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Master in Management

Non-financial Reporting as a Form of Environmental Disclosure:

The Case of International Construction Industry

Master Thesis by a 2nd year student

General track, CEMS

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ЗАЯВЛЕНИЕ О САМОСТОЯТЕЛЬНОМ ХАРАКТЕРЕ ВЫПОЛНЕНИЯ ВЫПУСКНОЙ КВАЛИФИКАЦИОННОЙ РАБОТЫ

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АННОТАЦИЯ

Автор	Анастасия Евгеньевна Малышева
Название ВКР	Нефинансовая отчетность как форма раскрытия экологической информации на примере международной строительной отрасли
Направление подготовки	Менеджмент (общий профиль)
Год	2017
Научный руководитель	Юрий Евгеньевич Благов
Описание цели, задач и основных результатов	Целью работы является выявить основные тенденции в раскрытии экологической информации международными строительными компаниями путем публикации нефинансовой отчетности. Проведен анализ современной научной литературы о методах оценки экологической ответственности и основных стандартах нефинансовой отчетности. Собран набор экологических индикаторов, согласно которому был проведен контентно-сравнительный анализ нефинансовых отчетов 30-ти компаний. Для исследования связи между степенью раскрытия экологической информации и инвестиционной привлекательностью компаний был проведен регрессионный анализ. В заключении представлены выводы касательно роли нефинансовой отчетности в отрасли и факторах, влияющих на степень раскрытия экологической информации.
Ключевые слова	Нефинансовая отчетность, устойчивое развитие, экологическая ответственность, экологические показатели, строительная отрасль, степень раскрытия информации

ABSTRACT

Master Student's Name	Anastasiia Malysheva
Master Thesis Title	Non-financial Reporting as a Form of Environmental Disclosure: The Case of International Construction Industry
Main field of study	Management (General Track)
Year	2017
Academic Advisor's Name	Yury E. Blagov
Description of the goal, tasks and main results	The paper aims to find out the main tendencies of environmental disclosure by international construction companies via non-financial reporting. It starts with an overview of contemporary academic research on the environmental performance assessment, as well as the main standards of environmental disclosure. A set of environmental indicators was aggregated and used to analyse reports of 30 companies. Regression analysis was run to probe the relationship between the degree of environmental disclosure and the companies' investor attractiveness. The final section concludes about the role of non-financial reporting in the construction industry and the factors influencing the degree of environmental disclosure.
Keywords	Non-financial disclosure, sustainability, environmental responsibility, environmental indicators, construction industry, degree of disclosure

Content

Introduction

The topic of environmental responsibility is gaining popularity both in research and in industry. Along with the social and the economical responsibility, the environmental responsibility is an essential part of companies' sustainability policy.

Construction industry is one of the most environmentally-damaging, and thus, the issue of environmental responsibility is particularly acute there. Richard and Ramli (2011) point out the main ecological consequences of construction work: land and water pollution, CO2 emissions, high proportion of waste, energy and water consumption, deforestation, among others. This explains the **actuality** of the chosen research topic.

Analysis of literature has shown that construction is rarely a subject of research, and little academic discussion can be found about the specificity of sustainability measures that should be taken in construction. There are many national environmental standards for construction but no universal (international) framework that would exhaustively explain how to measure and estimate companies' environmental performance. **The novelty** of this research paper lies in the methodology of assessment of environmental performance and in the final result – the environmental responsibility rating of international construction companies.

The **main purpose** of this paper is to discover the main tendencies in the environmental disclosure by the international construction companies. To reach this purpose, the research targets the following **goals**:

- Reveal the limitations of existing environmental methodologies through the analysis of contemporary academic literature;
- Collect a pool of relevant indicators to estimate construction industry's impact on the environment;
- Find out the degree of disclosure for each indicator;
- Discuss whether it is possible to rank the companies using secondary data (non-financial reports);
- Make conclusions about the main factors that influence the content of environmental reports by the construction companies.

This research paper is framed by the following **research questions**:

(1) What is the degree of environmental disclosure by the international construction companies? Is it possible to rank the companies by their environmental performance based on the information they disclose in their non-financial reports?

(2) Are there any construction industry-specific environmental issues that are not covered by major corporate sustainability assessment frameworks?

(3) Is higher degree of disclosure associated with higher investor attractiveness?

The research paper contains an introduction, three chapters followed by summaries of findings, a conclusion, annexes and a list of references. The first chapter gives an overview of literature on environmental responsibility and reporting, the impact of the construction industry on the environment, and the main challenges of rating methodologies. The second chapter describes the data collection process and the methodology of the current study. The third chapter presents the results – a proposed list of environmental performance indicators for the construction industry, and discusses how the new methodology tackles the challenges of environmental performance assessment and of the rating methodology. The conclusions section summarises the learnings and presents them as answers to the research questions. Theoretical and managerial implications as well as directions for further research are also discussed in the conclusions.

It should be noted at this point that in this paper the terms ‘environmental performance’ and ‘environmental responsibility’ are used interchangeably. Sometimes the term ‘sustainability’ may be used as a hyperonym for environmental responsibility since the latter is one of the three aspects of sustainability.

Chapter I. Literature review

Sustainability and, more narrowly, environmental responsibility, are gaining popularity in both the academic research and the industry. Nowadays it is equally important to be both economically profitable and responsible socially and environmentally. The problem, however, is in deciding how to measure environmental performance, especially when it comes to comparing companies from different countries. There are a few studies that suggest their own framework for sustainability assessment, but a universal extensive list of sustainability indicators has not been elaborated so far.

This paper is dedicated to creating a framework of environmental responsibility evaluation for the construction industry on the international level. For this, indicators and the measurement system need to be agreed on.

The study requires thorough theoretical background on environmental responsibility as a subset of contemporary sustainability theory, as well as on sustainability reporting and sustainability ratings. Literature review is aimed at revealing the current trends in understanding of sustainability and approaches to estimate sustainability performance as well as formulating the potential alterations to be made and tested in chapters two and three of this paper.

The chapter starts with a discussion on the impact of the construction industry on the environment. This will explain the existing tension and the choice of topic for research. Then follows an overview of the existing environmental assessment tools (or standards). After that we give a brief summary of non-financial reporting systems such as the Global Reporting Initiative, and reason the purpose of reporting. The last section is dedicated to the pros and cons of the rating methods in assessing companies' sustainability. The chapter ends with the summary of findings from the four sections and the research gap for the study presented in this paper.

1.1. Environmental impact of construction industry

Recent years have seen an increased concern over environmental problems. It has reached the global level: in 2015 the United Nations signed the New Sustainable Development agenda for 2030 signed by almost 200 countries who agreed to strengthen their performance on the 17 Sustainable Development Goals (SDGs) (UN, 2017).

Each industry affects the ecology in its own way. Richard and Ramli draw plenty of facts illustrating *how unsustainable construction affects the environment* (Richard, Ramli, 2011):

- It produces 5% of the world total carbon dioxide emitted through cement production. Some companies have started using foam concrete that can be called a sustainable material;

- Extensive mining of raw materials for the cement production often results in rapid deforestation and loss of the top soil;
- The building and construction sector take up 40% of the world's energy consumption and 12% of water consumption;
- 40% of construction waste is sent to landfill.

It is needed that companies build sustainable policies and set long-term goals to decrease their ecological footprint. However, it is challenging to find motivation for a company to restrain the use of resources and enforce eco-friendly production unless it is regulated by local or international authorities to do so.

With the rise of environmental concerns in the construction industry the concept of sustainable construction was born. Sustainable construction is tautologically defined as 'the result of the application of sustainable development in the construction industry' (Shi, 2008). Sustainable development is "the development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland, 1987). In order to promote it in the construction industry, different assessment tools have been introduced. They are often referred to as the green building assessment tools. Some of them are presented below in Fig. 1:

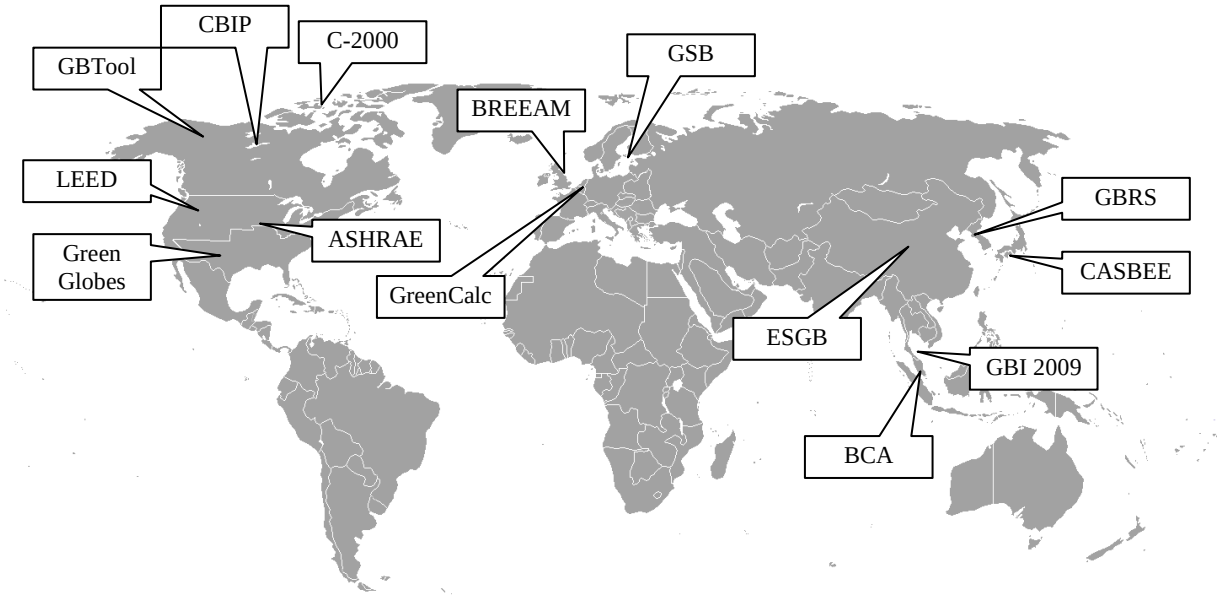

Fig. 1. Green building assessment tools

LEED (United States Green Building Council)
Green Globes from the United States
BREEAM from the United Kingdom
GBTool (SBTool), C-2000 IDP and CBIP from Canada
ASHRAE from the US
Guideline for sustainable building from Germany
GreenCalc from Netherlands
CASBEE from Japan
GBRS from Korea
ESGB from China
BCA- GM from Singapore
GBI 2009 from Malaysia

These tools are guidelines and standards that help regulate the environmental impact of construction in the given region. Such variety of standards makes it challenging to compare sustainability performance of companies from different countries. These standards have very similar indicators - only BREEAM, CASBEE, LEED, GBTool and Green Globes are the original ones (Fowler & Rauch, 2006). The rest of them use one of these five tools as a base for their framework.

These green building tools should not be confused with the ones that we will use in this paper to collect a pool of environmental indicators for construction companies. The goal of this paper is to analyse environmental disclosure of construction companies at the corporate level, and not to analyse environmental impact of the building structures.

We have come to the notion of green building, a narrower concept within sustainable construction. Green building focuses specifically on the environmental impact of construction process and the structures themselves (Kibert, 2004).

In this section we have discussed the facts that bring in the actuality of the topic: the negative impact of construction on the ecology is undoubted. The section acquaints the reader with the concept of green building and green building assessment tools.

1.2. Environmental responsibility and its assessment tools

In the 21st century *sustainability* has become a buzzword. Governments, organisations and individuals put the interests of the society and the environment on the discussion table together with profitability. The link between being responsible and profitable has been discussed in academic research and witnessed in practice. Dyllick and Hockerts (2002) explain the interrelation of the environmental, social and business aspects of sustainability. As is shown in Fig.2, sufficiency and eco-effectiveness aim at sustainable development and bring about society and businesses as the two producers of environmental good:

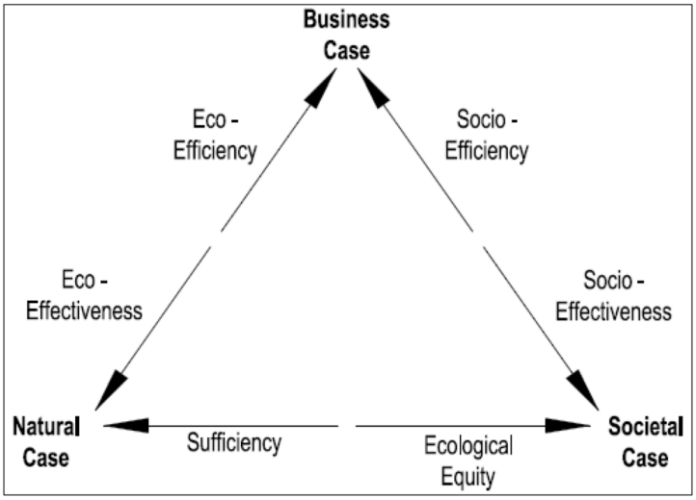

Fig. 2. The natural, societal and business cases. Extracted from Dyllick & Hockerts, 2002.

In other words, society and business have a common goal to take care of the environment, and being an environmentally responsible business is part of being socially responsible. Now, how does this translate into profitability? Environmental standard are set by the governments, and are directly linked to financial consequences in case of non-compliance. Besides, being sustainable makes for a good reputation among sustainability-conscious customers and investors. A phenomenon called socially responsible investing is in place now that investors have seen that companies' sustainability practices produce direct material impact on their valuations (Chouinard et al, 2011). Today firms can only prove they are viable in the long run by providing evidence of their sustainability practices. It is usually done through sustainability reporting – disclosing such type of information alongside the financials.

Environmental performance can be defined as the set of initiatives that companies take to control their impact on the environment (Walls et al, 2011). Environmental performance is another term for environmental responsibility of a company in a more practical meaning tied to certain metrics. Environmental performance is about carrying out the firm's environmental strategy. Environmental strategy involves products, processes, and policies that help decrease waste and energy consumption, the strategy implies usage of sustainable resources, and implementation of environmental management systems (Bansal, Roth, 2000).

Judith Walls and her colleagues suggest classifying environmental strategies into reactive and proactive. Reactive environmental strategies deal with 'environmental issues when they arise as a result of the firm's activities'. Proactive environmental strategies are those that attempt to prevent environmental consequences of firm's operations and aim at combining resources for the firm to develop environmental capabilities (Walls et al., 2011). Notably, regardless of what kind

of environmental strategy a company claims to have, it seems hardly possible to estimate whether it actually is proactive or not. But the researchers propose a tool that sets the direction for evaluating the environmental responsibility of businesses (Walls et al., 2011):

1) Historical orientation. The authors believe that firms with a history in environmental strategy are more likely to integrate environmental concerns in their operations. They are more likely to have already formed environmental capabilities.

2) Network embeddedness of supply chain and other stakeholders. This construct is especially valuable, because 'networks are socially complex and difficult to imitate'.

3) Endowments – ISO certification, environmental management system, environmental R&D. Endowments help firms become proactive. Walls et al use the term to mean the volume of firm investments in environmental R&D combined with supporting structures that maximize the endowment (for example, ISO-14001 certified environmental process).

4) Managerial vision – long-term commitment to environment. The authors suggest measuring managerial vision in time (short- or long-term goals are set) and depth (global or not).

5) Top management team skills – senior environmental executive, reporting structure. It is important to take into account whether there is an environmental manager in the executive team and whether they report at a local or facility level.

6) HR – environmental training programs, acquaintance of staff with GRI or other reporting systems. Formal environmental training programs and formal environmental performance reporting systems define the skills of company employees for environmental strategy.

The authors highlight that all capabilities are highly correlated with one another. This correlation will be reflected in the rating, since the companies who have managed to integrate these capabilities, will accumulate higher score for each criterion.

One of the most prominent theories of environmental responsibility is the natural resource–based view, introduced in the 1990s. The conceptual framework of the NRBV is built upon the **three major strategic capabilities**: pollution prevention, product stewardship and sustainable development, which, if taken advantage of, allow for cost reduction through continuous improvement and stakeholder integration (Hart, 1995). A company that boasts such capabilities is able to be always ahead of its competitors and be proactive. Stuart L. Hart explained the specifics of the three capabilities.

Pollution prevention implies elimination or minimization of emissions, effluents and waste. Pollution comes from inefficient use of materials and human resources. Pollution-prevention measures together with pollution control equipment are forms of pollution abatement, which means eco-friendly manufacturing process and minimal ecological footprint of a

company. Pollution control increases productivity and efficiency and thus leads to cost reduction. Unique ways of cost reduction are the most desirable competitive advantages of any firm.

Product stewardship refers to such product design and development processes that are environmentally responsible. In order for a product to bring low environmental costs, it should consist of renewable and non-toxic materials. Producing green products affects the company's reputation in a favourable way.

Sustainable development highlights the idea of long-term profits. Firm's ability to envision sustainable technologies and products and be the first to create them is the highest-end competitive advantage it can get. The hidden rock here is the necessity to have enough financial and infrastructural resources in order to sacrifice short-term profits for the implementation of these potentially economic and environmentally responsible technologies. It takes special commitment and vision to successfully enter the path of sustainable development.

Pollution prevention, product stewardship and sustainable development are interconnected strategies, which means they need to be implemented together, and work best with the synergy effect.

Sharma and Aragón-Correa are contemporary authors on NRBV. In their 2005 book they argue that three strategic capabilities can allow firms to identify and prepare for major environmental events (Sharma, Aragón-Correa, 2005). A firm that has all three capabilities is likely to drive environmental innovation and effectively address sustainability problems.

Nowadays the tools for assessing environmental performance are numerous and differ by the scope (industry-specific or non-industry-specific) and geography (national or international), as is shown at Fig. 3 below:

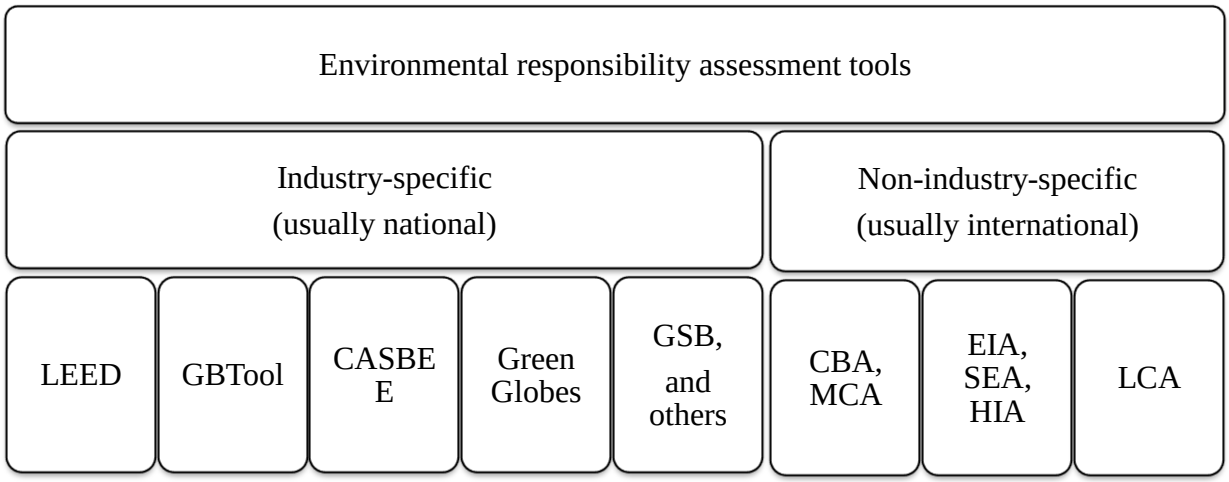

Fig. 3. Environmental performance assessment tools

A few of the notorious international tools are *not industry-specific* and include EIA (Environmental Impact Assessment), SEA (Strategic Environmental Assessment), LCA (Life Cycle Assessment), HIA (Health Impact Assessment), CBA (Cost Benefit Analysis), MCA (Multiple Criteria Assessment). Some of the mentioned assessment tools are used in the development process of legislation, policies and projects (EIA, SEA, and HIA). They do not suggest a list of environmental indicators, but recommend a certain procedure of decision-making regarding the environment. Two of the mentioned tools – CBA and MCA - are designed to help compare alternatives, for example a few projects. They do not compare companies' performances on the corporate level though. Life Cycle Analysis helps to find out the impact of a product, process or service on the environment and human health. The scope of these tools does not fit the goal of this study, so we cannot find a discrete set of environmental indicators from them.

Industry-specific tools (such as LEED, Green Globes, JSBC, GBTool, and CASBEE in the case of construction industry) are usually applied in certain regions and are rarely used outside of the country of origin. For the purpose of this research we will compare a few of these tools to aggregate the most exhaustive set of environmental impact indicators for the construction industry. A more detailed examination of these tools is provided in Chapter II where we choose which tools to use as sources of performance indicators for the new aggregated list.

1.3. Role of non-financial reporting

The most common way for a company to boast its sustainability is to publish non-financial reports. They can be called differently: CSR reports, sustainability reports, environmental responsibility reports, or by the name of the standards: GRI reports, SA8000 reports, and so on. Non-financial report is "the company's portrait" (RSPP, 2017) in the sense that it reflects the company's social role. Non-financial reports allow the reader to see the company's strategy and what it does to achieve its goals. The very fact of publishing a non-financial report and especially leaving it in the open access is evidence that the firm aims at building transparent and trustworthy relationships with its stakeholders (RUIE, 2017). In this respect the high quality (namely, degree of disclosure) is an important factor for strengthening trust and reputation.

In chapter 3 of this paper we will analyse the content of the international construction companies' non-financial reports, so it is considered important at this point to discuss the role of non-financial reporting.

Environmental responsibility and disclosure is encouraged at many levels:

- *Global:* initiatives such as the Paris agreement on the Climate Change;
- *National:* some governments have made it mandatory to report on certain ESG aspects (such as those of the UK and the Netherlands);
- *Institutional:* external independent institutions (for example, Greenpeace and WWF) and consulting/research organizations (such as KLD Analytics and RobecoSAM) publish articles, ratings and guidelines for environmental disclosure.
- *Stakeholder:* the stakeholder expectations often include efficiency and eco-friendliness of business.

Unlike financial reporting, the trend of non-financial reporting is quite new, and companies need assistance on how better to implement sustainability policies and report their performance. For the sake of unification and facilitation of non-financial reporting, standardized systems have been elaborated.

Companies are free to design their non-financial reports using any (or no) standard. Among the non-financial standardized reporting systems are GRI (the Global Reporting Initiative), AccountAbility (AA1000), Social Accountability International (SA8000), and ESG guidelines provided by stock exchanges. SA8000 only deals with the human right issues in the company management[1]. The guidelines for AA1000 are not published in the open access, so we are unable to use them as sources of environmental performance indicators for our research. In this paper we will analyse in more detail the GRI and ESG frameworks.

GRI is the oldest sustainability reporting standard, which explains its wide use as a benchmark and the amount of research conducted about the content of GRI reports. The GRI explains its purpose as to help organizations measure, understand and share their economic, environmental, social and government performance (GRI, 2016). Thus it aims at empowering them to take actions towards more sustainable economy.

GRI offers such definition of sustainability reporting: "A sustainability report is a report published by a company or organization about the economic, environmental and social impacts caused by its everyday activities" (GRI, 2017). Yet in the early 2000s John Elkington, the guru of sustainability and the author of the Triple Bottom Line theory, noticed the increasing demand for the non-financial information by businesses' stakeholders "to compare, benchmark and rank the performance of competing companies" (Elkington, 2004).

Among the reasons why non-financial reporting is important are the following:

- *The perceived environmental visibility of the firm* (Skouloudis et al, 2009). This is however, linked with greenwashing that we will discuss later in this section.

[1] From URL: http://sa-intl.org/_data/n_0001/resources/live/SA8000%20Standard%202014.pdf

- *Facilitation of the dialogue with stakeholders and providing data to help establish the industry benchmarks and point out the best practices* (Chouinard et al, 2011). Companies can drive industry innovation by learning from each other's best practices or fails. For the stakeholders published open information is the first point of reference when they get acquainted with the company.

- *The support of investor decision-making* (Slater & Gilbert, 2004).

The latter is a popular topic in scientific research. Most academics argue that investors are increasingly more concerned about the sustainability performance of the firms (Busch et al 2015; Cadman, 2011), while some sources provide statistical evidence that in very few cases sustainability information is included in investors' decisions. For example, Eurosif study says that ESG-based rating results are systematically included within investment decisions in only 8% of cases (Eurosif, 2010).

The solid evidence of the increasing emphasis on sustainability is the phenomenon of Sustainable Stock Exchanges (SSEs). The SSE initiative was launched by the UN in 2009 as "a peer-to-peer learning platform for exploring how exchanges, in collaboration with policymakers, regulators, investors and companies, can promote responsible investment for sustainable development" (SSE Initiative, 2016). 58 stock exchanges joined the initiative. While it might seem that the initiative itself is an indicator of the investor interest in non-financial reporting, the Initiative representatives found out that only 10% of CEOs confirmed investor pressure to higher sustainability (SSE Initiative, 2016).

Having discussed the potential benefits from non-financial reporting, let us now look at the major points of criticism. These will be useful to take into account while conducting comparative content analysis of the reports.

Some researchers emphasize the lack of context in the reports, i.e. absence of comparisons with regional averages and industry averages, as well as with previous years' performance by some companies (Fonseca, 2010; Isaksson, Steimle, 2009).

Another ground for criticism is *the confusing system of assigning grades* to companies for their GRI reports. Companies can get B, B+, A, A+, which are not the grades for sustainability *performance*, but for the quality of the *report* (Bernard et al, 2015). This means that a company might not have an outstanding sustainability policy, but by issuing an impeccably written GRI report can get an A or A+. Such grading system is misleading to some readers who perceive the score as attributed to the company's actual sustainability score.

One more important notice *is the 'greenwashing' effect* of sustainability reports and their misuse by companies in attempt to create an image of an ecologically-conscious and sustainable

business while in reality this is not the case (Bradford, 2007). Interpretative nature of sustainability reports requires more attention to the tactics of CSR communication (and sustainability reports are a method of it) and establishment of a tool that helps estimate companies' environmental performance.

There were also attempts to estimate whether GRI reports help achieve the stated goals of the initiative. Sneha Bernard et al in their 2015 study of GRI reports issued by 64 companies from 5 industries have reached to the conclusion that '*GRI does not appear to drive corporate sustainability so much as recount pre-existing trends*' (Bernard et al, 2015). Another negative inference was made by A. Fonseca about the fact that sustainability reports may enable companies to 'conceal unsustainable behaviour' (Fonseca 2010). This happens because companies are free to report their best sustainability practices and not report their operations that yield to unfavourable results.

A summary of the positive and negative critique on the sustainability reports is presented at Fig. 4.

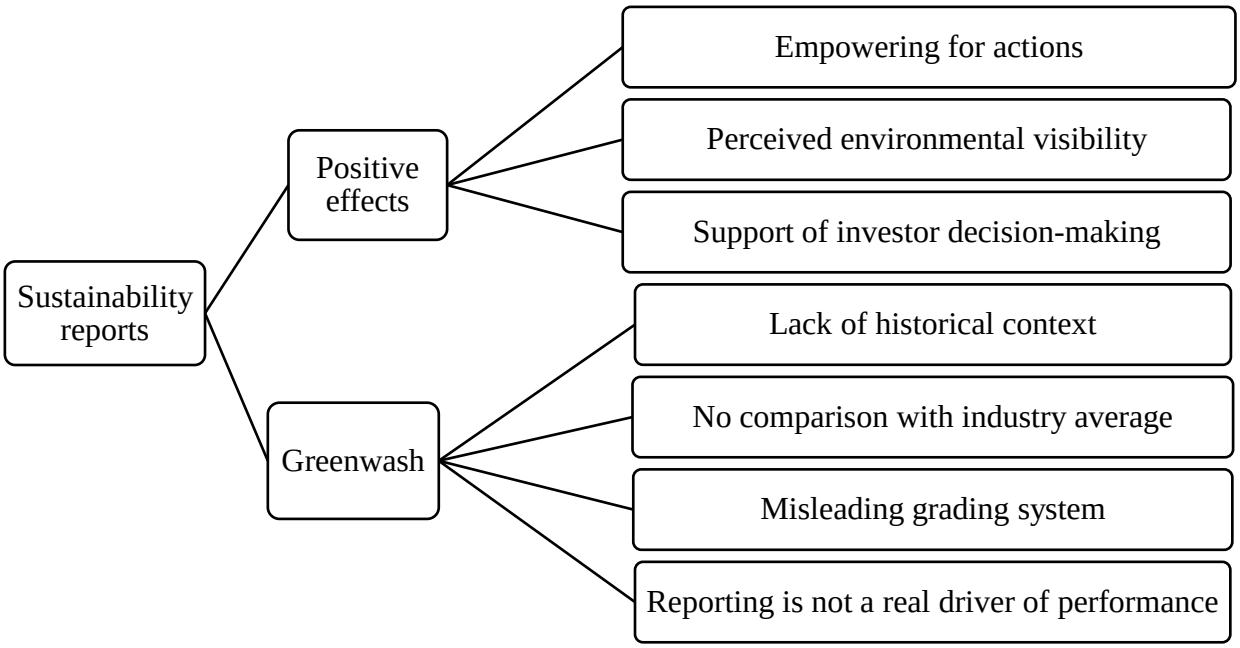

Fig.4. Pros and cons of sustainability reporting

This section helps us locate the challenges when analysing non-financial reports. These reports may also create a false image of a responsible company and cover for unsustainable practices, which is called the 'greenwashing' effect. While it is easier to find criticism of non-financial reporting, it should be praised for encouraging firms to work further in the direction of their sustainable development.

1.4. Rating method: pros and cons and limitations

In the previous section it is mentioned that sustainability information may be needed for investors or other stakeholders to benchmark and compare performances. The most popular form of comparative analysis is a rating. In order to discuss the possibility of ranking the companies based only on the information provided in their sustainability reports, it makes sense to look as the current criticism of the rating method.

So far the major challenge for researchers who compile the ratings is to agree on the measures when estimating environmental strategy. Once the measurement scale is established, data collection can start and the rating method can be used efficiently to enable comparison of multiple firms on multiple criteria.

Goldman Sachs has targeted the issue of measurability and has tried to convert ESG (environmental, social and governance) criteria into quantitative scores (Goldman Sachs, 2011). Goldman Sachs appeals to the need to calculate social and environmental risks. In their report the main emphasis is made on clean energy, carbon emissions, volume of investment in environmental issues, growth of LEED-certified office space (energy efficient offices), and financing of preservation of nature. The reporting format is adjusted to the specifics of the financial industry. Goldman Sachs presents a table of their environmental indicators and their values in 2005, 2010 and 2011. Such historical comparison makes the analysis more transparent, as well as helps the company track its progress and evaluate the improvement of its sustainability performance. Busch argues that despite the advancement of such quantitative approach, it cannot avoid arbitrariness (Busch et al, 2015). When speaking about ratings, Busch points out two spheres of improvement for sustainability ratings: data collection process and transparency.

An example when a rating methodology was praised in the academic literature is the KLD rating approach. KLD Analytics is a consulting company that specializes in environmental, social and governance (ESG) research. They have launched the Global Sustainability Index (GSI) and are running its own ESG database and working on elaboration of an ESG benchmarking system. ESG ratings by KLD Analytics were compared against actual results, and were found to be an adequate measure of companies' environmental performance (Chatterji et al, 2009). We would like to argue on whether KLD methodology is the most advanced since it remains unclear how KLD measures each of the indicators since the description of each indicator gives much room for interpretation. For example, the description to the indicator (ENV-str-C), about recycling, reads "the company is a substantial user of recycled materials" (Risk Metrics Group, 2010). It is not clarified how to measure "substantial use", and different companies might have different thresholds to define 'substantial'.

Dow Jones Sustainability Index (DJSI) is another prominent tool to assess and rank companies on their sustainability performance. RobecoSAM, the company that manages the index, emphasizes that the index is oriented at long-term company policies as much as at current performance (RobecoSAM, 2017). The main challenge of using Dow Jones' set of indicators is the intangible nature of what the index measures. For example, such criteria as Climate strategy or Operational Eco-Efficiency could be measured in various ways and, thus, the score might be different. The company does not provide information on how it measures every indicator, but in this paper we will try to incorporate DJSI into our framework.

One more drawback of the rating method relates to the criteria of choosing sustainability measures for assessment. A rating is built upon some criteria of sustainable performance (sustainability measures), however it is difficult to say which measures are meaningful (i.e. relevant) and which are not (Orlitzky, 2013). Meaningful measures are those that can trace improvements in the company's ecological, social and ethical performance. It can thus be inferred that each measure should be tested before deciding to use it as a criteria for comparison.

Another critique discards one of the arguments from the previous section on how disclosure of environmental information can attract investments. Eurosif study claims that ESG-based rating results are systematically included within investment decisions in only 8% of cases (Eurosif, 2010).

Chatterji et al (2009) bring to attention a limitation to the sustainability ratings: they show no predictive power and are hardly helpful in foreseeing performance and compliance violations by companies. We would like to argue that this point is not always relevant to the end-users of ratings for they use ratings for a snapshot of current state of the industry, not in order to make prognosis.

Despite the mentioned limitations, ratings can help fight with 'greenwashing' and encourage continuous improvement of sustainability performance (Parguel et al, 2011). It was shown in the empirical research by Parguel et al that sustainability ratings are a significant help for consumers to evaluate a company's CSR more precisely and responsibly. This means that the ratings allow them to draw conclusions and make decisions based on firm-to-firm comparison and not on their personal interpretations of released CSR information. By analogy, sustainability ratings might be of use for all other stakeholders, including investors and potential partners of the companies. It was also proved in academic research that ratings influence behavior of the market: even unrated firms start working on improving their sustainability performance with the growing number of the rated companies (Sharkey et al, 2015). This means that ratings could potentially be a driving force for a greener industry together with legal regulations.

This section has shown that sustainability ratings, though being an attempt to present an objective comparison of multiple companies, require a more rigid choice of indicators (or criteria) and a thoroughly elaborated measurement system. KLD Analytics and RobecoSAM introduced their own tools to facilitate sustainability ratings, but both of them use indicators that can be interpreted in many ways, which makes them not specific enough for a comparative analysis.

In this chapter we discussed a lot of environmental evaluation tools and standards. The table 1 below presents in a structured fashion the rationale of choosing among these sources for environmental performance indicator list collection:

Source (in order of appearance)	**Used or not**	**Reason**
Green building assessment tools (LEED, BREEAM, CASBEE and others)	Not used	Unsuitable scope (building level instead of the corporate level).
Academic paper by Walls et al., 2011	Used	Propose a performance evaluation tool based on the companies' capabilities analysis
EIA, SEA, HIA	Not used	Unsuitable scope (national/policy level instead of the corporate level).
CBA, MCA	Not used	Unsuitable scope (project level instead of the corporate level).
LCA	Not used	Unsuitable scope (product/service level instead of the corporate level).
AA1000	Not used	Guidelines unavailable in open access
SA8000	Not used	Unsuitable scope (social responsibility instead of environmental
GRI	Used	International non-financial reporting standard suggesting a set of 30 environmental performance indicators
ESG guidelines	Not used	Differ by issuers, no set of indicators is published
KLD Analytics	Used	Evaluate corporate environmental performance by specific criteria
Dow Jones Sustainability Index (RobecoSAM)	Used	Evaluate corporate environmental performance by specific criteria

Table 1. Choosing the sources for environmental indicator list compilation

1.5. Summary of findings from Chapter I

1) Construction industry can have a significant negative impact on the environment, which brings the need for responsible management. Environmental ratings might help motivate construction companies to be more sustainable.
2) Companies report their sustainability performance in their non-financial reports and can choose any of the existing standards of non-financial reporting.
3) Non-financial reports are praised for encouraging the companies to improve their sustainability performance and attracting investment from 'responsible' investors. They are criticized for giving the companies the opportunity to cover their unsustainable behaviour and still look responsible – the so-called 'greenwashing' effect.
4) No universal methodology to measure sustainability has been developed yet. Sustainability ratings are blamed for arbitrariness and bias. They need to bring more context (against industry and historical comparison). Revealed limitations of the rating methodology are to be overcome in the methodology developed in this research work.
5) The most successful examples of measuring sustainability performance are the systems such as KLD Analytics and RobecoSAM. These will be useful in the development of an environmental assessment framework for this paper, taken together with the international and industry-specific tools for measuring environmental impact.

Research gap

Analysis of contemporary academic literature revealed the lack of agreement on how to report, measure and evaluate corporate environmental performance.

Despite the ecological impact of the industry, the environmental performance of construction companies is discussed only at the project and not the corporate level.

Non-financial reporting is agreeably an important medium of communicating about sustainability to stakeholders, however, the opinions on the role of non-financial reporting in investor decision-making are polarised.

This paper is an attempt to fill the research gap by aggregating a most comprehensive set of environmental performance indicators, applying it for analysing the construction companies' reports and discussing the relationship between the degree of environmental disclosure in non-financial reports and investor attractiveness.

Chapter II. Data collection and methodology

This chapter gives reasoning for the methodological choice of this research paper. We use qualitative study I order to answer the research question 1 and 2 and quantitative study to answer the third research question.

2.1. Choice of methodology

In order to describe research methodology it is necessary to define: a) its type by data and analytical method, b) the purpose of research, c) the research strategy. By the data type and analysis research methods are divided into three categories - qualitative, quantitative and mixed. According to the purpose of research it can be exploratory, explanatory, evaluative, descriptive and combined studies. The classification of research methodologies is illustrated in Fig. 5:

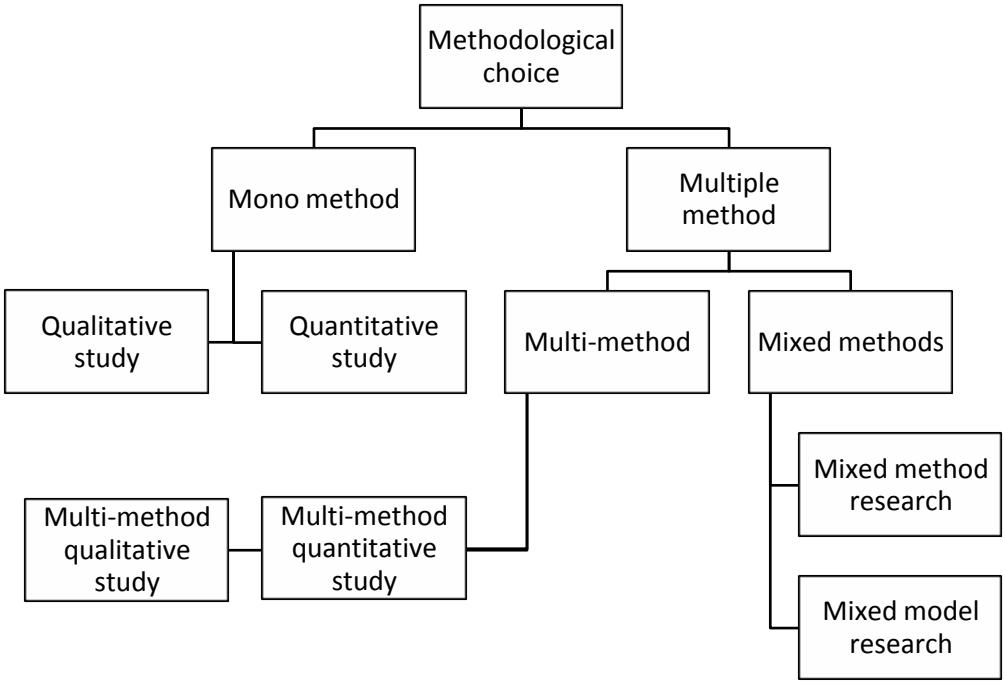

Fig.5. Research choices available. Source: Saunders et al. (2016)

This paper is a multiple method study. Such studies use a few different methods to collect and analyse data. If they use both quantitative and qualitative methods, such studies can be called either mixed method or mixed model studies. In our case, this is a **mixed model study**, because we don't only deal with different nature of data, but *transform* qualitative data into quantitative scores.

We begin with a comparative content analysis of the companies non-financial reports. This research method is a perfect fit according to the nature of the first two research questions, which is to find out the tendencies of disclosure by the international construction companies. Thus, the first (qualitative) part of our research can be classified as an **exploratory study** with elements of **descriptive study** (Saunders et al, 2016). It aims at gaining insights in the research topic, to clarify some aspect of a matter. Its outcome is relatively unpredictable. Exploration starts with acquaintance with broader topics, and then narrows down to a certain issue.

The third research question requires a quantitative method. We will conduct regression analysis to find association of the return on investment with the degree of environmental disclosure. The degree of disclosure will be a numerical score resulted in the quantification of qualitative data studied in the first part of the research.

Research can follow different strategies, i.e. have different action plans or structures. Research strategy refers primarily to data collection: ether primary or secondary data can be used. Primary data are the data collected by a researcher for a particular research. The main research strategies when collecting primary data are: experiment, survey, ethnography, action research, grounded theory, narrative inquiry. Secondary data are data collected by a second party (for instance, market reports), or published by a company that is the subject of research. Strategies involving secondary data are archival and documentary research, case studies. Data needed for this research are sourced from the companies' sustainability reports. Thus, this research is based on **secondary data analysis**, and its strategy is defined as an **archival/documentary research**.

2.2. Data collection and sample description

In order to achieve the research purpose and answer the research questions we need to collect two types of data: environmental performance indicators from different methodologies and the environmental performance reports of the international construction companies.

When sourcing for the environmental indicators we followed two criteria: they have to deal with the corporate level of performance and be applicable in the construction industry (not be designed specially for a different industry).

The companies for the sample of environmental disclosure information were selected according to three criteria:

1) having international operations;

2) providing 2016 data in the open access; and

3) being the largest contractors worldwide.

The list of the companies includes 30 international construction contractors from the top-50 on the Engineering News Record website. Some of them have diversified businesses (such as oil drilling and construction services), but all of them have international construction operations, therefore they need to adjust to different stakeholder expectations and legal regulations regarding environmental management depending on the country they are entering. ENR ranked the companies **"***according to construction revenue generated outside of each company's home country in 2016 in U.S. $ millions"* (ENR, 2017).

Most companies have their headquarters in Europe (13) and Asia (13). The United States, Canada, Brazil and Australia are represented by one company each.

The full list of 30 companies with their headquarters can be found in Annex 1.

2.3. Methodology

The flow of research consists generally of four parts:

1) Aggregating the indicators from existing environmental standards/assessment tools into one pool. We will be doing this in parallel with comparing the lists of indicators and merging the repeating indicators. The goal of this stage is to avoid creating a duplicate for existing methodologies, but to enrich them so that they show a full picture about environmental management in the construction industry. In order to achieve maximum objectivity, we will compare the indicators from 4 different sources and eliminate repetition.

2) After the pool is collected, we will test it by using the indicators to analyse the environmental reports. At this stage we find out both the degree of disclosure by the companies and also the correctness of the indicator. When it comes to the degree of disclosure we will rank the companies answers per indicator by full disclosure, partial disclosure and information not provided. We will also see whether the reports covered some additional aspects of environmental performance than the ones we will have selected from the pool. The assumption is that in case there are such additional aspects, they are industry-specific.

This stage is the most challenging part of research because it has two goals – to qualify the indicators and assess the degree of disclosure. Such cross-qualification means that there are a few iterations of the list revision. This process can be called the cycle of continuous improvement, or called plan-do-check-act (PDCA) cycle (Searcy et al, 2009).

3) The next step is making conclusions about the specificity of environmental reporting in the chosen industry using the induction method. We will also correct the list of

indicators if necessary in order to provide a final set of indicators that could be used to assess the environmental performance of the companies.

4) Running a regression analysis in order to find out the relationship between the degree of environmental disclosure and ROI. The results will allow us to make conclusions about the industry trends in disclosing the environmental information as well as validate or disprove the arguments about the role of non-financial reporting in attracting investment.

2.4. Obstacles and limitations

The main **limitation** of current study lies in the fact that qualitative research design is mainly associated with interpretative nature of study. However, we refer to multiple sources of information when it comes to the indicator list compilation to compensate for the possible personal biases. The main **obstacle** in this research is the lack of data provided in the sustainability reports in order for us to actually rank the companies' performance and make further interesting conclusions such as the correspondence of performance with the degree of disclosure. The lack of data can be explained by two factors that are interrelated:

- The sensitivity of the subject, and
- The freedom to choose the disclosure format.

Since the companies' reputation is at stake, they might choose not to disclose on certain aspects where their performance is low. Not having a mandatory non-financial reporting standard allows them to do so. Besides, the auditors who verify the reports do not have to point out the missing data since their responsibility is "checking the consistency of information in the accounts" (ICAEW, 2008).

Chapter III. Analysis results discussion

In this chapter we will aggregate a list of environmental indicators from the major environmental assessment standards. Then we will analyse 30 top international construction companies' non-financial reports using these indicators as points of difference.

The degree to which the companies chose to disclose on each indicator will help us make inferences about the industry priorities in the environmental reporting. The scores on degree of disclosure are used for regression analysis to test whether higher degree of environmental disclosure would lead to higher investor attractiveness.

3.1. Creation of the indicator list

This section covers stages 1 and 2 of the process flow shown at Fig. 6.

In chapter I we have briefly reviewed all the standards/tools that we will use to collect a pool of relevant environmental indicators:

- a framework by the non-industry specific reporting initiative GRI (GRI, 2017);
- frameworks by KLD (Risk Metrics Group,2010) and RobecoSAM (2015);
- academic study suggesting their own approach to environmental assessment: Walls et al 2011.

As we mentioned before, there are many industry-specific standards evaluating green building. These are not included in this research because they deal with buildings themselves, not the overall operations of construction companies. We do however take them into consideration in one indicator – "Certifications and awards". If a company has constructed a certain percentage of LEED, BREEAM, etc.-certified buildings, it is indicative of its environmental performance – namely, product design.

We start by listing the indicators from the GRI G4 guidelines. Then we list the indicators by KLD in the next column, matching them with the ones from GRI if they have the same subject matter. In the same way we add indicators from DJSI, Walls et al 2011 and Hart 1995. Analysis of the tools has shown that GRI has the most extensive list of environmental criteria, whereas all the others have very vague formulations of each indicator and do not provide recommendations on how to measure each of them. Lists of corresponding indicators from each tool can be found in the table in the annex 2.

The list of indicators has 40 items, only 9 of which are not listed in the GRI guidelines. Interestingly, only one indicator (number 7 in the annex 2) is mentioned in all frameworks: environmental impact of the product. KLD and DJSI do not formulate it in this way, but we are

making an assumption that Transmission & Distribution (GJSI) and Pollution Prevention (KLD) are included the environmental impact of the product.

Each framework has contributed at least one unique environmental criterion that was not suggested by the others. Indicators that are only mentioned in one source are the following:

1) Total environmental protection expenditures and investments by type (GRI).

This could be implied in the generic formulation of the "Environmental Policy/Management system" in other sources, but since GRI distinguishes between the policy and the money allocated on the environment, we consider it a separate indicator. By the way, Engineering News Record used environmental expenses as one of the very few indicators in its environmental rating of construction contractors, which adds value to our argument in favour of separating this criterion.

2) Business risks and opportunities (DJSI).

It is debatable whether this should be a separate indicator, because the wording implies multilateral analysis of the internal and external circumstances for the company and all the other indicators of environmental performance lead to the discussion about the risks and opportunities anyway.

3) Employee trainings (Walls et al 2011).

Employee trainings, and in general, engagement of employees, encouragement to be more environmentally responsible, not only enforces the culture within the company, but also pays off in the form of lower scope 2 of the CO2 emissions if the employees use less electricity and car-share, for example. In the case of electricity it will also pay off directly by lower bills for office and on-site electricity use.

4) Historical orientation (Walls et al 2011).

What we will mean by this indicator is whether the company compares its performance with previous years on most of its numbers. This information refers mainly to the report quality, but it is also indicative of how transparent the company is and how it tracks the progress.

5) Certifications and awards (endowments) (Walls et al 2011).

In this area we will look at awards such as Energy star, inclusion in the CDP Climate A list and whether a few company's projects received a LEED, BREEAM or any other green building certification. We do not use a threshold for how many projects have to be certified, because even if the number is low, the very fact of certification means that the company has already gained advanced competences in environmental management, and has a potential to scale them to the corporate level.

6) Network embeddedness (Walls et al 2011).

What Judith Walls means by that is engagement of stakeholders. We have already separated employees in a specific indicator, so in this case we are looking at two aspects: a) whether the company audits its suppliers; and b) engages communities in the environmental initiatives that it runs.

7) Property, plant, and equipment (KLD).

The explanation of this indicator provided by KLD is "The company maintains its property, plant, and equipment with above average environmental performance for its industry". This indicator is generic since the environmental performance is not defined. We assume that this indicator would be relevant to an industrial setting, manufacturing, rather than to construction.

The indicator "Agricultural chemicals" (KLD) is irrelevant to the construction industry and is not included in the final list of indicators.

When comparing the indicators suggested by GRI and by the other sources it becomes evident how generic (immeasurable and subject to interpretation) the indicators are in all sources besides GRI. Let's look at the two outstanding examples by KLD:

- "Operational eco-efficiency" is not an indicator but rather a topic worth covering on many pages and in many aspects. We allocated this indicator as a duplicate for all GRI's indicators assessing intensity and some indicators measuring consumption of resources.
- "Climate strategy" is also a multi-faceted notion. We pair it with all indicators related to air emissions.

The final names of the indicators can be found in the right column of the table in the Annex 2.

3.2. Degree of disclosure by the companies

The analysis of 30 companies from the top 50 international construction companies showed that they use different reporting standards:

- 23 companies used **GRI** guidelines to structure their reports. Only 7 of them filed their reports into the GRI database, the others only referred to GRI guidelines unofficially - for structure.

- 3 companies that disclosed according to the **ESG (environmental, social and governance) reporting guide** are China Communications Construction Group Ltd (CCCG),

China Metallurgical Group Corp. (CMG) and China State Construction Engineering Corp. Ltd (CSCI). All companies are listed in the Hong Kong Exchanges and Clearing (HKEX), which has its own ESG guideline for reporting. CSCI and CMG use ESG guidelines together with GRI guidelines, which are easily compatible with each other. The main difference between the GRI and ESG approaches is that the latter uses "a 'comply or explain' policy approach that requires companies to either report on their sustainability impacts or explain why they choose not to" (GRI, 2016). In other words, ESG is more flexible than GRI, and we expect that companies using GRI guidelines disclose more than those who opt for ESG.

- One company – Ferrovial - uses AA1000 principles, but does it together with the GRI guidelines.

- 6 companies do not mention any reporting standard that they use. As we will show further, they provide the least amount of information compared to the other examined companies.

The degree to which the companies disclosed on each indicator can be seen in Annex 3. The table looks like a grid, where black cells stand for full (detailed) disclosure on the matter, grey ones mean that the information was generic or not all required information was provided; white cells mean the information was not provided at all.

We ranked the companies by the degree of environmental disclosure. For each fully disclosed indicator (coloured black in the grid in Annex 3) they scored 1, for a partially disclosed (grey) indicator we assigned 0,5 points. The ranking position of the companies can be found in the Annex 4.

It can be seen that all the companies that do not use a certain standard as a reference to structure their report, are positioned at the bottom of the table.

Strabag, CCCG, CMG and SNC score surprisingly low despite using a reporting standard. In fact, CCCG and CMG rely on the ESG guidelines, so they exercise the right to "explain why they choose not to disclose" on a certain issue (GRI, 2016). These two companies are listed in the HKEX which issued its own ESG guidelines. HKEX ESG requirements are more flexible due to the permission not to disclose information as long as the reason for non-disclosure is explained. Strabag and SNC use the GRI format but they were not registered in the GRI database for the year 2016, so they might have only used GRI to facilitate the report production process.

Overall, the degree of disclosure by the 30 examined companies is quite low, especially given the number of companies that refer to GRI. Why is this the case? The main reason is in the

recommendative nature of the reporting standards. Companies can use reporting guidelines in order to help structure the report and even set a proper environmental KPI system to track performance during the year. They are not obliged to disclose on every single indicator. For instance, SK E&C and Samsung Engineering base their reports on the GRI guidelines and they provide a GRI index at the end of their reports, but they only list those GRI indicators in the index that they actually reported, so the reader's first impression is that they reported on all indicators.

3.3. Degree of disclosure per indicator

In Annex 5 we provide a summary of the degree of disclosure by indicator – how many companies out of 30 disclosed on it (regardless of whether fully or partly) in absolute number and in percentage.

Two indicators were not disclosed on by any of the companies: (40) *Property, plant, and equipment* and (7) *Reductions in energy requirements of products and services*. Interestingly, Ferrovial included the indicator 7 in its GRI index, but the only reported information on the indicator was that they consider energy efficiency in the purchasing and subcontracting processes.

Indicator (27) *% of products sold and their packaging materials that are reclaimed* was disclosed by only one company – Larsen and Toubro. We assigned half a point for the degree of disclosure because the company explained why the data could not be provided (product does not require packaging). Such disclosure is not enough for a full point because the company did not report on the reclaimed products (buildings to be demolished or cancelled building projects). Even if there were no cases of product environmental violations, reporting on it is important.

Seven more indicators were disclosed by 10 or less percent of the companies. Let us look at them in more detail using the Keeble's approach:

It is suggested that an ideal performance indicator should be (Keeble et al, 2002):

- Measurable and verifiable (MV);
- Potentially benchmarkable (BM);
- Able to measure progress over time (PR);
- Meaningful at group level (it should be clear whether a higher value is good or bad for the environment) (ME).

In the Table 2 we marked with a "+" the indicators that fit the verification criteria, with "- " those that do not fit. "±" means that it depends on the situation or it is difficult to measure,

benchmark and track the indicator. For example, it is possible to measure direct impacts on biodiversity; however it is difficult to measure the indirect ones. Environmental impacts of products and services can be measured by multiplying the firm's total impacts by the proportion attributed to a product. This means, the indicator repeats what other indicators measure. That is why we put all ± to this indicator.

Indicator №	Indicator	Disclosed by	MV	BM	PR	ME
12	Direct and indirect impacts on biodiversity	10%	±	±	±	±
14	Number of endangered species affected by operations	10%	+	+	+	±
24	Weight of hazardous waste transported and treated	10%	+	+	+	±
25	Water bodies/habitats affected by the discharges of water and runoff	10%	+	±	+	+
33	Business risks and opportunities	10%	-	-	-	-
19	Emissions of ODS by weight	7%	+	+	+	+
26	Environmental impacts of products and services	7%	±	±	±	±
27	% of products sold and their packaging materials that are reclaimed	3%	±	±	±	+
7	Reductions in energy requirements of products and services	0%	±	±	±	+
40	Property, plant, and equipment	0%	-	-	-	-

Table 2. Verification of the least disclosed indicators

Using Keeble's system we can discard the indicators № 33 and 40. As we had assumed before, such formulations are too generic for an indicator. Three companies did disclose on the indicator 33, but it was rather a section of the report than a specific performance value. The rest of the indicators, except number 19 may be difficult for the companies to measure or collect the information about. Although the measurement system for them can be potentially established, it is difficult in practice to calculate the number of species, or keep track of the hazardous waste transported and treated.

As for the ODS emissions, CIMIC included them in the GRI index at the end of their report, but referred to the section on the GHG emissions despite the fact that it is a different type

of emissions. A few companies left a note that they consider these emissions immaterial (BAM, Salini, OHL). According to the GRI guidelines (GRI, 2017), material issues are those that are crucial for the organisation's goals and "substantively influence the assessments and decisions of stakeholders". Such materiality focus of GRI aims at increasing the relevance of the report content and making them easier to read. But at the same time, it gives the companies an excuse not to report on a few issues.

Now let us discuss the most covered environmental indicators by the examined companies. The highest degree of disclosure per indicator is 80%. Eleven indicators were covered in 53-80% of reports. We have analysed the possible reasons for such relatively wide disclosure and found three possible explanations:

1) The issue is legally regulated (indicators 15, 3 and 4).

The careful disclosure of GHG emissions and energy consumption can be explained by the fact that in most countries these are highly regulated by the government, especially in Europe. Besides, the GHG emissions and energy consumption are linked in one generic problem of climate change. In November 2016 55 countries signed the Paris agreement on climate change, with the purpose to maintain the average temperature rise below 2 degrees Celsius (UNFCCC, 2017). The agreement requires all parties to establish their nationally determined contributions (NDCs) and report on their emissions levels and efforts to reduce them.

We would like to note that most companies reported total energy consumption without clarification about direct/indirect sources. In the grid, such companies are marked with grey for both the direct and indirect energy consumption.

2) Positive image creation.

Indicators 37, 39, 13, 31, 36 and 32 do not address the environmental damage of the company. In fact, none of them, except the indicator 13 on the habitat protection, are about the environmental impact per se. Besides, some of them are intangible, so there is more freedom on how to disclose on these issues.

If we were to compare the companies' environmental performance, we would have to exclude indicators 39, 31 and 32 because they are non-discrete (qualitative). For the other two indicators a measurement system would have to be introduced. Indicator 37 could be measured in the number of awards and percentage of green building- certified project. Indicator (36) *Network embeddedness* could be expressed in the percentage of suppliers audited for compliance; however, it would be challenging to measure the relationship with other stakeholders.

3) Easy to collect data.

Indicators 13, 22 and 8 are relatively easy to measure. For example, water consumption and weight of waste are usually tracked because they are being paid for. In the case of indicator (13)

Habitats affected, protected or restored, many companies wrote about the replanted areas and land restoration projects.

3.4. Construction industry-specific environmental indicators

Let us look at what other information was disclosed besides the 40 indicators that we have suggested.

Water intensity – was reported on by CIMIC and ACS. This measure is defined by the amount of water used per million of revenue. Together with energy intensity, emissions intensity and, for example, waste intensity, they would make a nice set of environmental criteria for ratings and comparative studies. The companies do not need to disclose intensity because they can easily be calculated is the total consumption number is reported. What is challenging though is that companies report revenue in their national currencies, so in order to standardize the values we would need to translate all currencies into one and adjust by purchasing power. Another consideration is whether revenues are a sufficient indicator of the company size. For more objectivity we could use two values of intensity – per revenue and per workforce.

Energy efficiency – disclosed only by Tecnicas Reunidas. This value indicates how much energy was delivered out of the whole volume of energy produced. This is a difficult measure and it has to be calculated in-house. Such indicator would be a nice criterion for a rating, however as long as the companies are not required to report this value, it might be rarely reported.

Waste intensity – reported only by BAM Group. Another intensity value that can be evaluated per revenue or workforce and would be useful in the rating methodologies or comparative analyses.

Soil removed, reused soil – reported by Ferrovial.

Construction-generated soil emissions – reported by SK E&C.

Construction industry has the heaviest effect on soil through the amount of soil removed, deforestated and polluted. Reporting on the soil damage is relevant to the industry, and is not prescribed by GRI, KLD and other methodologies.

Waste water – disclosed only by Hyundai. This value can be helpful in evaluating water efficiency. The actuality of water use in the current environmental discourse is out of doubt, so it can be expected that water use and wastage will soon be regulated as much as GHG and energy use.

Although the above mentioned indicators are relevant not only to the construction industry, they give a fuller picture of the impact on the environment and present measurable and benchmarkable value that can be used for rankings and comparisons.

The construction-specific environmental indicators can be found in the green building standards (LEED, BREEAM, GRTool and others), but those evaluate building projects from the design stage until the demolition. Because green building tools assess environmental performance on the project and not the corporate level, they are not relevant for our research. The only way we can take them into account is when finding the proportion of a company's projects that are green building-certified (indicator 37).

3.5. Degree of disclosure and ROI

In the first chapter we discussed the role of non-financial reporting for investor decision-making and communication with other stakeholders. Having analysed the environmental disclosure by the international construction companies and evaluated their degrees of disclosure, we can now test whether there are financial implications of environmental reporting. Specifically, whether higher degree of disclosure is associated with higher investment attractiveness (higher return on investment). We used Excel 2007 Data Analytics extension to run the regression analysis testing the hypothesis:

(H1) The higher is the degree of environmental disclosure, the higher is the company's ROI.

The null hypothesis then is:

(Ho) ROI value does not get higher with the growth of the degree of disclosure.

We will use the degree of disclosure scores that we assigned to the companies as the predictor variable and ROI as the outcome variable. The values can be found in Annex 4. ROI values were calculated using the 2016 financial data provided in the companies' reports, Yahoo finance portal or stock exchanges. Data for each separate company were taken from the same source to ensure consistency of the values. There are variations on how to calculate ROI, but all of them express the relation of profits to the resources invested (Farris et al, 2010). In our case, given the data availability, ROI was calculated using revenue and revenue expenses (COGS) values:

$$ROI = \frac{(Revenue - Revenue\ \ Expenses)}{Revenue\ \ Expenses},$$

where (Revenue – Revenue Expenses) express the gains from investment and Revenue Expenses (the denominator) express the investment cost.

The sample size for our regression test is 29, because the privately held company Odebrecht does not provide open access financial data.

The results of the regression analysis can be found at Table 3 below. The value of the R square tells us how much of the ROI variance is explained by the values of degree of disclosure – only 1,9%. Meanwhile, the p value is too high (p=0,4659) indicating that there is a 47% chance that the result was obtained randomly. Our hypothesis was not confirmed; there is no significant relationship between the degree of disclosure and ROI.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0,140913945
R Square	**0,01985674**
Adjusted R Square	-0,016444862
St Error	0,117685585
Observations	29

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0,007575803	0,007575803	0,546993482	**0,465931005**
Residual	27	0,373947219	0,013849897		
Total	28	0,381523022			

	Coeffic-s	*Stand Error*	*t-stats*	*P-value*	*Lower 95%*	*Upper 95%*
Y-intercept	0,0646	0,0456	1,4149	0,1685	-0,0291	0,1582
Degree of disclosure	0,0027	0,0036	0,7396	**0,4659**	-0,0048	0,0101

Table 3. Summary output of the regression analysis

The scatter plot at Fig. 6 illustrates the distribution of the ROI and degree of disclosure values:

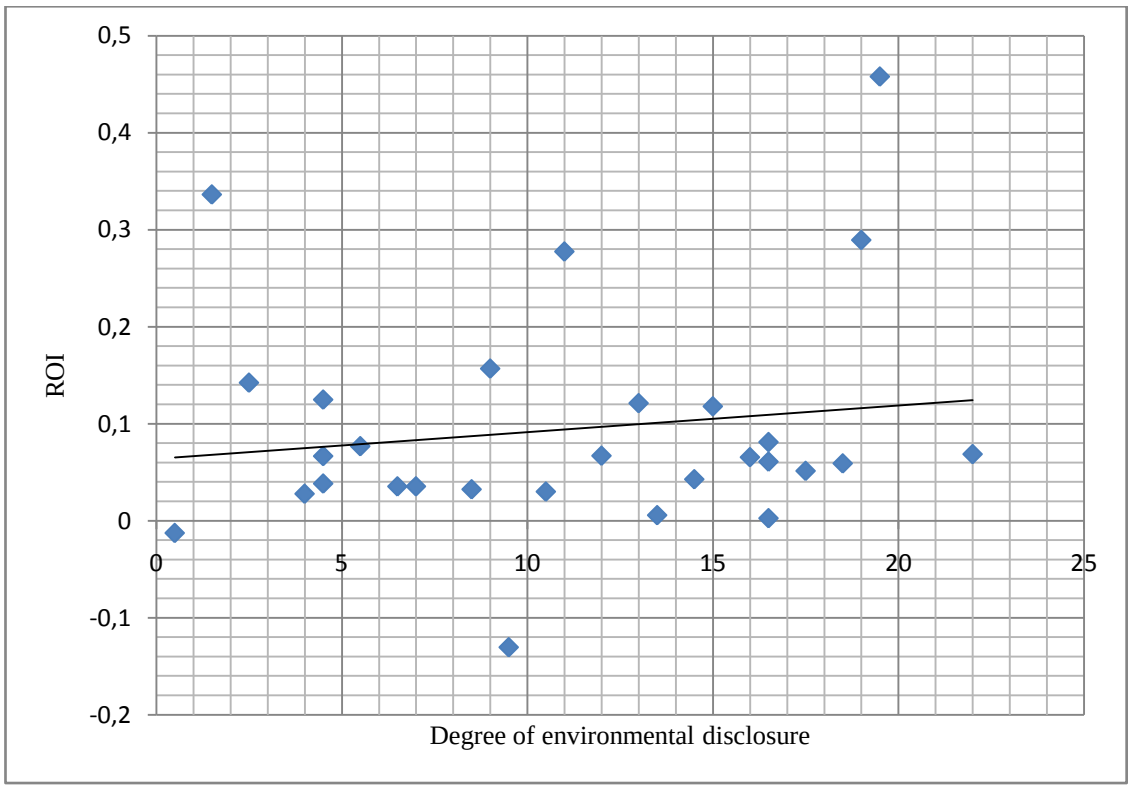

Fig.6. Scatter plot: ROI and degree of disclosure

The scatter plot helps to see both the 'big picture' and the individual cases. One can easily spot that the majority of the ROI values are gathered close regardless whether the degree of environmental disclosure is the highest or the lowest in the sample. Extremely high ROI values appear for the lowest, the medium and the highest values of disclosure. There are two companies that have negative ROI (Saipem and Orascom), who are in the bottom half of the degree of disclosure rating in the Annex 5. The vast majority of the companies have ROI that is lower than 20%.

How can we interpret such statistical results?

Firstly, this might be caused by the small sample size. It is recommended that regression is run using 60 or more entries in the sample in order to track at least a medium effect of the predictor on the outcome (Field, 2009: 223). Due to the nature of data collection for our research we limited our research to 30 companies.

Another conclusion is that the degree of environmental disclosure alone is not enough to influence ROI. This has opened perspective for further research to find out whether the degree of disclosure on all 3 sustainability aspects – economical, environmental and social - influences the

investor attractiveness of a company, or whether it is the environmental (or sustainability) performance and not degree of disclosure that actually interests investors.

So far, we cannot confirm that there is investor pressure for the construction companies to increase their degree of environmental disclosure. This might be the reason why the construction companies follow the reporting guidelines flexibly.

3.6. Summary of findings from Chapter III

1) In the sections above we discussed the degree of environmental disclosure by 30 international construction companies. It may or may not reflect the environmental performance by the companies; however it could be useful for investors, NGOs and other stakeholders if the companies reported according to the same system. Following the same reporting and measurement system would facilitate ratings and comparative performance analyses.
2) We have aggregated indicators from different environmental assessment tools into one pool containing 41 indicators. After qualifying the reports against these indicators a conclusion was made that 3 indicators are irrelevant to the industry or are formulated incorrectly. Besides, we found 6 issues that the construction companies disclosed on that were not mentioned in our original indicator list. Out of these 6 indicators only 2 are construction industry-specific.
3) The indicators that were covered in all or majority of the reports deal with legally regulated environmental issues, create a positive image of the company and are relatively easy to collect the information about. The indicators that were poorly covered in the reports are difficult to measure and benchmark or obtain information about.
4) Even though the majority of construction companies follow GRI guidelines to structure their non-financial reports, they have the freedom to choose what topics they disclose on and to what extent. They also interpret differently what each indicator means. Unless the companies are encouraged to use more of quantitative data and provide lists and examples of practices, innovations, affected species, etc. it is difficult to compare their performance without collecting primary data via surveys and/or audits.
5) We ran regression analysis with the aim to find out whether higher degree of disclosure associates with higher return on investment. The result was not significant enough to confirm the hypothesis, which is why additional influence factors can be looked for in further research.

Conclusions

The **main purpose** of this paper was to reveal the main tendencies in the environmental disclosure in the international construction industry.

In order to do so, we started the paper by analysing the limitations of environmental assessment methodologies discussed in scientific research. We have looked at the most popular sustainability disclosure and performance assessment tools. They can be divided into non-industry specific (such as GRI, ESG) and industry-specific tools (such as LEED, BREEAM). The latter are focused on the green product and do not help assess the performance at a corporate level.

Then we collected a pool of environmental performance indicators from four different sources: GRI, KLD Analytics, RobecoSAM and Walls et al. (2011). We matched the indicators that have the same subject matter and shortlisted them to eliminate repetition and establish maximum coverage of the issues. After that, we screened 30 environmental reports published by the international construction companies according to the indicator list. We assigned scores for full and partial disclosure and ranked the companies by the sum of the scores. This allowed us to run a regression analysis later to find whether there is a relationship between the degree of environmental disclosure and ROI.

From the academic literature we have found out that non-financial reporting might be a powerful medium of communication with the stakeholders, it creates an image about the company and could help attract new, sustainability-conscious, investors. However, as is shown in chapter 3 of this paper, reports are of little use when it comes to comparing companies' environmental performances.

Answering the **research question 1**, we can say that unless the companies are obliged to report by the same system and have similar degree of disclosure, there is too much missing data that hinders comparative analysis.

All companies, except Samsung Engineering, disclosed on less than 50% of indicators. Companies that do not use any reporting standard as a reference showed the least degree of environmental disclosure, as did the companies that use a very liberal ESG approach to reporting. The majority of the companies used the GRI format of reports, however not all of them were registered in the GRI database, which means not all those reports were graded by quality.

It was also found that almost all companies disclosed on the issues that are regulated by the governments (for example, GHG emissions and energy use), easy to collect information about and produce a positive image. The least disclosed indicators turned to be difficult to

measure and benchmark. In this case, the companies preferred to call them immaterial, or insignificant to the companies' goals and overall performance.

The **second research question** addressed industry-specific indicators that might be found in the non-financial reports beyond the original set of indicators. We found that the companies sometimes disclosed in more detail about environmental issues that it was prescribed in the standards, but only two industry-specific indicators were found among them: s*oil removed*, *reused soil* and *construction-generated soil emissions.*

Finally, the results of the regression analysis showed that higher ROI is not associated with higher degree of environmental disclosure (answer to the **research question 3**). This means that the environmental disclosure degree alone is not enough to facilitate investor decision-making. Besides, the lack of investor pressure to report the environmental performance might explain such low degree of disclosure in the industry.

Therefore, the main influential factors for the environmental disclosure in non-financial reports remain to be only the measurability of the issues (and, thus, the easiness to collect information) and the established environmental regulations.

Managerial implications

One of the products of this paper is a set of environmental indicators which can be used by companies, consulting and rating agencies as a comprehensive tool to evaluate environmental performance. Besides, it can be used by companies looking for ways to enrich their sustainability reports.

A clarification was made about the role of non-financial reporting for investor decision-making, which is a message for the industry that environmental disclosure alone is not enough for investor attractiveness.

The implication for the reporting standards comes from the analysis of the least covered environmental issues. Formulation or even subject matter of a few indicators could be changed so that the reports provide measurable and benchmarkable data that is easier to collect for the companies and is more usable by external parties assessing the actual performance.

Theoretical implications and further research perspectives

This paper presents a holistic tool for corporate environmental assessment in the construction industry. The framework includes perspectives of different stakeholders by

aggregating the environmental indicators from a reporting standard, rating methodologies and an academic paper.

The hypothesis about the influence of the degree of environmental disclosure on investor attractiveness was not confirmed which opens new issues for future research. It can be further explored whether degree of disclosure on all three aspects of sustainability together (social, economical and environmental) actually influences investor attractiveness of a construction company. Surveys and interviews with investors and other stakeholders can be used for more insights about the role of non-financial reporting for investor decision-making in the construction industry.

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Appendix 1. List of studied companies

ENR 2016 position*	Name of the company	Headquarters
1	ACS, Actividades de Construcción y Servicios	Madrid, Spain
3	CCCG (China Communications Construction Group Ltd.)	Beijing, China
4	VINCI	Rueil-Malmaison Cedex, France
8	Skanska AB	Stockholm, Sweden
9	Strabag SE	Vienna, Austria
11	CSCI (China State Construction Engineering Corp. Ltd.)	Beijing, China
12	Saipem	San Donato Milanese, Italy
13	Ferrovial	Madrid, Spain
14	Hyundai Engineering & Co. Ltd.	Seoul, S. Korea
15	Petrofac Ltd.	Jersey, U.K.
16	Fluor Corp.	Irving, Texas, U.S.A.
17	CIMIC Group Ltd.	St. Leonards, Australia
18	Salini ImpreglioSPA	Milan, Italy
20	Samsung C&T Corp.	Gueonggi-do, S. Korea
21	China Railway Group Ltd.	Beijing, China
22	Technicas Reunidas	Madrid, Spain
24	Royal BAM Group NV	Bunnik, The Netherlands
29	Odebrecht Engenharia e Construçao SA	São Paulo, SP, Brazil
30	Obayashi Corp.	Tokyo, Japan
32	Orascom Construction Ltd.	Dubai, U.A.E.
33	Larsen & Toubro Ltd	Mumbai, Maharashtra, India
34	Samsung Engineering Co Ltd	Seoul, S. Korea
35	SK E&C	Seoul, S. Korea
37	OHL SA (Obrascon Huarte Lain SA)	Madrid, Spain
39	Toyo Engineering Corp.	Chiba, Japan
40	Kajima Corp.	Tokyo, Japan
43	SNC-Lavalin Inc.	Montreal, Quebec, Canada
44	Jan De Nul Group (Sofidra SA)	Capellen, Luxemburg
45	NCC AB	Solna, Sweden
48	China Metallurgical Group Corp. (CMG)	Beijing, China

*the companies that did not fit the selection criteria are not included in this table

Appendix 2. Pool of environmental indicators (grouped by source and subject matter)

	GRI	KLD	DJSI	Walls et al 2011	Final indicator name
1	(G4-EN1) Materials used by weight or volume.	-	Operational Eco-Efficiency	-	Materials consumption
2	(G4-EN2) Recycled input materials (in %)	Pollution Prevention (ENV-str-B), Recycling (ENV-str-C)	Operational Eco-Efficiency	-	Proportion of materials recycled
3	(G4-EN3) Direct energy consumption by primary energy source	Clean Energy (ENV-str-D)	Electricity Generation	-	Direct energy consumption
4	(G4-EN4) Indirect energy consumption by primary source	Clean Energy (ENV-str-D)	Electricity Generation	-	Indirect energy consumption
5	(G4-EN5) Energy intensity	-	Operational Eco-Efficiency	-	Energy intensity
6	(G4-EN6) Energy saved / reduced	-	Operational Eco-Efficiency	-	Energy saved / reduced
7	(G4-EN7) Reductions in energy requirements of products and services	Pollution Prevention (ENV-str-B)	Transmission & Distribution	Environmental R&D, product design and development processes, innovation	Reductions in energy requirements of products and services
8	(G4-EN8) Total water withdrawal by source	-	Water-Related Risks	-	Total water consumption
9	(G4-EN9) Water sources significantly affected by withdrawal of water	-	Water-Related Risks	-	Water sources significantly affected by withdrawal of water
10	(G4-EN10) Percentage and total volume of water recycled and reused	Recycling (ENV-str-C)	Water-Related Risks	-	Percentage of water recycled/reused
11	(G4-EN11) Operations in or adjacent to protected areas	-	Biodiversity	-	Operations in or adjacent to protected areas
12	(G4-EN12) Direct and indirect impacts on biodiversity	-	Biodiversity	-	Direct and indirect impacts on biodiversity

Appendix 2 (Continued). Pool of environmental indicators

13	(G4-EN13) Habitats affected, protected or restored	-	Biodiversity	-	Habitats affected, protected or restored
14	(G4-EN14) Total number of IUCN Red List species and national conservation list species with habitats in areas affected by operations, by level of extinction risk	-	Biodiversity	-	Number of endangered species affected by operations
15	(G4-EN15, 16) Total direct and indirect greenhouse gas emissions by weight (scope 1,2)	Substantial Emissions (ENV-con-D), Climate Change (ENV-con-F)	Climate Strategy	-	Total direct GHG emissions (scope 1 and 2)
16	(G4-EN17) Other relevant indirect greenhouse gas emissions by weight (scope 3)	Substantial Emissions (ENV-con-D), Climate Change (ENV-con-F)	Climate Strategy	-	Indirect GHG (scope 3)
17	(G4-EN18) GHG emissions intensity	Substantial Emissions (ENV-con-D), Climate Change (ENV-con-F)	Operational Eco-Efficiency	-	GHG emissions intensity
18	(G4-EN19) Initiatives to reduce greenhouse gas emissions and reductions achieved	Pollution Prevention (ENV-str-B), Climate Change (ENV-con-F)	Climate Strategy	-	Reductions in GHG
19	(G4-EN20) Emissions of ozone-depleting substances by weight	Ozone Depleting Chemicals (ENV-con-C)	Climate Strategy	-	Emissions of ODS by weight
20	(G4-EN21) NO, SO, and other significant air emissions by type and weight	Substantial Emissions (ENV-con-D)	Climate Strategy	-	NO, SO, and other significant air emissions by type and weight
21	(G4-EN22) Total water discharge by quality and destination	-	Water-Related Risks	-	Total water discharge
22	(G4-EN23) Total weight of waste by type and disposal method	Recycling (ENV-str-C)	Operational Eco-Efficiency	-	Total weight of waste by type and disposal method

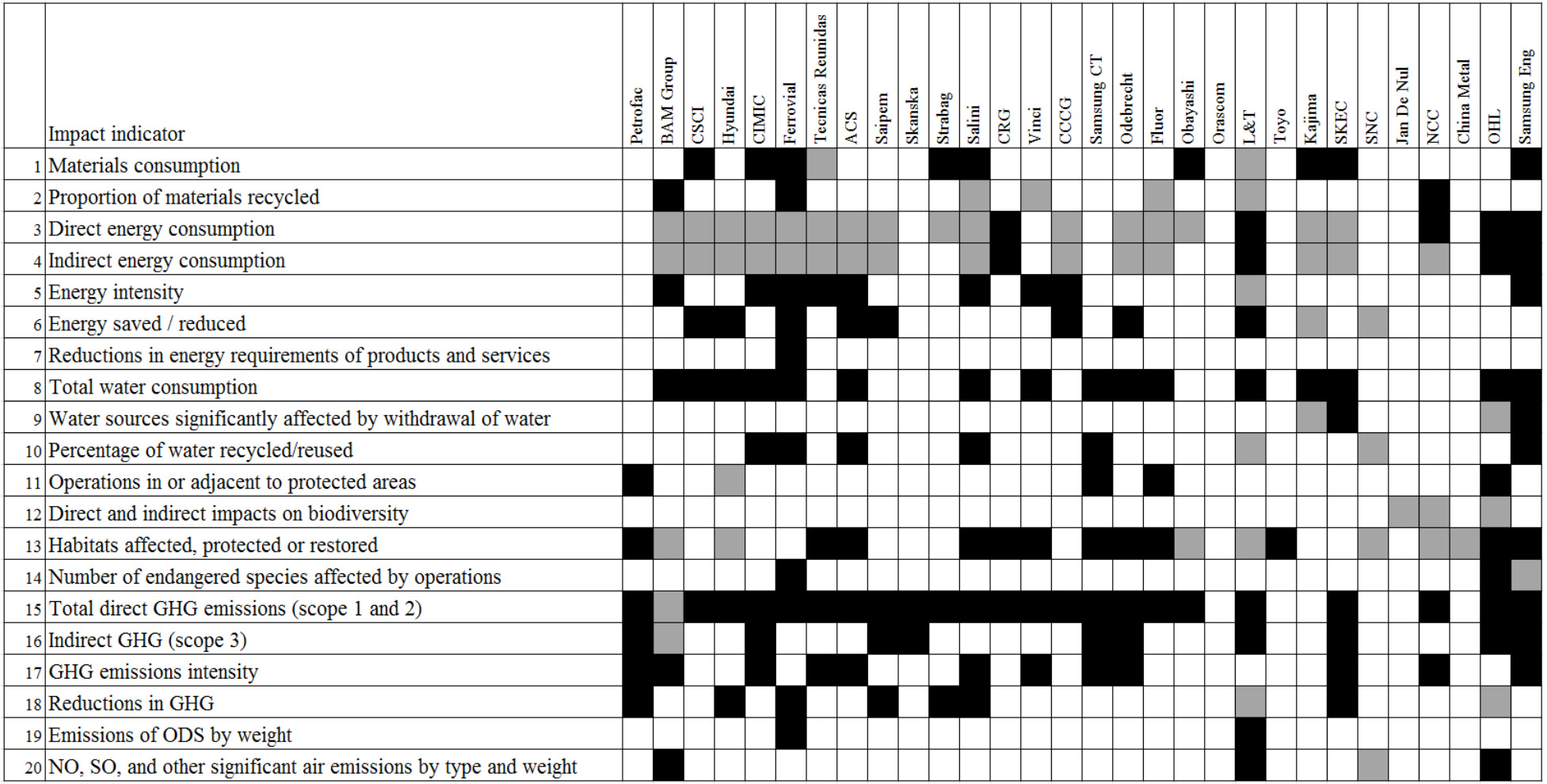
Appendix 2 (Continued). Pool of environmental indicators

23	(G4-EN24) Total number and volume of significant spills	-	-	-	Total number and volume of significant spills
24	(G4-EN25) Weight of transported, imported, exported, or treated waste deemed hazardous, and percentage of transported waste shipped internationally	Hazardous Waste (ENV-con-A)	Transmission & Distribution	-	Weight of hazardous waste transported and treated
25	(G4-EN26) Water bodies and related habitats significantly affected by the discharges of water and runoff	-	Water-Related Risks	-	Water bodies and related habitats significantly affected by the discharges of water and runoff
26	(G4-EN27) Environmental impacts of products and services, and extent of impact mitigation	Beneficial Products and Services (ENV-str-A)	-	Environmental R&D, product design and development processes, innovation	Environmental impacts of products and services
27	(G4-EN28) Percentage of products sold and their packaging materials that are reclaimed	Beneficial Products and Services (ENV-str-A)	-	-	Percentage of products sold and their packaging materials that are reclaimed
28	(G4-EN29) Monetary value of significant fines; number of non-monetary sanctions for noncompliance	Regulatory Problems (ENV-con-B), Other Concern (ENV-con-X) (controversies)	-	-	Value of non-compliance fines
29	(G4-EN30) Significant environmental impacts of transporting products as well as transporting members of the workforce	-	Transmission & Distribution	-	Impacts of transportation of resources and people
30	(G4-EN31) Total environmental protection expenditures and investments by type	-	-	-	Total environmental protection expenditures and investments by type

Appendix 2 (Continued). Pool of environmental indicators

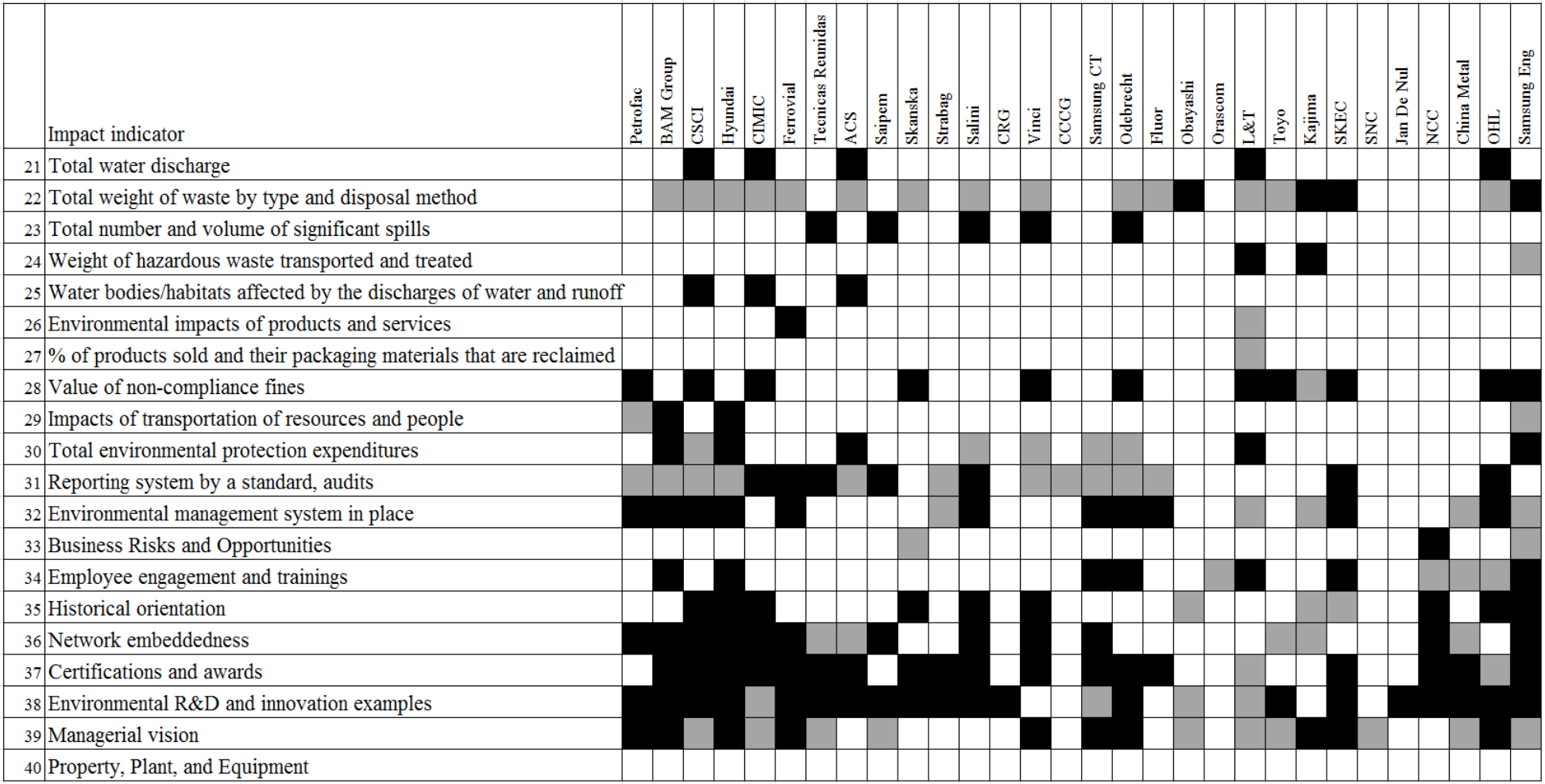
31	-	Communications (ENV-str-E)	Environmental Reporting	Reporting system	Reporting system by a standard, audits
32	(G4-DMA) Management approach	Management Systems (ENV-str-G)	Environmental Policy & Management Systems	Environmental management system in place	Environmental management system in place (CSR department, executives)
33	-	-	Business Risks and Opportunities	-	Business Risks and Opportunities
34	-	-	-	Employee trainings	Employee engagement and trainings
35	-	-	-	Historical orientation	Historical orientation
36	-	-	-	Network embeddedness (inclusion of supply chain and other stakeholders)	Network embeddedness
37	-	-	-	Certifications and awards (endowments)	Certifications and awards
38	-	-	-	Environmental R&D, product design and development processes, innovation	Environmental R&D and innovation examples
39	-	Other Strength (ENV-str-X)	-	Managerial vision	Managerial vision
40	-	Property, Plant, and Equipment (ENV-str-F)	-	-	Property, Plant, and Equipment
41	-	Agricultural Chemicals (ENV-con-E)	-	-	-

Appendix 3. Degree of disclosure grid



- not disclosed - partly disclosed - fully disclosed

Appendix 3 (Continued). Degree of disclosure grid



- not disclosed - partly disclosed - fully disclosed

Appendix 4. Ranking by the degree of environmental disclosure

Company name	Reporting standard used	Number of indicators disclosed	ROI
Samsung Egineering	GRI	22	0,069
L&T	GRI	19,5	0,458
OHL	GRI	19	0,289
Ferrovial	AA1000 + GRI	18,5	0,059
Salini	GRI	17,5	0,051
BAM Group	GRI	16,5	0,003
CIMIC	GRI	16,5	0,061
SKEC	GRI	16,5	0,081
Hyundai	GRI	16	0,066
Odebrecht	GRI	15,5	N/A
CSCI	ESG + GRI	15	0,118
ACS	GRI	14,5	0,043
Samsung CT	GRI	13,5	0,006
Vinci	GRI	13	0,121
Petrofac	GRI	12	0,067
NCC	GRI	11	0,278
Tecnicas Reunidas	GRI	10,5	0,030
Saipem	GRI	9,5	-0,130
Kajima	GRI	9	0,157
Fluor	GRI	8,5	0,033
Skanska	none	7	0,036
Strabag	GRI	6,5	0,035
Obayashi	none	5,5	0,077
CCCG	ESG	4,5	0,067
Toyo	none	4,5	0,038
China Metal	ESG + GRI	4,5	0,125
CRG	none	4	0,028
SNC	GRI	2,5	0,142
Jan De Nul	none	1,5	0,336
Orascom	none	0,5	-0,013

Appendix 5. Degree of disclosure by indicators

Indicator № *	Impact indicator	Disclosed times, out of 30	Disclosed in %
15	Total direct GHG emissions (scope 1 and 2)	24	80%
3	Direct energy consumption	21	70%
4	Indirect energy consumption	21	70%
37	Certifications and awards	20	67%
39	Managerial vision	20	67%
13	Habitats affected, protected or restored	19	63%
22	Total weight of waste by type and disposal method	18	60%
31	Reporting system by a standard, audits	18	60%
36	Network embeddedness	17	57%
8	Total water consumption	16	53%
32	Environmental management system in place	16	53%
17	GHG emissions intensity	12	40%
28	Value of non-compliance fines	12	40%
35	Historical orientation	12	40%
1	Materials consumption	11	37%
16	Indirect GHG (scope 3)	11	37%
34	Employee engagement and trainings	11	37%
5	Energy intensity	10	33%
6	Energy saved / reduced	10	33%
30	Total environmental protection expenditures	10	33%
18	Reductions in GHG	9	30%
10	Percentage of water recycled/reused	8	27%
2	Proportion of materials recycled	7	23%
38	Environmental R&D and innovation examples	6	20%
11	Operations in or adjacent to protected areas	5	17%
21	Total water discharge	5	17%
23	Total number and volume of significant spills	5	17%
9	Water sources signif. affected by withdrawal of water	4	13%
20	NO, SO, and other signif. air emissions by type and weight	4	13%
29	Impacts of transportation of resources and people	4	13%
12	Direct and indirect impacts on biodiversity	3	10%
14	Number of endangered species affected by operations	3	10%
24	Weight of hazardous waste transported and treated	3	10%
25	Water bodies/habitats affected by the discharges of water and runoff	3	10%
33	Business risks and opportunities	3	10%
19	Emissions of ODS by weight	2	7%
26	Environmental impacts of products and services	2	7%
7	Reductions in energy requirements of products and services	1	3%
27	% of products sold and their packaging materials that are reclaimed	1	3%
40	Property, plant, and equipment	0	0%

*as they appeared in Annex 2