage*, and *Size*. From the three models, it shows different significant and correlation results of each model. Result from model (1) shows that the *MDQScore* is negatively significant to BidAskSpread whilst it has no other variables following. This result is matched with Welker, (1995) and Petersen and Plenborg, (2006) while they show that the disclosure quality can reduce the bid-ask spread. Contrary to the Model (1), Model (2) shows that the MDQScore is insignificant to the BidAskSpread while it uses control

variables. The surprising result is also indicated by the contradictory correlation result of MDQScore when it shows a positive correlation instead. Therefore, to do further investigation we create model (3) by using only firm-level factors. The result shows that MDQScore is insignificant to the BidAskSpread yet the correlation is matched with the Model (1) which is negative. As shown in Model (2), *ROA*, *Size*, and *MarketType* are found to have a significant negative correlation to the *BidAskSpread* at 1% level. Whilst Model (3) *ROA* is found to have less significant effect compared to Model (2), *Size* significant level remains the same at 1% level.

Table 10: Results for Bid-Ask Spread

Variables	(1)	(2)	(3)
MDQScore	-0.0004**	0.0001	-0.0001
	0.0002	0.0002	0.0002
ROA	-	-0.0262***	-0.0175*
	-	0.0098	0.0089
Leverage	-	-2.8900	-0.0001
	-	0.0002	0.0002
Size	-	-0.0022***	-0.0020***
	-	0.0003	0.0003
MarketType	-	-0.0096***	-
	-	0.0019	-
D_Utility	-	-0.0001	-
	-	0 .0008	-
Constant	0 .0092***	0.0337***	0.0258***
	0 .0015	0 .0037	0.0032
R-squared	0.0175	0.3183	0.1841
No.Observation	296	296	296

Note: Table 10 presents the regression results for the Bid-Ask spread models, where the independent variable for this model is MDQ score. Model 1 examines the MDQ score alone. Model 2 examines MDQ score with all other control variables. Model 3 examines MDQ score with only firm-level control variables. Robust t-statistics are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

5. Discussion

5.1 Hypothesis 1a and 1b

In this study, we explored (1) how firm-level and market-level determinants influence materiality disclosure quality (MDQ) of NFR and (2) the implications of MDQ to the information asymmetry in environmental sensitive industries. Firstly, we will discuss the findings for the hypothesis 1a and 1b as the following:

> H_{1a}: The levels of materiality of NFR regarding environmental issues differ across industries.

> H_{1b}: The levels of materiality of NFR regarding environmental issues differs across different level of market development

The analysis for the hypothesis 1a and 1b refers to *Table 9*. The three models in the regression show both alignment and contradiction to the result from previous literature. According to Model (2), The result indicates that firms in developed markets tend to disclose higher levels of materiality. This finding is matched with hypothesis 1b which expects that the disclosure quality varies between market development and affected by the company's location (in terms of market development). Furthermore, the result also shows that the industry factor such as utility has the higher level of materiality. This finding is matched with hypothesis 1a which expects that the disclosure quality varies between industries and is affected by the industries where the company belongs to. Although industries show significant impact to *MDQScore*, it becomes insignificant when the firm-level factors are included. This implies that the firm-level determinants collectively influence the materiality of NFR more than market level determinants do. The influence of external factors such as market type and industries toward materiality disclosure are as a result of different regulation, public pressure, or stakeholders' attitudes (Fifka, 2013).

Additionally, Size shows a positive and significant correlation in model (1) and (3). This result is aligned with Cormier et al. (2009) who found the bigger size of the company results in a higher disclosure quality. On the other hand, leverage shows positive interaction in models (1) and (3). This finding is contradicted with Cormier, et al. (2009) that shows leverage negatively affects the disclosure quality. As Cormier, et al (2009) mentioned, the companies with higher leverage may indicate a higher financial risk, hence this kind of companies usually can not withstand more risk by disclosing its proprietary information which is potentially harmful.

However, whilst the level of leverage may alter the company's financial risk, there are companies that naturally intend to have higher debt proportion of capital structure due to some factors such as collateralizable value of assets and industry types (Saeed, 2007). He explained that the more tangible assets owned by companies which can be accepted as security of issuing debt, the higher possibility of companies to have a higher debt capital. Companies that have this kind of assets are usually manufacturing industries including (Utilities, Energy, and Materials) that require high investments of assets. As well as agency cost between manager and principal, companies that have relatively higher debt in the capital structure also have higher agency cost of debt (Clarkson, et al. 2008). Therefore, in order to reduce the debtholder's pressure on firms to disclose environmental related matters to assess potential future liabilities, the company tries to provide more material information. This argument is supported by Clarkson, et al (2008) who also found that leverage is positively associated with disclosure quality.

5.2 Hypothesis 2

We discuss the findings from hypothesis 2 as the following:

> H_2: The high level of materiality of disclosure will help to reduce the information asymmetry

In the second hypothesis, we measured the impact of materiality of NFR to the market information asymmetry which the result refers to in **Table 10**. The three models in the regression show different results. According to our best fit model (2), the result shows that materiality of NFR does not help reduce information asymmetry. The result is not aligned with Welker (1995) and Petersen and Plenborg (2006) that shows voluntary disclosure can lower information asymmetry. This contradictory result may be influenced by some potential reasons. The first reason may come from the nature of industries we studied are companies that have a high collateralizable value of assets. The characteristics of this industry that possess a higher debt ratio (Saeed, 2007) may indicate that the company has interest to not only disclose information to reduce information asymmetry with shareholders but also debtholders. Second reason is due to the investor behaviour in these industries. Investors which are concerned about the environmental sector may not take the risk to invest in environmentally sensitive industries. As mentioned by Renneboog, et al. (2008), the conventional investors may not take the non-financial information into account when making investment decisions. Arena et al. (2019) suggest that companies with state or community logics tend to disclose non-financial information for the purpose of communicating to regulators or community stakeholders rather

than investors. Therefore, a high level of environmental materiality may be of benefit to other stakeholders rather than to shareholders.

5.3 Additional Analysis

Panel data of MDQ score in *Table 4* indicates that companies in utilities have the highest average MDQ score which supports the results of materiality disclosure assessment by industry of Fasan and Mio (2017). Most of the Utilities companies are state-owned and exposed to high scrutiny to the public since they usually operate within their home-country while oil & gas and mining companies may partly have operations off-shore. Therefore, the environmental impacts may directly influence the home country's stakeholders to a higher degree for the utilities industry (Giacomini, et al., 2020).

Furthermore, from untabulated regressions (see appendix 2), we found that removing Size from the MDQscore regression model as seen in model (5), the utility sector has become significant again. This indicates that there can be companies that have much larger total assets than other companies and have high MDQ scores. We have found anomalies of 3 firm-year that have the largest size (above 15 point) which is one company from the energy sector. Then, also in untabulated regressions (see appendix 2), 3 firm-years that have largest size were taken out to see if the relationship between MDQ score and Bid-Ask Spread has changed. However, the results remain the same as the results illustrated in *Table 10*.

6. Conclusion

In conclusion, our results suggest that firm-level determinants have stronger association to the level of materiality compared to external factors such as market development and types of industry. Nevertheless, our results support the hypothesis 1a that companies in developed markets tend to disclose higher levels of materiality of environmental information. We also found that the result supported hypothesis 1b if the firm-level factors were excluded. In other words, when all the factors are included, the industry type factor is no longer significant which means that the hypothesis 1b does not entirely hold.

Additionally, the results suggest that the materiality level has no implication to the information asymmetry. This confirms our concern about EU's unbinding guidelines of non-financial reports that it may not increase standardization of non-financial disclosures for the users to be able to compare unless the guideline has become mandatory or provide practical recommendations such as score indexes. We hope that this paper may be of use for policy

makers to consider developing the guidelines that are easier to implement and be of use for making decisions.

This study has suffered from various limitations. First of all, small sample size is mainly due to the absence of annual reports and filing date, which is the result of different requirements from stock exchange markets in different countries to submit non-financial reports. Moreover, qualitative content analysis such as MDQ index has its flaws. First, to determine the scores in each component, there is a need to set some ground rules between the evaluators. These ground rules are still subjective to our agreements. Second, the components of MDQ are somewhat weighted equally between 0-2 or 0-1 whereas some components may be more important than others.

To increase the observation size, we suggest to expand the variation of industries such as comparing between firms in environmentally sensitive industries and non environmentally sensitive. The future research can also further develop MDQ index to measure materiality regarding other sustainability issues such as social or human capital which can be applied to broader types of industry since the environmental disclosure may be interesting to limited types of industries. Furthermore, we also found interesting results regarding the relationship of environmental materiality to market information asymmetry that is contradicted to previous literature which might be due to different logic reporting, firm characteristics and investors behavior. Therefore, we would like to suggest the future research to add another variable in observation of information asymmetry such as the specific firm characteristics, behavior side of investors, particularly investors of environmentally sensitive firms, to see how they would determine environmental disclosure.

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Appendix

Appendix 1: Content analysis based on MDQ scoring

Index 1: **Materiality Section** (0 = no materiality section, 1 = there is materiality section, and 2 = materiality section mentioned in table of contents)

Score	Example	Analysis
1		Source: **Boliden**, GRI Report (2017), p. 11 - There is material section that includes environmental topic
2		Source: **Acciona**, Sustainability Report (2018), p. 3, 222 - Materiality section mentioned in table of content - Its material section includes environmental topic

Index 2: **Identification process**: If there is any stakeholder interaction, periodic conference regarding the value of company-related to environment aspect i.e. NGOs, environment protection organization, or local communities (0 = no information disclosed, 1 = identification process mentioned, and 2 = identification process mentioned with detail stakeholder interaction)

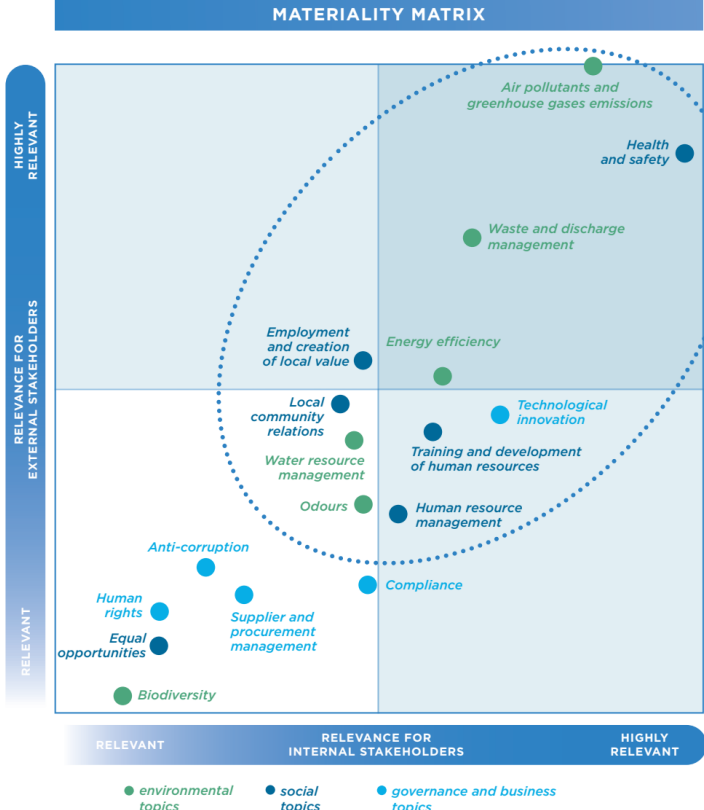| Score	Example	Analysis
1		Source: **Statoil**, Sustainability Report (2017), p. 5 - Identification process regarding environmental issues mentioned but did not provide detail of stakeholder interaction
2		Source: **Salzgitter AG**, Non-financial Report (2017), p. 10-11 - Identification process regarding environmental issue mentioned with detail stakeholder interaction regarding environmental issues

Index 3: **Description of material aspect** (0 = description of material aspect, 1 = issues or impact mentioned with less explanation (environmental impact mentioned but not in numeric information), and 2 = issues or impact mentioned with good explanation (Specific environment activities with numeric information))

Score	Example	Analysis
1	**The Directors present the Strategic Report for the year ended 31 December 2017.** **Business review** A detailed business review is included within the Operating and Financial Review on pages 9 to 14. **Principal risks and uncertainties** The management of the Group's business and the execution of its strategy are subject to a number of risks. Risks are formally reviewed by the Board and appropriate processes put in place to monitor and mitigate them. If more than one event occurs, the overall impact of such events may compound the possible adverse effects on the Group. The key financial risks affecting the Group are set out in note 24 to the financial statements. The key operating risks affecting the Group, most of which are those typically faced by other companies in the gold mining sector, are set out below. **The Group's licences** The Group's activities are dependent upon the grant and renewal of appropriate licences, permits and regulatory consents. The Group's licences contain a range of obligations, including those described in note 17 to the financial statements, failure to comply with which could result in additional costs, penalties being levied or the suspension or revocation of the licence. **Mitigation:** management closely monitor compliance with the terms of the Group's licences and discussions are held with the appropriate authorities in respect of the development and operation of the Group's projects and amendments to licences where required. **Reserve and resource estimates** Reserve and resource estimates may require revision based on actual production experience. The volume and grade of reserves mined and processed and recovery rates achieved may vary from those anticipated and a decline in the market price of gold may render reserves containing relatively lower grades of gold mineralisation uneconomic. **Mitigation:** the Group estimates its ore reserves and mineral resources based on information compiled by Competent Persons as defined in accordance with the 2012 edition of the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (the JORC code). The Group also conducts detailed geological modelling and ensures that all analyses of exploration samples are undertaken by accredited laboratories. **Environmental and health and safety issues** The Group's operations, which involve the use of various chemicals and contaminants including cyanide, are subject to extensive Russian environmental and health and safety laws and regulations. The legislation comprises numerous federal and regional regulations which are not fully harmonised and may not be consistently interpreted. Changes in regulations, or the interpretation of regulations, may result in additional costs. **Mitigation:** the Group monitors compliance with the relevant legislation and regulations and seeks to ensure that the Russian environmental authorities are satisfied with the Group's compliance with applicable environmental laws and regulations at all stages of development and production. Management systems at the Group's operations include comprehensive safe working practices and the Group also organises safety training for employees. **Mining and processing risks** The risks inherent in the exploitation of mineral deposits, some of which are outside the Group's control, include geological, geotechnical and seismic factors and production risks (ore grade/quality, tonnages and recovery/yields), industrial and mechanical incidents, processing problems, technical failures, labour disputes and environmental hazards including the discharge of toxic chemicals, fire, flooding and other acts of God. As with all mining operations, there is uncertainty associated with the Group's operating parameters and costs. There is significant seismic activity in Kamchatka, as evidenced by an offshore earthquake in March 2013 which caused rock falls in some stoping areas. Local climatic conditions may also impact on mining operations and the delivery of supplies, equipment and fuel. **Mitigation:** the Group's technical and operational management have extensive experience from other Russian mining projects and operational audits are undertaken by external experts. All buildings and installations at the Asacha mine have been designed and constructed to withstand seismic activity. Logistic arrangements allow for weather disruption.	Source: **Trans-Siberian Gold plc**, Annual Report and Accounts (2017), p. 16 - Environmental issues mentioned with less explanation or measurable impact
2	Uniform key indicators have been devised for these key aspects and gathered from each production plant. This lays the foundations for the next step, of measuring the further potential for improvement of the plants and setting Group-wide targets. The life cycle analysis or environmental footprint at some steelworks is currently being analyzed in more detail. **Emissions into the air** In addition to greenhouse gases – CO_2 in particular – the main air pollutants from SCHMOLZ+BICKENBACH's production processes are nitrogen oxides (NO_x) and dust. SCHMOLZ+BICKENBACH with its production plants remains within or often even well below all these emission limits which are mandated by law. Emission levels are measured through constant records as well as through regular analyses. **CO_2 emissions Scope 1** Production of crude steel in the production process in electric arc furnaces leads to process-related CO_2 emissions resulting from combustion of natural gas, melting of steel scrap, alloys and additives as well as burnup of graphite electrodes. Further CO_2 emissions arise from natural gas furnaces, during reheating of steel for molding in the rolling plant or forge as well as during heat treatment of our steel products. Scope 1 are the direct CO_2 emissions which result from our production and processing operations. Total CO_2 emissions Scope 1 from the Ascometal, DEW, Finkl Steel, Swiss Steel and Ugitech plants were reduced to 610 kilotons in 2019 from 709 kilotons in 2018 due to lower production volume for economic reasons. Per ton of crude steel produced, emissions increased because more high-alloy steels were produced, which have longer production processes. A reduction in specific Scope 1 emissions is possible when, for example, the production processes in our plants can be made more efficient. SCHMOLZ+BICKENBACH is working continuously on this. CO_2 emissions Scope 1 of all crude steel producing production sites in kt/in t per t of crude steel produced 589 / 0.30 (2017); 709 / 0.30 (2018); 610 / 0.33 (2019) ■ Absolute in kt — Specific per t crude steel	Source: **SCHMOLZ + BICKENBACH**, Annual Report (2019), p. 37-41 - Environmental impact mentioned with statistic information

Index 4: **Time horizon** (0 = no time reference, 1 = boilerplate reference, and 2 = specific time reference (short, medium, and long term impact or specific years))

Score	Example	Analysis
1	**Environment** EnQuest welcomes the drive for increased governance and transparency in relation to climate change, and discloses its assessment of associated potential risks to the execution of its strategy within the risks and uncertainties section of this report (see page 44). The Company's place within the wider energy transition is to improve performance and efficiencies at producing assets through short–cycle investments, avoiding the need for costly, carbon intensive and long–dated new developments. EnQuest recognises that industry, alongside other key stakeholders such as governments, regulators and consumers, must contribute to reduce the impact of carbon–related emissions on climate change. As such, the Group aims to reduce carbon and other atmospheric emissions from its operations where practicable. At present, the Group endeavours to do so through improving operational performance, minimising flaring and venting where possible, and applying appropriate improvement initiatives, noting the ability to reduce carbon emissions is constrained by the original design of our later–life assets where the main sources of atmospheric emissions come from combustion plant associated with power generation and flaring. Current legislation requires the UK to achieve net–zero by 2050. EnQuest is committed to contribute positively towards achieving this target and in 2020, a systematic programme of work is being undertaken to put in place plans that will deliver a pathway to support this. These plans will include specific, measurable emissions reduction targets, supported by specific projects, which will form the basis of our 2021 corporate targets. EnQuest will engage internally with	Source: **EnQuest PLC**, Annual Report and Accounts (2019), p. 37 - There is time frame mentioned without giving details of time reference for their plans
2	The **short-term strategy** is influenced by climate change issues that are more closely related to competitiveness (energy costs and CO2), and by the regulatory framework of its activities. Its strategy is focused on boosting the Company's resilience to these regulatory frameworks. **Carbon pricing** is a critical element of climate policies aimed at carrying out the transition to a low-emissions future. Accordingly, for investment decision-making in new projects, Repsol has established an initial internal carbon price of $25/t CO2, with the aim of attaining $40/t CO2 in 2025. In addition, **energy efficiency** will allow reducing the energy and carbon intensity of its operations. Repsol has adopted specific targets and plans on **energy efficiency** that include, inter alia, projects of energy integration of units, optimization of processes and efficient operation of facilities. Indeed, the current contribution of energy efficiency will be extended as the main drive of emission reduction until nearly the midway point of this century. For the **medium and long term**, Repsol is analyzing different models of energy supply and demand in order to comprehend how the sector can tackle the future challenges with respect to mitigating climate change while supplying energy for a growing world population. These models are used to develop scenarios that show how energy demand will change over time, how quickly supply technologies can change, and the implications in terms of CO2 emissions. Analysis of climate scenarios is a very important tool for determining how the energy sector will continue to supply the energy society needs while doing so in a sustainable manner. Repsol is currently developing its own scenarios compatible with a 2°C future and, more specifically, with the Sustainable Development Scenario (SDS) of the International Energy Agency. Hence, the company is showing its ability to analyze the key levers and technologies that will make up a low-emissions future and identify new risks and opportunities. The Company is also applying metrics that will enable it to quantitatively contribute to the development of its long-term strategy. In addition, Repsol is facing this challenge by taking part in international associations such as The Global Oil and Gas Industry Association for Environmental and Social Issues (IPIECA) and initiatives like the Oil and Gas Climate Initiative (OGCI), through working groups dedicated to the low-emissions pathway scenarios of IPIECA and the low-emissions opportunities of OGCI. These long-term models and scenarios are being explored jointly with other sector companies. This is a complex analysis, as it depends on different regions of the world and the type of products that are included in the equation. Repsol believes that these new scenarios offer a significant opportunity for innovation and investment in low greenhouse gas-emission solutions. Demand for natural gas will increase because it is a "clean fuel" compared to coal. Emissions of CO2 per energy unit account for approximately half of those related to coal, not including the performance gap between the technologies associated with these fuels in electricity generation. The shift from coal to natural gas fuels offers a major opportunity to achieve large-scale reductions of CO2 in a cost-efficient manner: that is, at a lower cost for society, where a structured transition to a low-emissions future is the most efficient way forward. Carbon Capture, Use and Storage (CCUS) is a factor to be taken into account in the CO2 emissions reduction policy in Repsol's value chain. The Company supports the deployment of these technologies, working to allow projects to be technically and economically feasible, sustainable and socially acceptable. In addition, with a medium-term view, Repsol is continuously monitoring trends and the latest technologies being developed in renewable energies, investing in sustainable mobility and contributing to emissions reductions through production and research and development into biofuels and advanced fuels. Through the fund OGCI - Climate Investments, Repsol, in coalition with other Oil & gas companies, will continue to invest in low-emissions projects and technologies. It will support projects where a collective effort is the key to achieving synergies and successful results. OGCI will invest €1,000 million over ten years for this purpose. **$40/t CO2** Internal CO2 price to be reached by 2025 Repsol has been a part of this iniciative along with nine other leading sector companies, to collaborate in climate action sharing best practices and technological solutions. OGCi https://www.oilandgasclimateinitiative.com	Source: **Repsol**, Annual Corporate Governance Report (2017), p. 55 - Strategy regarding environmental issues were given in specific time reference (Short-term, medium-term, and long-term)

Index 5**: Materiality matrix** (0 = no matrix at all and 1 = matrix)

Score	Example	Analysis
1		Source: **Saras**, Sustainability Report (2019), p. 19 - There is materiality matrix that includes environmental issues

Index 6**: Risk and opportunities** (0 = not mentioned at all and 1 = mentioned)

Score	Example	Analysis
1		Source: **INA**, Annual Report (2018), p. 91-97 - Both environmental risk and opportunity were mentioned

Index 7: **Mitigation action** (0 = not mentioned at all, 1 = brief explanation, and 2 = detailed explanation)

Score	Example	Analysis
1	**Health, safety and environmental** Potential harm to people (employees, contractors or the public) and the environment **Main strategic theme:** ■ **Principal/significant impacts:** The potential for serious injury or loss of life in remote, extreme circumstances. The potential for catastrophic damage to private, public or commercial property/ infrastructure including the consequent effect on water and wastewater service provision. The potential for serious impact on wildlife, fish or natural habitats resulting in significant fines and reputational damage. **Management and mitigation:** Supported by strong governance and management systems certified to OHSAS 18001 we have developed a strong health and safety culture where 'nothing we do at United Utilities is worth getting hurt for'. We actively seek to improve health, safety and wellbeing across the group through targeted improvements and benchmarking against our peers. Also certified to ISO 14001, we seek to protect and improve the environment through the responsible delivery of our services. This includes helping to support rare species and habitats through targeted engagement and activity and commitment to reducing our carbon emissions by designing out waste from our operations, generating our own energy and looking at ways to reduce our use of raw materials. We also recognise the impact the environment can have on our service provision with extreme weather and climate change being integrated into our risk, planning and decision-making processes.	Source: **United Utilities Group PLC**, Annual Report and Financial Statements (2019), p. 75 - There is brief explanation of mitigation actions regarding environmental issues
2	**6.2.1.3 Organization and instruments for the prevention of environmental risks** To implement its objectives, the Group relies on a network of internal experts and on a structured organization: • the Environment, Industrial Risks and Product Liability Department (DERIP) defines the Group's benchmarks, coordinates the general dynamics of continuous improvement, implements the control mechanisms of internal standards and provides expert technical support to the sites and projects; • more than 60 people make up the network of HSE functions at sites, with a reporting line to their senior management for the vast majority of them; • once a year, the Committee of Occupational Hygiene, Health and Safety (HS & S) and Environment (E) analyses the skills available within the Group with regard to requirements and concerns. This proactive approach is conducted in coordination with the Human Resources Departments of the Group Divisions and the Safety Prevention and Environment Departments. Monitoring and control systems constitute one of the key strengths of the Group's environmental management. In this respect, a dedicated environmental IT system (EraGreen) has been fully deployed in all industrial and mining sites, allowing for the collection and consolidation of environmental and energy performance indicators. The Group also relies on a demanding internal audit system for the performance of its entities in the areas of Environment, Health, Safety and Energy. The common audit guidelines are structured according to three pillars: human involvement, operational control and prevention. They fully take into account the requirements of ISO 14001, OHSAS 18001 and ISO 50001. Joint teams comprised of Internal Auditors (Corporate, Divisions and Sites) conduct these audits over several days to provide a detailed overview of the environmental performance of sites. Sites may also be subjected to targeted audits on specific issues (containment of atmospheric emissions, mine tailings management or environmental management system in 2019 for instance). During the period 2015-2019, 30 out of 40 sites with significant environmental issues were audited in accordance with these methods. Corrective action plans are defined at the end of each audit, and for all risks considered significant, a quarterly report on the implementation of corrective actions is consolidated at Group level.	Source: **Eramet**, Universal Registration Document (2019), p. 265 - Substantial explanation of prevention of environmental risks

Appendix 2: Additional regressions

Additional regression 1

Results for determinant of materiality disclosure quality (MDQ) score

Variables	(1)	(2)	(3)	(4)	(5)
ROA	-2.5773	-	-1.2651	-1.4051	-0.2574
	2.6394	-	2.7613	2.6739	2.8444
Leverage	0 .1771***	-	0.1616***	-	0.1758***
	0.0556	-	0.0498	-	0.0501
Size	0 .4435***	-	0.4142***	0.4239***	-
	0.0876	-	0.0909	0.0905	-
MarketType	-	1.0374**	1.0816**	1.1089**	0.9997**
	-	0.4847	0.4645	0.4673	0.4849
D_Utility	-	1.2648***	0.5819	0.6870	1.1333**
	-	0.4385	0.4557	0 .4547	0.4400
Constant	2.1603***	4.9256***	1.3794	1.3490	4.8902***
	0.7809	0.4423	0.9203	0.9211	0 .4638
R-squared	0.1012	0.0472	0.1252	0.1093	0.0661
No.Observation	296	296	296	296	296

Additional regression 2

Table regression result BidAskSpread and MDQScore

Variables	(1)	(2)	(3)
MDQScore	-0.0004**	0.0001	-0.0001
	0.0002	0.0002	0.0002
ROA	-	-.0261***	-.0178**
	-	0.0098	0.0090
Leverage	-	6.4900	1.200
	-	0.0002	0.0002
Size	-	-.0022***	-.0022***
	-	0.0003	0.0003
MarketType	-	-.0094***	
	-	0.0019	
D_Utility	-	0.0001	
	-	0.0008	
Constant	0 .0092***	.0341***	.0274***
	0 .0015	0.0037	.0033

R-squared	0.0166	0.3183	0.1940
No.Observation	293	293	293