Towards

SUSTAINABLE PROJECTS

Rosanne Stel - April 2019
MSc. Construction, Management & Engineering

TU Delft
Royal HaskoningDHV

COLOPHON

Title	Towards sustainable projects
Subtitle	A research into the reasons influencing the integration of sustainability aspects into projects within the engineering sector
Date defence	25-04-2019

Author

Name	Rosanne Stel
Student number	4464001
E-mail	rosannestel@gmail.com

Study program	MSc. Construction, Management & Engineering
Faculty	Faculty of Civil Engineering and Geoscience
University	Delft University of Technology

Graduation Committee

Chair	Prof. Dr. H.L.M. (Hans) Bakker
First supervisor	Dr. D.F.J. (Daan) Schraven
Second supervisor	Ir. B.R. (Brian) Baldassarre, MSc.
External supervisor	Dr.Ir. J.R. (Jan Reinout) Deketh

Institution

TU Delft
Civil Engineering and Geosciences
Stevinweg 1
2628CM Delft
www.tudelft.nl

Graduation company

Royal HaskoningDHV
Enhancing Society Together
George Hintzenweg 85
3068AX Rotterdam
www.royalhaskoningdhv.nl

PREFACE

Writing this preface, I thought about my Bachelor's thesis and looked at the acknowledgement I wrote a few years ago. I concluded that thesis with the sentence: "*This is my first thesis, in a few years the next one*". And here it is, my Master's thesis as the final product of my participation in the Master's Degree course 'Construction Management and Engineering' at the Delft University of Technology.

During my first internship at a contractor, I became interested in the differences between company ambitions and the way execution was performed. I noticed that even when the ambitions are high, only part of the ambitions are really realised. When I attended a presentation of Royal HaskoningDHV, the company ambition 'Enhance Society Together' triggered me. In a follow-up meeting, I noticed that the translation from ambition to realisation of a company vision or a new concept is a challenge in engineering consultancy companies as well. Combined with my personal interest for sustainability, the topic of this research was born.

This research would not have been possible without the guidance and feedback of my graduation committee. You taught me how to be more critical and work in a more structured way. Daan, I would like to thank you for your feedback and many discussions. I learned a lot from your systematic approach and how to define a route beforehand so that I just had to walk in a straight line. This may sound easy but it was not always easy for me. As you once mentioned, you had to push me from relevance to rigorous otherwise I would keep jumping around. Brian, I would like to thank you for the positive conversations we had and the time you took for me. These gave me new energy and helped me to see things clearly. You taught me how to keep things simple, often in combinations with nice and clear sketches. Jan Reinout, I would like to thank you for helping me get to know the company and believing in me when I proposed tight schedules and lofty ambitions. Hans, I would like to thank you for the constructive feedback you gave during the meetings and the way how you continued to challenge me to deliver the best results within an ambitious timeline.

I am grateful to have been able to conduct this research in collaboration with Royal HaskoningDHV and thanks to my colleagues who always were available to test new ideas, propose new connections and relevant news items or take some time for discussions. Special thanks to René who fulfilled the role as 'organisational' supervisor for me within RHDHV Rotterdam and made me feel welcome in the team from the first moment. I would like to express my gratitude to all the participants within this research, who took the time to share their experiences with me. The examples and reflections on this research helped me a lot.

Many others have contributed to this thesis. I would like to thank my friends and family for supporting me during this thesis period and beyond. Special thanks to my parents, who made it possible that I am where I am and for always being there for me. Last but not least, Niels, thank you for your continuous trust and support.

Enjoy reading!

Rosanne Stel
Rotterdam, April 2019

EXECUTIVE SUMMARY

With the signing of the Paris Agreement (UNFCC, 2015), over 170 countries agreed to put their best foot forward in trying to mitigate the effects of climate change. The engineering and construction industry can, through projects they execute, contribute directly to this necessary and ambitious goal. Moreover, the construction industry is considered one of the most polluting industries and one of the largest users of natural resources.

At a very high level, construction projects can be divided in two parts, one of engineering and one of execution. While execution is the act of performing the construction, engineering is the work involved in designing and constructing deliverables and as such, is the option to scope and design for sustainability the greatest. In other words, the engineering part of a project plays a vital role. That is why in this research, the focus is on engineering projects.

This thesis 'Towards sustainable projects´ will focus on the integration of sustainability aspects in projects in the engineering industry. This research uses the following definition for 'sustainability': "*meeting the needs of the present without compromising the ability of future generations to meet their own needs*" (Brundtland, 1987). This means that in this research 'sustainability' is about aspects which ensure that a population's present and future needs can be met. These are in essence relevant variables within the three 'topics' within sustainability: environmental, economic and societal aspects.

The integration of sustainability within engineering projects is still limited. Regulation and tools give guidance on integrating sustainability aspects, for example BREEAM and the Sustainable Development Goals, however, these seems to be more of an exception rather than a rule. Even though projects are part of a bigger system, they can influence the part they are involved in. As Robert Swan quotes (2012): "*The greatest threat to our planet is the belief that someone else will save it*." The role of project managers is to steer their projects. Project manager are the connecting link between the client and the engineers, and from this position they can influence both parties to incorporate sustainability in their projects.

It is unclear what influences the incorporation of sustainability in projects, so the following main research question needs to be answered: **What influences the integration of sustainability in engineering projects?**

In order to answer this main research question, three research steps were taken. Firstly, the most relevant sustainability aspects within projects were collected from Sustainable Impact Assessments (SIAs) from literature. Thirty aspects were selected as most important for sustainable projects as these were mentioned most in all SIAs. The thirty aspects consist of: eleven aspects about the environment, for example minimising CO2 emissions or minimise the amount of waste; eleven aspects about society, for example development of human capital or respecting human rights; and eight aspects about economy, for example procurement and business agility.

Secondly, a group of 20 Dutch project managers of Royal HaskoningDHV with various types of projects within the engineering industry ranked the thirty sustainability aspects based how difficult it was to integrate the sustainability aspects in their project. It was determined that the aspects about people were most easy to integrate, meaning 'health & safety', 'ethical behaviour', 'fair and safe labour' and 'human rights'. On the other hand, the most difficult aspects to integrate were the aspects about planet, meaning 'transport', 'CO2 emissions, 'harmful emissions' and 'material efficiency'.

Thirdly, the participants were asked to give motivations for ranking the five most easy and most difficult sustainability aspects to integrate in projects, as they have during the second step. It was expected that project characteristics as the type of project, the type of client and the project size would influence the ease of integrating sustainability aspects in projects. Results show that the integration is influenced more by the personal motivation of the client, the project manager or the company strategy and vision, rather than by the project's characteristics. This is shown in the interviews and because there is no direct link between the sustainability aspects and the project's characteristics.

In order to answer the main research question, the most influencing reasons can be divided into five groups: process, product, supplier, client and society.

Figure 1 shows the five groups and their mutual relations. 'Process' is about how people work to realise the project. People working on the process need a mindset which focuses on the sustainability impact of the project in order to help integrate sustainability. The process is influenced by the supplier, who has a role as facilitator and inspirator. 'Product' is about the contract scope and requirements, which can be influenced by the process but is set by the client. 'Focus' and 'shared responsibility' help within this group to integrate sustainability. As the client is indirectly influenced by the supplier and directly influences the product, he or she needs an open attitude towards integrating sustainability. The group society is about laws and regulations and local culture. This group has an overarching role influencing the other four groups.

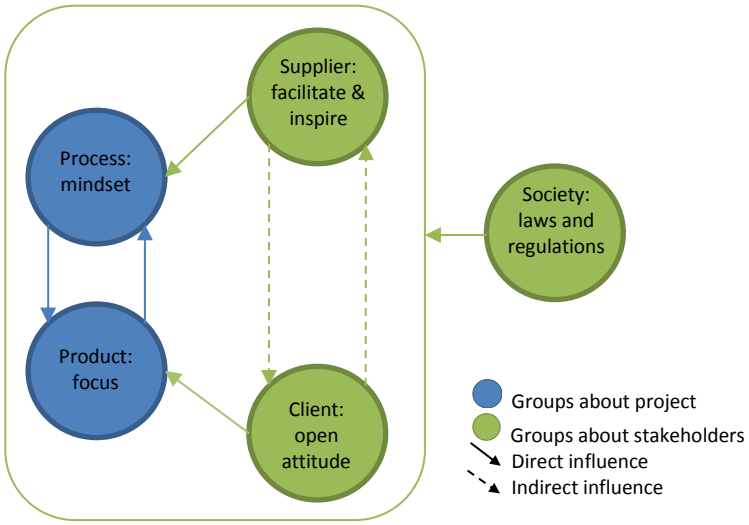

Figure 1 Groups with actions influencing the integration of sustainability in engineering projects

The five most mentioned reasons are within the project's process and product. Three of these fall within 'process': 'inclusion within standard working practice', 'perception of importance of the aspect to the project goals' and 'perception of responsibility or influence of the project manager'. Two fall within the 'product': 'inclusion in project scope' and 'perception of room for improvements within the contract'.

The research indicates that integration of sustainability is not the full responsibility of one person, but, everyone can influence the integration of sustainability from their circle of influence. All stakeholders of a project can contribute to the integration of sustainability in a project from their own position, but collaborative actions have bigger impacts.

This research contributes to practical solutions in two ways. Firstly, by presenting groups which influence the integration and suggesting actions per group which increase sustainability in projects. This could help to define actions towards sustainable projects from different viewpoints. Secondly, by emphasising on contributions one can make as an individual and in co-operations. This enlarges the awareness of individuals involved in engineering projects to take their responsibility towards contributing to sustainability. After all, the future depends on what we do in the present.

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DEFINITIONS

- **Aspect of sustainability** is a particular part of sustainability
- **Driver** is a factor which causes a particular phenomenon to happen or develop *(Oxford Dictionaries, n.d.-b)*
- **Engineering** is the work involved in designing and constructing deliverables, i.e. engines, machinery, or structures such as roads and bridges (Collins dictionary, n.d.)
- **Sustainability** is meeting the needs of the present without compromising the ability of future generations to meet their own needs *(World Commission on Environment and Development, 1987)*
- **Sustainable project management** involves managing a project's social, environmental and economical impacts by an approach that considers uncertainty, flexibility, complexity and opportunity *(A.J.G. Silvius, 2018)*
- **Project** is a temporary endeavour undertaken to create a unique product, service, or result *(Project Management Institute, 2013:553)*
- **Operationalise** means to put something into operation or use to determine or prove it, be in action or have an effect (Oxford Dictionaries, n.d.-a)
- **Integrate** means to combine (two things) so that they form a whole or to bring equal participation in or membership of a social group or institution
- **Implement** means to put (a decision, plan, agreement, etc.) into effect or to start using a plan or system

ACRONYMS

BREEAM	Building Research Establishment Environmental Assessment Method
IUCN	International Union for Conservation of Nature and Natural Resources
PM	Project manager
RHDHV	Royal HaskoningDHV
SDGs	Sustainable Development Goals
SIA	Sustainable Impact Assessment
TBL	Triple Bottom Line / Triple P (people – planet – profit)
UN	United Nation
UNEP	United Nations Environment Programme
UNFCC	United Nations Framework Convention on Climate Change
WWF	World Wildlife Fund

HIGHLIGHTED EXTRAS

These blocks show additional information or examples enriching the text, however not necessary to understand the text.

1 INTRODUCTION

The reason for this research is twofold. First, performing a scientific research is part of completing the Master Construction Management and Engineering. Due to interest of the researcher, the focus is on integrating sustainability in projects. Second, there is a gap between science and practice regarding integrating sustainability. Science provides models and methods to integrate sustainability, however, companies indicate the translation of sustainability from ambition level to realisation as a challenge.

There is a worldwide trend to increase sustainability, on large scale in international agreements and on smaller scale in rising initiatives and businesses. Sustainability not only focuses on the traditional environmental impact, but also includes social and economic impact. The most applied definition of sustainability is: *"meeting the needs of the present without compromising the ability of future generations to meet their own needs"* (Brundtland, 1987).

The social, environmental and economic parts of sustainability are also called the Triple Bottom Line: People, Planet and Profit (Elkington, 1998)

There are several trends in which the importance of sustainability is emphasised, for example growing public and political consciousness of sustainability issues which shapes the face of businesses (Bowater, 2018), emphasis on the complexity and coherence between all systems in the world (Raworth, 2017), and international agreements for worldwide improvement in the form of the Sustainable Development Goals (United Nations, 2016).

With the worldwide importance of sustainability, companies can contribute to the application of sustainability, which leads to (financial) benefits for them as well (Mauro L. Martens & Carvalho, 2017). Guiding principles are mentioned in science, but practice shows companies are still struggling with integrating sustainability in their projects. "*Although the term sustainability has been established in science and everyday life, the content and especially the operationalization of the basic idea remains controversial*" (Kammerl, Zink, Hollauer, & Lindemann, 2017)(p. 190).

One of the companies which wants to contribute to sustainability in their daily work is Royal HaskoningDHV (RHDHV), an independent international engineering and project management consultancy company. RHDHV was selected as case study for this research because of its ambition to be a leader in sustainable development and innovation, and in this way contribute to a better society. RHDHV's slogan is 'Enhance Society Together' and it aims to stimulate its employees to deliver better, more sustainable projects by triggering its clients with questions on a level which stretches the project scope if required. These questions are about stakeholder requirements, added value, future-proof results, and minimising the use of natural resources and energy.

1.1 Problem analysis

The most commonly cited reasons for the struggle that companies have to integrate sustainability in their daily work are the vague and broad definition of sustainability with no clear set of sustainability aspects, multiple ways to assess the impact of sustainability which are minimally applied in practice, and a lack of integrating sustainability in projects (Kammerl et al., 2017; Mauro L. Martens & Carvalho, 2017; I Oehlmann, 2010; Økland, 2015; A. J. G. Silvius, 2018; Zijp, 2017). The need to translate the general principles of sustainability into operational definitions and practices is underlined by López-Ridaura, Masera, & Astier (2000).

The construction industry is one sector in which there are many possible improvements regarding sustainability. Within the Netherlands, the construction industry is responsible for almost half of the CO2 emissions, energy consumption, generated waste, raw materials used, transport of goods and water consumption, which are all sustainability aspects (ABN AMRO & Circle Economy, 2015; BAM & ARUP, 2017; The Ministry of Infrastructure and the Environment, 2016 cq. Hertogh, 2018). At a very high level, construction projects can be divided in two parts, one of engineering and one of execution. While execution is the act of performing the construction, engineering is the work involved in designing and constructing deliverables and as such, is the option to scope and design for sustainability the greatest. In other words, the engineering part of a project plays a vital role. That is why in this research, the focus is on engineering projects.

Examples of engineering projects are all works to deliver: roads, rails, bridges, factories, hospitals, offices, urban (re)developments, airports, canals or water treatment plants.

Most of the work within the construction industry is performed via projects. Projects are uniquely suited to address the sustainability challenges and to practically integrate sustainability because of the temporary and focussed structure (Bocken, Schuit, & Kraaijenhagen, 2018; GPM Global, 2016; Økland, 2015). Project managers are in most cases the linking pin between strategic management and practical execution within projects. Within this role, they can influence project success (Hassan, Bashir, & Abbas, 2017).

The problem analysis can be summarized in the statement that it is unclear what influences the integration of sustainability in projects.

1.2 Research objective

As mentioned in the previous sub-chapter, even though the importance of sustainability within engineering projects is emphasised in multiple sources, it is unclear what influences the integration of sustainability in projects. The objective for this research is to contribute to addressing the gap by finding reasons, given by project managers, which influence the integration of sustainability in projects.

1.3 Research questions

Research questions help to deliver the research objective. Sub-questions are stepping stones to answer the main question. In this research, the following main question will be answered: **What influences the integration of sustainability in engineering projects?**

To support answering the main question, four sub-questions are designed:

1 How can sustainability be defined in the context of engineering projects?

The goal of the first question is to provide background information about the topics ‘sustainability’, ‘engineering projects’, and ‘integration of sustainability’, based on a literature review. This information is necessary for understanding what this research is about as well as providing input for the selection of sustainability aspects relevant within engineering projects. The sources listing sustainability aspects are the input for the next question.

2 How can the integration of sustainability in engineering projects be measured?

The goal of this question is to find a strategy for collecting the necessary data to fulfil the research objective. As the measurement of integrating sustainability tends to be subjective, Q-methodology is applied. This method is specific for subjective scientific research. Within the chapter answering this sub-question, the following topics are described 1) how the literature of the previous question provides sustainability aspects which can be coded and merged to a manageable set. 2) How a group of project managers sorted the selected aspects to measure the ease of integration. This results in a top 5 of the most easy and difficult aspects to integrate. 3) How the answers of supportive interviews are coded into a manageable selection.

3 Which reasons influence the integration of sustainability aspects in engineering projects?

The goal of this question is threefold and shows the results of method described in the previous question: 1) a list of sustainability aspects which cover the topic ‘sustainability in projects’, based on literature resources. 2) The top five most easy and most difficult aspects to integrate in engineering projects, according to project managers. 3) The reasoning behind the most easy and difficult aspects to integrate.

4 How can the identified reasons be used in projects to achieve a higher level of sustainability?

The goal of this question is to bring forward the bigger picture of the results of the thesis. The reasons influencing the integration of sustainability are combined with literature which could contribute to strategic solutions for engineering companies to achieve sustainable projects. Moreover, results are validated to prove the reliability of this research.

1.4 Thesis structure

This sub-chapter is part of the introduction and describes the thesis structure. The thesis structure of the main body of this research is visualised in Figure 2. Chapter 2 covers a brief literature review that introduces the topics 'sustainability', 'sustainability in the engineering sector', and 'the integration of sustainability'. The subsequent chapter describes the methodology by recapping the objective and explaining how this will be addressed in this research. Chapter 4 presents the results of the research by defining what aspects of sustainability are relevant within engineering projects, how these aspects are integrated in projects and why some are easier to integrate in projects than others. This is followed by a discussion and validation of the findings in which the results are linked to the literature in an attempt to present a bigger picture, and the results are validated by experts. The thesis concludes with final comments about the results including the answer to the main research question, the research limitations, and recommendations for engineering companies and further research.

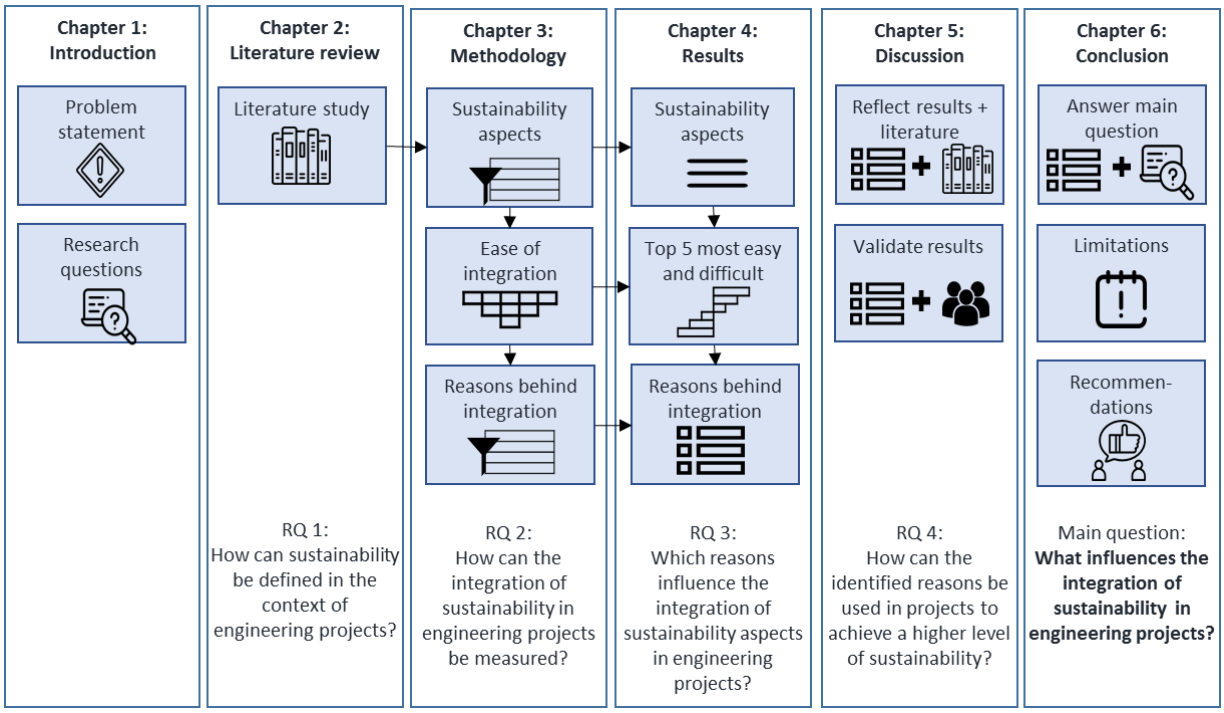

Figure 2 Thesis structure (own figure)

The footer on each page shows the chapter blocks of Figure 2 including one extra block: appendices. Extra information, raw data and examples are presented in the Appendices, following the structure of the main report. The first page of the Appendices shows the table of content of the chapter. The blocks in the footer are highlighted and contain links, corresponding to the chapter, easing the navigation throughout the report.

2 LITERATURE REVIEW

This chapter provides a short introduction to the three topics addressed in this research: 'sustainability', 'engineering projects' and 'integration of sustainability'. The content goes from broad to specific, starting with a broad elaboration on sustainability and engineering projects, where definitions and relevant concepts are addressed. Followed by a description of how sustainability is integrated into projects and a selection of sources which contain relevant sustainability aspects in projects. The selection of sources containing relevant sustainability aspects in projects answers the first sub-question: '**How can sustainability be defined in the context of engineering projects?'**

2.1 Sustainability

The first reference to sustainability can be linked to the book 'The Limits of Growth' written by Meadows et al. (1972) and is based on the principles of the Club of Rome, an informal international association that fosters understanding of the interdependent components of the global system in which we live. In this book, a connection is made between economics and population growth taking into account a finite supply of resources. The social component of sustainability was introduced in 1979 by the Canadian International Development Agency as eco-development. Its mandate was to "*support sustainable development in developing countries in order to reduce poverty and contribute to a more secure, equitable, and prosperous world*" (Pratt, 1994)(p. 366). In 1980 The World Conservation Strategy emphasised that *"the fruits of gradual experiential learning" show that "there could be no species preservation without habitat preservation and no habitat preservation without local livelihood security"* (IUCN, UNEP, & WWF, 1980 cq. Gibson, 2006)*(p. 261)*. In this quote the interconnection between habitat and security, meaning environment and society, is emphasised.

The most popular definition of sustainability comes from the Brundtland Report, written by the World Commission on Environment and Development (United Nations), in 1987: *"sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs"* (Brundtland, 1987). The general term 'needs' can reflect social development, environmental protection and/or economic growth. Elkington referred to these three pillars as the triple Ps: People - Planet – Profit, also called the Triple Bottom Line (TBL), which must be in harmony or balance (Elkington, 1998), see Figure 3. The interrelation between economy, nature and society is seen as more important but the concept is not new, since the combination of economy and nature has been discussed since the late 1960s (Haberl & Schandl, 1998). The World Summit on Sustainable Development redefined the TBL into People – Planet – Prosperity to emphasise on the financial impact of sustainability instead of just economic growth (European Commission, 2002).

Definition sustainability simplified: make sure your children's children could have the same opportunities and way of living as we have now.

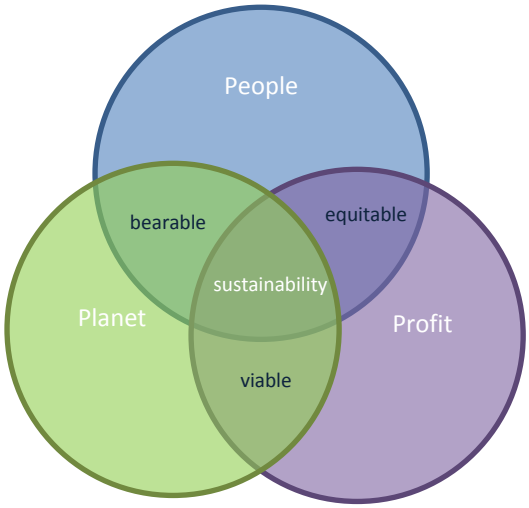

Figure 3 Triple Bottom Line (Mauro L. Martens & Carvalho, 2017)

Based on the Brundtland definition and the Paris Agreement, the United Nations (UN) defined eight Millennium Goals, in which poverty must be reduced before 2015 (United Nations, 2000). Because not all targets were met, for example inequalities persists and human progress is still uneven in the world (Kumar, Kumar, & Vivekadhish, 2016), the UN introduced the Sustainable Development Goals (SDGs) in 2016 with new goals to be realised between 2016 and 2030. These 17 goals, subdivided into 169 targets, cover a broad range of issues varying from human rights to environmental issues and sustainable economic growth, see Figure 4.

The UN is an international organisation established in 1945 and with members of 195 countries, aiming to solve world problems in a peaceful way.

Figure 4 The 17 Sustainable Development Goals (UN, 2015)

The SDG targets facilitate new understanding of sustainability and new learning through quantified analysis such as modelling. But, as a starting point not as an end point (Mair et al., 2017). Worldwide 9000 companies and 4000 non-profit businesses signed up to actively contribute to the realisation of the SDGs (United Nations Global Compact, 2018). In Western Europe, the focus is particularly on targets 8, 12 and 13 (FD, 2018).

Four privately held companies, working in the construction sector in Support Services and based in the Netherlands, committed to contributing to the realisation of the SDGs and integrated the SDGs into their annual year report (United Nations Global Compact, 2018). Table 1 shows which SDGs these companies committed to contribute to.

Table 1 Overview of a selection of companies contributing to the SDGs

	Sustainable Development Goals (SDGs)*															
Companies	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Arcadis NV (2017)			x	o	o	x	o	o	x		x	o	x	o	x		x
Deloitte (2017)			x	x	x		x	x	x	x		x				x	x
Royal HaskoningDHV (2017)				o		x	x	o	x		x	x	x				x
Witteveen & Bos (2018)			x			x	x	x	x		x	x	x	x	x		
x=strong contribution 0=intermediate contribution																	

2.2 Engineering projects

Engineering projects are typically complex and uncertain projects and involve many stakeholders (Yu, Zhu, Yang, Wang, & Sun, 2018). In 1994 the concept of sustainable construction was born at a tactical level in the building sector and in civil engineering (Fernández-Sánchez & Rodríguez-López, 2010). The requirements of sustainability challenges the project deliverables as well as the project delivery process (Gareis, Heumann, & Martinuzzi, 2010; Marcelino-Sádaba, González-Jaen, & Pérez-Ezcurdia, 2015).

Research indicates growth in project-based activities. In his book, The Focused Organization (2012), Antonio Nieto-Rodriguez identified the increasing shift from operations focus to projects focus over the last 100 years. Research has shown that as of 2014, approximately 30% of the world's GDP is spent on projects, and some forecasts suggest a rise to 40% by 2020 (GPM Global, 2016).

Project management is developing into a 'true' profession and with this comes a professional responsibility, perhaps even an ethical responsibility, to include sustainability. Project managers therefore need to take responsibility for integrating sustainability into their work (G. Silvius, Schipper, Planko, Brink, & Köhler, 2013), which would lead to a shift in scope in the management of projects; from managing time, budget and quality, to managing social, environmental and economic impact (A. J. G. Silvius, 2018).

Within projects, the project manager is at the wheel. (S)he is managing, monitoring and controlling all the necessary activities. According to Silvius et al. (2013), the relationship between project management and sustainability is rapidly gaining the interest of professionals and academics. If the project manager does not see a problem in the limited integration of sustainability in projects, it is likely he or she will not integrate a solution as well (Carnall, 2007; G. Silvius & Schipper, 2010).

A link can be made with the principles of Stephan Covey (1989). He developed the circles of influence and concern, as shown in Figure 5. In this figure the inner, green, circle is the circle of influence, consisting of things the project manager can influence or control. The outer, blue, circle defines the circle of concern, which the project manager is concerned about but has little control or influence over. The more a person focuses on one of the circles, the more that circle will grow. Consequently, with a bigger level of influence, more could be realised within engineering projects.

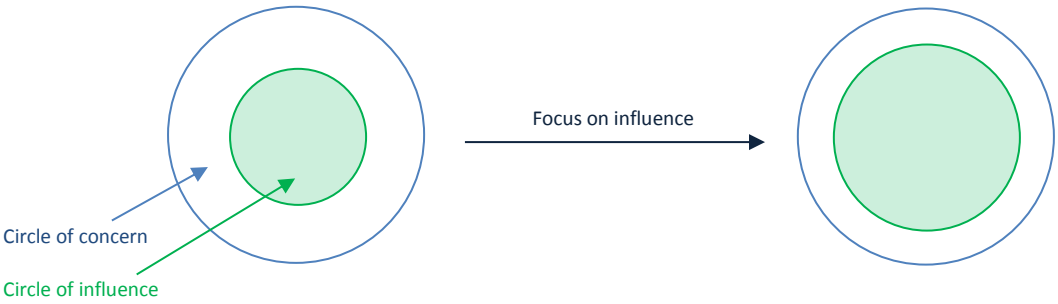

Figure 5 Circle of influence within circle of concern (Covey, 1989)

2.3 Integration of sustainability in projects

Once the concept of sustainability has been further analysed, and the role of the project manager within various engineering projects further elaborated, this chapter looks at the integration of sustainability within engineering projects.

Literature shows there is a need to translate the general principles of sustainability into operational definitions and practices (López-Ridaura et al., 2000). "*Although the term sustainability has been established in science and everyday life, the content and especially the operationalization of the basic idea remains controversial*" (Kammerl et al., 2017)(p. 190). Økland concludes in his research that a gap still exists between what is suggested in the literature and what is carried out in practice (2015).

Empirical studies could help to implement sustainability in projects. However, available empirical studies describing how the concepts of sustainability can be used within project management or what reasons influence the integration of sustainability in projects are limited (Mauro L. Martens & Carvalho, 2017; I Oehlmann, 2010; G. Silvius & Schipper, 2015; Szabó, 2016).

CROW performed an exploratory research into the present state and needs of municipalities regarding sustainable infrastructures. Their research emphasised the need for 'best' and 'bad' practices, in order to stimulate the integration of sustainability within projects (CROW, 2018; Trommel, Ven, & Sint Nicolaas, 2016). As acknowledged by employees in various exploratory interviews, this need is not only relevant for municipalities but also for engineering and project management consultancy firms.

CROW is a Dutch non-profit knowledge Centre for Regulation and Research in Soil, Water and Road Construction and Traffic Engineering.

Reasons influencing the integration can be both positive or negative, and intrinsic or extrinsic driven. Extrinsic influencers are based on external pressures (e.g. shareholder demands, or regulation). Intrinsic influencers are driven by morality and is thus a goal in its own right and focusses primarily on personal motivations (Muller & Kolk, 2010).

There are three levels at which sustainability can be implemented: personal, project and organisational level (G. Silvius, Schipper, & Planko, 2012). Figure 6 shows the best areas to integrate sustainable aspects into project management per process groups (Eid, 2009).

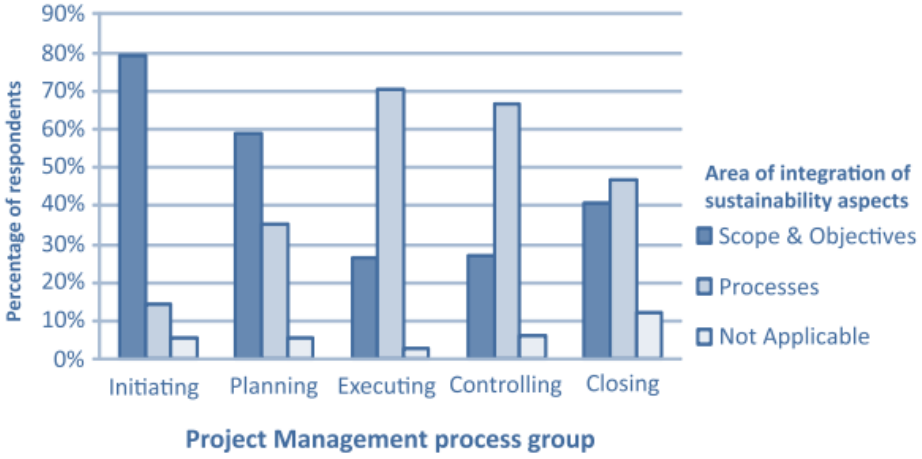

Figure 6 The best areas to integrate sustainable development into project management (Eid, 2009)

Project management can have a significant influence on the integration of sustainability within a project as can be seen above. However, it is not clear what the reasons are behind what influences the integration of sustainability, according to project manager. Assessments could help to get insight in the integration of sustainability.

To get insight into the integration of sustainability ambitions and the direction of the company, about 1000 methods and models have been designed (United Nations, 2014). The measurement of sustainability is

performed with Sustainable Impact Assessments (SIA), also called Maturity Models. The models are in all kinds of forms, varying between holistic qualitative approaches and focused quantitative approaches. Maturity models incorporate a set of criteria that describe a desired practice (e.g. a standard or procedure) and measure the compliance of practical processes along those criteria (Jong, Joss, Schraven, Zhan, & Weijnen, 2015).

The assessments can be assigned to strategic, tactical and operational level (Laedre, Haavaldsen, Bohne, Kallaos, & Lohne, 2015), and often direct decision-making towards sustainability. In most cases, indicators are used to divide sustainability into smaller parts, also called aspects or components (GPM Global, 2014; G. Silvius & Schipper, 2010; Szabó, 2016). Within this research the word ´aspect´ is used. Aspects break complex issues down into more readily understood chunks of information thus allowing communication between experts and non-experts (Merry, 2011, Morse, 2016). Likewise, through selection and measurement a finite set of quantified aspects that approximate the essential reasons of a concept, experts can 'measure' an otherwise immeasurable entity (Mair et al., 2017).

Most of the sustainability assessments are designed with a specific focus, for example for the type of industry or the phase of the project. Within this research the focus will be on sustainability aspects, relevant for projects within engineering projects. Within the literature, there are no assessments found of sustainability within engineering projects. However, relevant sustainability aspects can be collected from the most recent selection of Sustainability Impact Assessments with a focus on projects. Silvius (2018) performed the most recent review of structured project SIAs and found nine models.

1. Sustainability criteria for projects (G. Silvius & Schipper, 2010; G. Silvius et al., 2012)
2. Maturity model for the integration of sustainability in projects and project management (G. Silvius & Schipper, 2010)
3. Sustainable Footprint Methodology (I Oehlmann, 2010)
4. P5 Standard for Sustainability in Project Management Version 1 (GPM Global, 2014)
5. Project Sustainability Logbook (PSL) (FIDIC & EFCA, 2013)
6. Sustainable Project Management Maturity Model (SPM3) (G. Silvius & Schipper, 2015)
7. P5 Standard for Sustainability in Project Management Version 1.5.1 (GPM Global, 2016)
8. Project Sustainability Excellence Model (PSEM) (Szabó, 2016)
9. Project Sustainability Impact Assessment (PSIA) (Tam, 2017)

More information about each model can be found in Appendix **A.1** Sustainability Impact Assessments. The first two models are predecessors of the SPM3 model, model seven (P5) is the renewed version of model four and model nine does not predetermine sustainability aspects so these four are excluded. After this selection, only five of the nine models are used for this research to ensure that if the occurrence in literature is checked, the aspects of these models have similar weights since only the most relevant model per author is included.

These five SIAs can be used as source for the selection of the most relevant sustainability aspects in project and define sustainability in projects: 3, 5, 6, 7 and 8.

3 METHODOLOGY

The previous chapter summarised the history, definitions and relevance of sustainability, engineering projects and the combination of these two: the integration of sustainability in engineering projects. The result of the previous chapter was a list with sources containing sustainability aspects relevant within projects. These sources can be used to measure the integration of sustainability aspects in projects.

In order to answer the research question: '**How can the integration of sustainability in engineering projects be measured?'** it is vital to know what project managers think about sustainability and how they integrate sustainability in their projects. The measurement of sustainability integration in engineering projects requires three steps. This is visualised in Figure 7 and described below the figure.

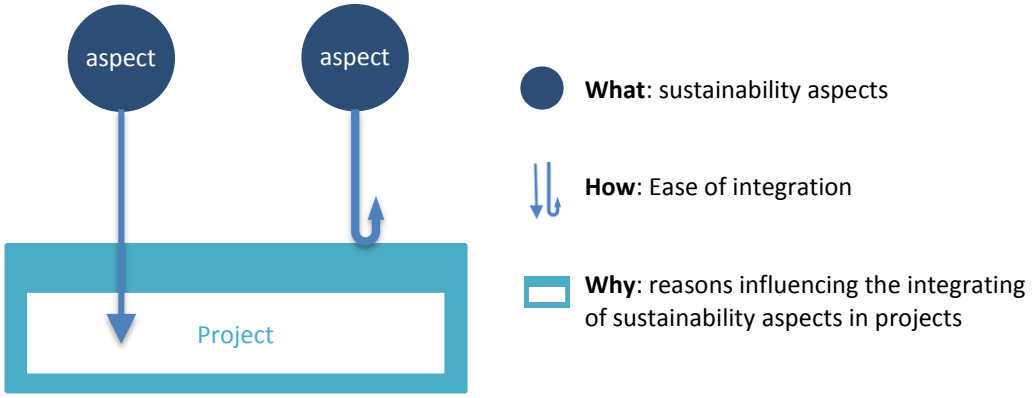

Figure 7 Process of integrating sustainability aspects into projects (own figure)

First, we need to know **what** sustainability aspects are relevant within projects, as represented by the circles in Figure 7. This means finding the sustainability aspects which are mentioned most often in the most relevant Sustainability Impact Assessments (SIAs), found within the literature review. Then we need to know **how** project managers experienced the ease (straight arrow) or difficulty (curved arrow) of integrating these aspects into their projects, see the arrows in Figure 7. This means project managers sort, in other words rank or categorize, the sustainability aspects according to the ease with which these can be integrated in one of their projects; in this case, they are ranked or sorted as difficult – neutral – easy. Lastly, we need to know **why** some aspects are easier to integrate than others: in other words what are the different reasons that influence the ease of integration, as shown by the light blue block in Figure 7.

As the perspective of project managers about the ease of integrating sustainability in projects tends to be subjective, it is important to find a research method which quantifies subjectivity. Therefore, it was decided to use a technique called: Q-methodology. Q-methodology is a way to reduce many individual viewpoints about one particular subject down to a few groups (also called 'factors') which represent shared ways of thinking. This method was originally developed by Stephenson in 1935 as a psychological research tool to help understand peoples' different perspectives about a potentially subjective topic. As the concept sustainability is also open to different interpretations, as described before, and views on aspects of sustainability therefore tend to be subjective, it was decided that Q-methodology would be a good technique.

In practice, Q-methodology involves collecting data and then finding patterns within those data. This method involves a specific sequence of steps as follows:

1. Define the **concourse** i.e. the sum of relevant data which covers the topic
2. Define set of statements (**Q-sample**)
3. Select participants (**P-set**)
4. Perform interviews with **Q-sorting**
5. **Analyse factors**

The steps of Q-methodology were divided into the three topics measuring integration of sustainability as shown in Figure 7: what, how and why. This chapter describes the research methods corresponding to the steps of Q-methodology used to answer the second sub-question, as shown in Figure 8. Below the figure first a short description of the three main topics of the figure is presented, followed by a more elaborated description of each topic in the three sub-chapters. The extensive version of the method with examples can be found in Appendix B Methodology: extra information and examples.

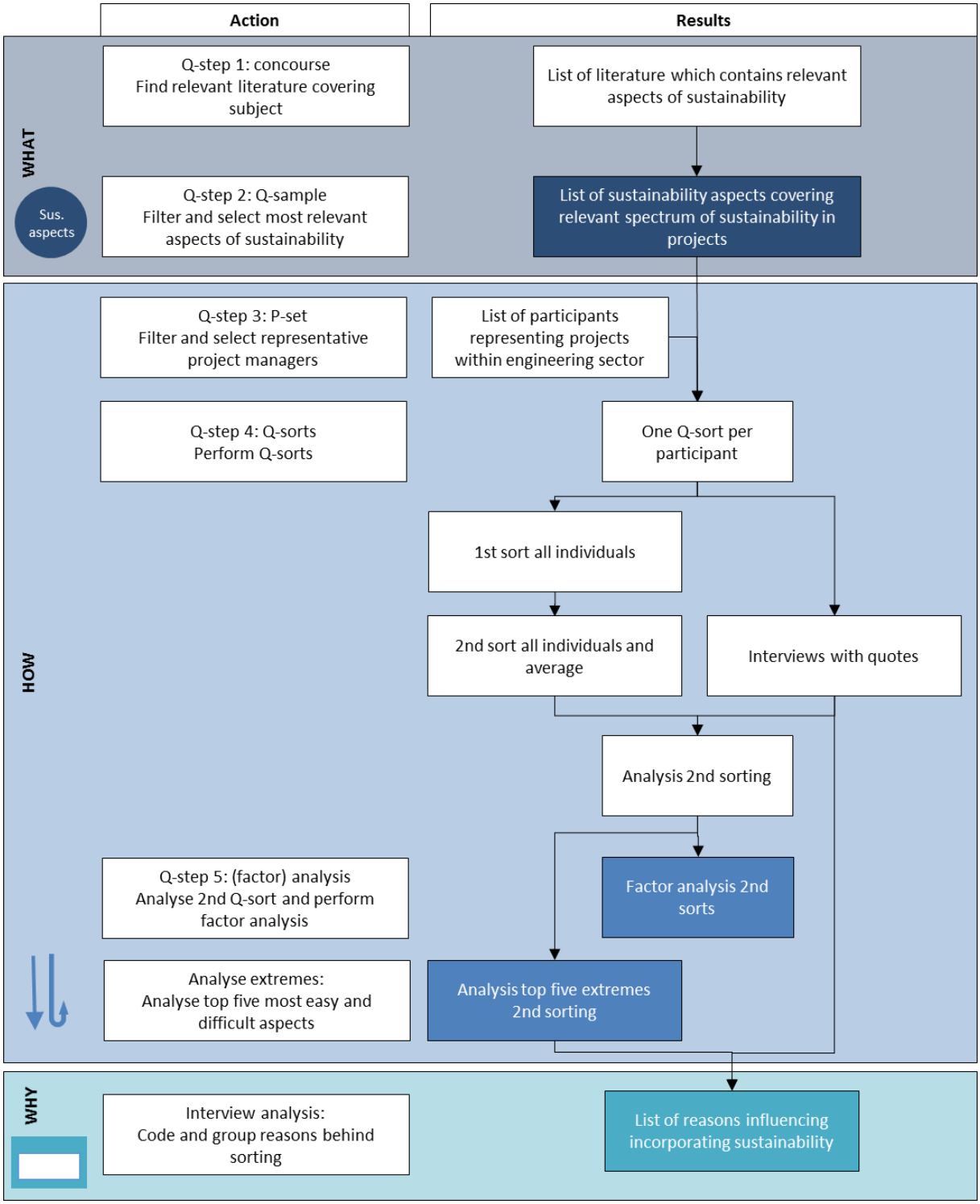

Figure 8 Research steps with actions and results (own figure)

WHAT: sustainability aspects
(Q-step 1) In this research the relevant data were taken from nine Sustainability Impact Assessments (SIA), see final paragraph in chapter 2.3. These SIAs are used by project managers as a guide to maximising sustainability within a project. Within these nine SIAs there is a great deal of variation in both the number and type of sustainability aspects. The most recent SIAs per author were selected as input for the selection of sustainability aspects, see Literature review chapter 2. (Q-step 2) From this collection of SIAs, a selection needed to be made to define the Q-sample. The Q-sample is the list of sustainability aspects relevant in projects which are then sorted in the next topic 'how'.

HOW: integration of sustainability aspects in projects
(Q-step 3) The P-set is in this research a representative selection of project managers within one engineering consultancy company. The first step was to select the participants. (Q-step 4) Having defined both the sustainability aspects and the participants for this research, the project managers were then contacted by phone and sent an attached Q-form in which they could rank the sustainability aspects according to ease of integration into one of their projects. After this, they were contacted by phone to discuss the reasons behind these ratings. This was an additional line of research in an effort to understand the motivations behind the ratings. These reasonings are the input for finding the 'why'. (Q-step 5) The resulting quantitative data was analysed using PQMethod software. The additional qualitative information, i.e. the interviews with the project managers, was used to further interpret the quantitative results. The result of step 3-5 was twofold: an overview of average scores of how project managers sorted the aspects, and a factor analysis which showed patterns within how groups of project managers sorted the aspects.

WHY: reasons influencing integration
(Interview analysis) The reasons behind the sorting were analysed by coding and grouping. Analysing the quotes by the project managers revealed the reasons which influence the integration of sustainability aspects in projects. Getting to grips within these reasons could help improve projects in the future.

3.1 Sustainability aspects: what?

After the relevant sources for the sustainability aspects were selected (chapter 2 Literature review) the selection of the most relevant sustainability aspects was performed by applying the Grounded Coding Theory. This theory is an analytical way to categorize and cluster data (Charmax, 2006 cq. Sääksjärvi, Deken, & Person, 2011). The goal is to better understand the data and support the process of reducing hundreds of sustainability aspects to just 30-50, which is mentioned as best amount of statements for the Q-sample (J Van Exel & de Graaf, 2005).

Two phases of the Grounded Coding are used in this research: initial coding in which parts of texts are coded with short sentences in active form, and focussed coding in which the initial codes are coded with single words. Focussed coding describes the aspects of sustainability for the Q-sample. The aspects with a focussed code which are mentioned only once in all SIAs are excluded from the list. This means the aspect has no overlapping character with other aspects and could be incidentally used. Each focussed code can be seen as one aspect for the final list of sustainability aspects, also called the Q-sample. Figure 9 shows the systematic way which is used to reduce the collected sustainability aspects from a few hundred within the SIAs of the literature to 30-50 most relevant sustainability aspects within projects. The results of each step can be found in Appendix C.1 Sustainability aspects.

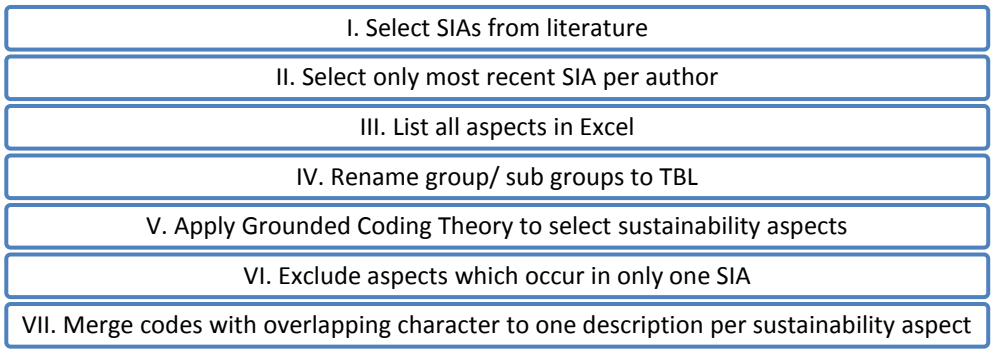

Figure 9 Selection criteria to list of sustainability aspects in projects

3.2 Integration of sustainability aspects in projects: how?

The process of finding the top five most easy and most difficult aspects to integrate, involves several steps. First the participants are selected, based on the selection steps in Figure 10. Participants are selected specifically to ensure the inclusion of certain viewpoints about the research topic. Q-studies do not need a large sample of participants (Brown, 1993) and the set of participants (P-set) usually is smaller than the Q-set (Brouwer, 1999). In most cases, there are around 8-20 participants taking part in the study (Webler, Danielson, & Tuler, 2009). The motivation behind each selection criteria and the extensive version of the analysis below, can be found in Appendix B.2 Integration of sustainability aspects in projects.

Figure 10 Selection criteria participants

Second, the selected project managers were contacted by phone and sent an attached Excel format in which they could rank the sustainability aspects according to ease of integration into their project. The ranking of the sustainability aspects is performed in two steps: a first rough sorting dividing the found sustainability aspects into three groups: easy – neutral – difficult, and a second specific sorting into a fixed format. This fixed format is prescribed by Q-methodology and ensures the results of the participants can be compared and analysed. Both rankings were based on one central question: '*How difficult was it to integrate the following sustainability aspects in your reference project?*'

As the final step of the Q-sorting, the participants were contacted by phone to discuss the reasons behind the five most easy and most difficult ranked aspects. This was an additional line of research in an effort to understand the motivations behind the ratings. These reasonings are the input for third research question.

Third, the resulting quantitative data were analysed. All sustainability aspects have similar weighting. The additional qualitative information, i.e. the interviews with the project managers, was used to further interpret the quantitative results. The methodological result of the second research questions is twofold: derive a list of most easy and difficult aspects to integrate based on the ranking of the project managers, and a set of shared perspectives among the project managers on how they experienced the integration of sustainability in their projects, based on a factor analysis.

This box shows an example of sorting the 30 sustainability aspects in a fixed format within Q-methodology.

How difficult was it to integrate the following sustainability aspects in your reference project?

Easy			Neutral			Difficult
-3	-2	-1	0	1	2	3
7	2	1	4	5	16	23
20	3	9	6	15	21	24
	11	10	8	19	22	
		17	12	25		
		18	13	26		
		30	14	27		
			28			
			29			

The first analysis is based on the average score of the 2nd sort. In Q-methodology, the average is used to analyse the general data while the Z-score is used to analyse separate factors (Roberts, Hargett, Nagler, Jakoi, & Lehrich, 2015). Boxplots are used to support the analysis of the top five most easy and most difficult aspects to integrate as these give insight into the clustered or scattered opinions of the participants. The result of the analysis of all sorts together is an overview of the averaged top five most easy and most difficult sustainability aspects to integrate in projects.

The second analysis is the factor analysis. This analysis is used to uncover the inner structure of a set of variables, meaning that if a group of variables shows great resemblance, a factor arises (du Plessis, Angelopulo, & du Plessis, 2006). A factor can be explained as a small number of sets of sorted statements that are different from each other and that synthesise the perspectives existing among participants (Mckeown & Thomas, 2013; Zabala & Pascual, 2016). Each final factor represents a group of viewpoints that are highly correlated with each other.

Although no participant is a perfect representative of a factor, each participant is more similar to one factor than to the others. The result will probably be between 2 and 7 different factors.

The analytical steps of analysing the Q-steps form raw data to a few factors are:

1. Insert all Q-sorts in PQ Method version March 2014, Release 2.35
2. Extract factors, meaning making groups of participants who sorted the aspects in similar ways. This is performed by Principal Components Analysis
3. Rotate factors to increase or decrease the mutual correlations of the q-sorts within the different factors. This means the more q-sorts load on only one of the factors and near-zero load on the other(s), the more optimum the case is. This is performed by Varimax rotation.
4. Analyse final factors based on a set of requirements for each found factor:
    a. Cumulative Explained Variance > 50% (Suprapto, 2016)
    b. All factors are acceptable (>2 Q-sorts are flagged per factor) (Brown, 1980)
    c. The more defining sorts for the number of factors the better (Job Van Exel & Graaf, 2005)
    d. The more distinguishing statements per factor the better (Job Van Exel & Graaf, 2005)
    e. The smaller the correlations between the factors the better (Webler et al., 2009)

If a #-factor does not meet one of the five requirements the results are insignificant and not suitable for further analysis. If multiple #-factors pass all five requirements, the best of these is chosen and further analysed. Within this analysis the distinguishing statements per factor, combined with the background information per participant and the reasons behind ranking the five extremes are explained.

The result of this analytical step is an overview of a number of factors which show different perspectives on how project managers experience the ease of integrating sustainability in their projects.

3.3 Reasons influencing integration: why?

All participants motivated the extremes in a supporting interview. For the five most easy and most difficult aspects, they explained why they chose this aspect as most difficult or easy. For the difficult aspects, they were asked to come up with solutions what could help to make the integration of these difficult aspects easier in future projects. As with merging the definitions of aspects of sustainability, so grouping and merging the reasoning is also a subjective step. Grounded Coding Theory (Charmax, 2006 cq. Sääksjärvi, Deken, & Person, 2011) is used to select the most dominant reasons, i.e. most mentioned by participants, and minimise the subjectivity of the researcher. The follow systematic steps of analysis are followed to select the reasons influencing the ease of integration, see Figure 11. The motivation of each step including examples can be found in Appendix B.3 Reasons influencing integration.

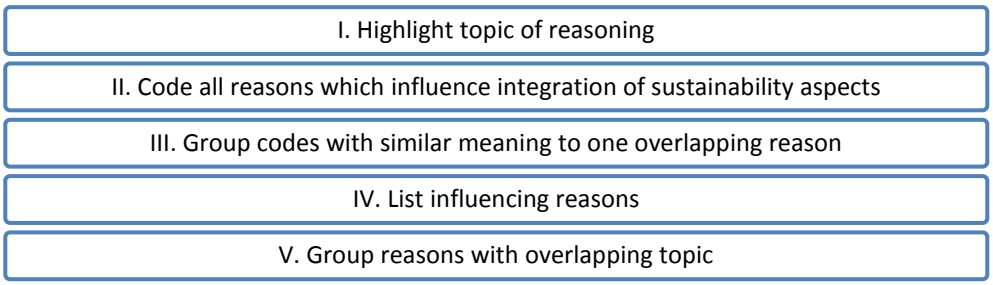

Figure 11 Analyse steps of interviews

4 RESULTS

The previous chapter showed the methods which are used to find the reasons influencing the integration of sustainability aspects in engineering projects. Coding and merging of sustainability aspects leads to a list of relevant sustainability aspects within projects. Q-methodology is used to find the top five most easy and most difficult aspects to integrate in projects, according to project managers. Interviews were performed and analysed with coding and merging to find a list of reasons which influence the degree of ease of integration. The results of these methods are shown in this chapter.

Each sub-chapter starts with a short introduction, followed by the results and a description of the meaning of the results. The last sub-chapter, 4.3, gives an overview of the reasons influencing the integration of sustainability and answers the sub-question: '**Which reasons influence the integration of sustainability aspects in engineering projects?**'

4.1 List of sustainability aspects in projects

Five Sustainability Impact Assessments (SIAs) reviewed by Silvius (2018) were selected within the Literature review, chapter 2. These SIAs consist of 353 sustainability aspects (FIDIC & EFCA, 2013; GPM Global, 2016; Iris Oehlmann, 2010; G. Silvius & Schipper, 2015; Szabó, 2016). All sustainability aspects are listed in Excel and coded and merged, as explained in the previous chapter. A list of 30 sustainability aspects was eventually selected, reflecting the most mentioned sustainability aspects within projects.

The 30 sustainability aspects include a description and for some, an example of a way to improve the ease of use for the participants, see Table 2. The total overview of all statements, including the examples and the Dutch translation, can be found in Appendix C.1.4 Sustainability aspects ENG – NL. From the 30 sustainability aspects, there are 11 aspects about people, 11 about the planet and 8 about profit.

Table 2 Overview of selected sustainability aspects

TBL	Nr.	Sustainability aspect	Description
People	1	awareness	make sure all stakeholders act with awareness of the (sustainable) impact of the project
	2	corporate governance	create transparency and have clear accountabilities
	3	ethical behaviour	act in an ethical manner
	4	fair and safe labour	stimulate fair labour with equal opportunities, diversity and fair compensation for all stakeholders
	5	health & safety	minimise health and safety risks for all stakeholders during the entire life cycle of the project
	6	human capital development	stimulate learning and development of the project team (and relevant stakeholders)
	7	human rights	respect human rights
	8	impact of project on people	provide added value for customers by meeting their needs and/or solving one or more of their problems
	9	stakeholder responsibility	ensure safe and responsible advertising of information, handling of data and customer privacy
	10	stakeholders	engage stakeholders proactively
	11	team	appoint someone in the team who is responsible for the application of sustainability criteria in the project
Planet	12	biodiversity (flora & fauna)	protect and compensate biodiversity and habitats by maintaining or improving nature's ecosystem
	13	CO2 emission	prevent or minimise CO2 emissions during both the product and project life cycle
	14	emission	prevent or minimise emissions into air, water and soil over the product life cycle (CO2 emission excluded)

	15	energy	prevent or reduce energy usage over the entire project life cycle
	16	impact of project on environment	examine alternative products and production processes with reduced impact on the environment
	17	material efficiency	minimise quantity of materials and resources used
	18	nuisance	prevent or reduce nuisance as a result of the product during its life cycle
	19	renewable energy	increase use of renewable energy
	20	transport	prevent or reduce transport and the negative effects of that, for members of the team, products, goods and materials
	21	waste	increase efforts to prevent, reduce, recycle and reuse waste during the project life cycle
	22	water use	prevent, reduce or recycle the water use in the project life cycle
Profit	23	business agility	enable flexible planning and decision making in the project
	24	business continuity	ensure long-term focus for sustainable business processes
	25	impact of project on economy	realise financial benefits with the project for the economy (society and environment)
	26	innovation	promote technical innovation within the project life cycle
	27	life cycle cost	apply the principle of life cycle costing in the project
	28	local development	contribute to the local community's economical and social development
	29	procurement	apply sustainability criteria when selecting suppliers
	30	risk reduction	reduce or prevent financial risks for all stakeholders

What stands out is that the number of sustainability aspects about profit is lower than the number of aspects for people and planet. The limited aspects about profit within this research are representative for the limited global attention towards aspects about profit. For example within the internationally agreed Sustainable Development Goals (United Nations, 2015), only one of the seventeen goals focusses on economy: SDG 8 'Decent Work and Economic Growth'.

Another explanation for the smaller number of economic sustainability aspects within this research could be linked to the association of sustainability in the last years. Even though the Triple Bottom Line, i.e. people-planet-profit, was published by Elkington in 1998, the main focus was on environment and society. The profit part Elkington referred to in his research was simply to keep in mind that profit is important to stay into business. Recent research by Raworth (2017) focuses on the complexity of the interconnection of all systems in the world and includes economy in a more prominent way. Her way of approaching economy enriches the concept of sustainability. This concept of economy is relative new compared to the latest version of Elkington.

4.2 Extremes ease of integrating sustainability aspects in projects

With Q-Methodology a group of 20 project managers sorted the 30 sustainability aspects based on the ease of integration within one of their reference projects.

The Q-sorts, performed by the participants are analysed in two ways: firstly, based on the average score of the whole group and secondly, based on a factor analysis.

4.2.1 Top five most easy and difficult sustainability aspects to integrate

The scores of all participants together lead to the average score of the sustainability aspects. Figure 12 shows the top five most easy (positive side of horizontal axis) and most difficult (negative side of horizontal axis) sustainability aspects. The form, colour and separate aspects are further analysed below the figure. The easy and difficult aspects are individually analysed, based on the distribution of how the participants ranked the aspects. Boxplots show the distribution i.e. how unified the opinion of the participants about the ease of integrating sustainability aspects in their projects is.

Figure 12 Graph extremes mean scores 2nd sorting

What stands out in the **graph** which shows the top five most easy and most difficult aspects to integrate, is that even though the maximum score of the original ranking goes from -3 to 3, the average score has maxima of -0,9 and 1,25. This shows the variety in opinions of the participants about the ease of integrating sustainability aspects in their projects.

The **colours** in the graph represent the three categories in which the sustainability aspects can be divided: yellow for people aspects, green for planet aspects and purple for profit aspects. There is a clear distinction between the colour distribution of the top five most easy and difficult aspects: 4 of the 5 'easy' aspects are about people, and 4 of the 5 'difficult' aspects are about the planet.

The **profit aspects** are more scattered, only one aspect is ranked within the top five most easy and one aspect within the top five most difficult. As mentioned in the Literature review, chapter 2, the role of economy has limited focus within sustainability (Green, 2014). This is emphasised by some of the participants who mentioned that they did not realise 'economy' was part of sustainability as well. Another meaning of the scattered distribution of aspects about profit could be that the integration of sustainability is easier for some than for others, so in average the score is neutral.

An example of combining existing functions to realise new business models could be to include heat pumps in foundation piles (Gemeente Amsterdam, 2014).

One of the challenges mentioned by the participants regarding profit aspects is the uncertainty about a positive business case for integrating sustainability aspects. This shows, profit could be the key to ease the integration of planet, by (re)developing business cases.

The **distribution** of how the participants ranked the **easy aspects** is scattered. Even though at least 50% of the participants scored these five aspects as positive, all aspects have outliers to very difficult (-3) with one exception with a minimum score of (-2), see aspect 4 in Figure 13. This shows there is no clear unity about the integration of these aspects.

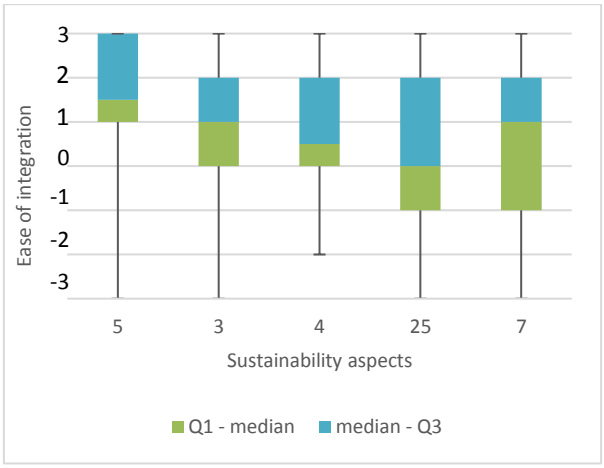

Figure 13 Boxplot positive extremes 2nd sorting

The most-easy aspects to integrate are 5 'health & safety', 3 'ethical behaviour' and 4 'fair and safe labour'. Laws and regulation and vested principles are given as reasons which make these aspects most easy to integrate. The motivation behind aspect 25 'impact of the project on economy' is linked to the basis of projects, as the goal of most projects is to contribute to economic growth or financial improvements of the client. The fifth most easy aspect is 7 'Human rights'. The reasons for the ease integration of this aspect compared to the first three aspects is that it is: either fundamental to the working process or part of laws and regulations.

A side-note made by participants is that these aspects are ranked as easy based on what they see or what concerns them, but they do not know how these aspects are integrated with sub-contractors or within local society.

The **distribution** of how the participants ranked the **difficult aspects** is less diverse compared to the easy aspects. 75% of the participants scored four of the five aspects as difficult so below 0, see the distribution of the aspects in Figure 14.

This means there is more unity in how difficult the aspects are, than in how easy the aspects are to integrate in projects. The outliers within the figure are much smaller compared to the easy aspects, meaning only one of the difficult aspects has outliers between -3 and 3, while the other four have outliers between -3 and 2 or even -3 and 1.

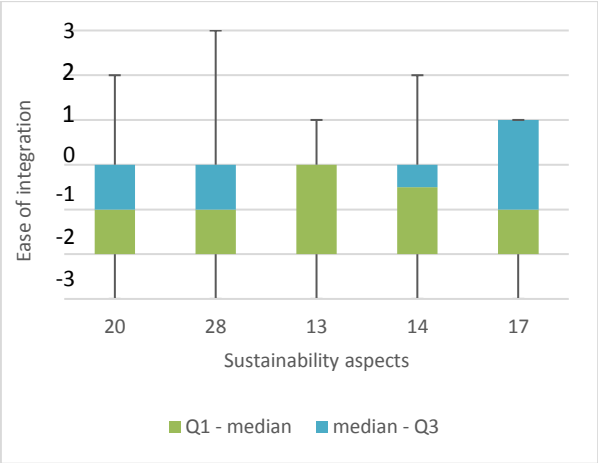

Figure 14 Boxplot negative extremes 2nd sorts

20 'Transport' is ranked as 'most difficult', as the struggle to limit transport is linked to the boundary conditions of the projects. One of the participants stated that: "*there is no focus on transport within the project because the results are not significant*". Also, projects are defined by their temporary and local character resulting in a need for transport either way. However, organisations could suggest that local clients involve local project members and communities in their work. Moreover, research into new, lighter, or locally produced materials could limit the amount of movement and/or total weight of transport needed.

The difficulty of integrating 28 'Local development' is emphasised by the limited level of influence by the project manager. As engineering projects are technical and focus either on a structure or a deliverable, there is limited or even no direct link with local development since this is not part of the contract provided by the client.

13 'CO2 emissions' and 14 'Harmful emissions' are difficult to integrate due to the limited insight of the consequences of investments. Worldwide, there is large focus on reducing emissions, i.e. the Climate Agreement (United Nations, 2000). The Global Carbon Project and the VN showed (Speksnijder, 2018), that the emissions have increased in the last two years: 1,6% in 2017 and 2,7% in 2018. Wouter Peters, Professor of Climate Change at the Universities of Wageningen and Groningen, said in the same report: *"even though we try, we cannot seem to beat our addiction to fossil fuels*."

The difficulty of material efficiency is emphasised by the growing attention to circularity, in which all materials are reused and there is no waste (Berndtsson, 2015). Besides, material efficiency is in sharp contrast to the traditional practices of the conservative construction industry which is compounded by the mindset - the habit of continuing to use materials which are 'proven to work'. Using materials in a different way implies possible and unforeseen risks for projects. This is emphasised by one of the participants who mentioned that due to responsibility and habit, it is difficult to look differently at material efficiency. It would demand a change in the mindset of all stakeholders involved to change the efficiency use of materials.

An example of using materials in a different way is shown in the book 'Materials Matters' by Thomas Rau (2016), who applied the concept 'light as a service' in which not the light bulbs are bought, but light hours are bought.

4.2.2 Factor analysis

Performing a factor analysis is the fifth and final official step of Q-methodology. Based on the criteria mentioned in the methodology, chapter 3.2, the analysis in PQ Method is executed with the data from the second sorting. Table 3 shows the results of the quantitative factor analysis.

Table 3 Requirements factor analysis (in red the insignificant solutions)

Requirements	2- Factor	3- Factor	4- Factor	5- Factor	6- Factor	7- Factor	Best option(s)
1. CEV* (%)	28	39	48	57	65	71	5,6,7
2. Acceptable factors (# participants load on factor)**	2 (8-6)	3 (7-5-6)	4 (7-5-3-5)	4 (4-5-1-3-3)	4 (3-1-1-3-2-2)	5 (4-2-1-2-1-2-2)	2,3,4
3. Defining sorts (#)	14	18	20	16	12	13	4
4. Distinguishing sus. aspects** (# per factor)	25-25	16-12-11	13-10-10-9	6-6-2-3-4	4-3-2-3-2-1	1-2-0-1-3-2- 1	2,3,4,5
5. Min. Correlation	-0,1273	0,0061	-0,0027	-0,0057	-0,0133	0,0193	2,3,4,5,6
6. Max. Correlation	-0,1273	-0,1346	0,1426	0,1852	0,2129	-0,3299	

*CEV= Cumulative Explained Variance
See appendix **C.2.3.1 Acceptable factors for the loadings of each participant on the various factors
***Number of distinguishing sustainability aspects is shown per perspective within the n-Factor (P_1 - … - P_n)

This table shows the results of the requirements for a 2- until 7-factor analysis. None of the 2 until 7-factor analysis brings a satisfying result as none of the factors pass all rules of Brown (see the red numbers). The 2, 3 and 4-factor have insignificant CEV (1) and 5, 6 and 7-factor do not fulfil the minimum of the acceptable factors (2). The 6- and 7-factor do not have enough distinguishing statements per factor as at least one of the factors has only 0 or 1 distinguishing statement per factor.

As the 4-factor and 5-factor options are on the boundary of acceptance, these are further analysed based on the five rules of Brown. All rules are elaborated to get insight in which of the two options is the most suitable for this research.

(1) The **CEV** of 4-factor is just below 50% which is insufficient as the factors from this analysis describe less than half of the sample (48%). The CEV of 5-factor is sufficient as it represents 57% of the sample. The minimum of 50% is set to make sure at least half of the sample is represented by the found factors. As the percentage has a minimum deviation (2%) of the middle, the 4-factor can be used within this research. A side note needs to be made that the four factors of the 4-factor only declare 48% of the variation so these are not *the* factors which cover the total sample. This means that these four factors are not satisfactory to such a degree that it can be immediately applied to the whole sample. However, the four factors do define some points of view regarding the integration of sustainability within projects they just do not cover the total picture of the sample. Still, it means the 5-factor is stronger.

(2) The **acceptable factors** of the 4-factor are sufficient as multiple participants load on the four different factors. The 4-factor is the only factor in which all participants load on one of the four factors. Minimal two Q-sorts need to load significant on each perspective to accept that perspective (Brown, 1996). The number of acceptable factors of the 5-factor, derived by automated flagging, is insufficient as only one Q-sort loads significantly on the third perspective. In both cases, the outcome of the 4- and 5-factor are 4 different perspectives on how participants approach the integrating of sustainability in projects. This means the 4-factor is stronger.

(3) All twenty **Q-sorts are defining** within the 4-factor analysis. All participants of 4-factor analysis are exemplifiers, meaning they load highly on one single factor (Groenewegen, 2013). Within the 5-factor analysis there are four con founders, see appendix C.2.3.2 Distinguishing statements 4- and 5-factor, so only sixteen q-sorts are defining in the 5-factor analysis. This means the 4-factor is stronger.

(4) The more **distinguishing statements** each perspective has, the better the results are. The 4-factor has for the four factors 13-10-10-9 aspects which distinguish factors 1-4. The 5-factor has for the five factors 6-6-2-3-4

aspects which distinguish factors 1-5. The more aspects distinguishing the factors the better, this means the 4-factor is stronger.

(5) The **correlations** are for both factors low as correlations below 0,3 are low according to Cohen (1988). There is insufficient difference to indicate which of the two factors is stronger.

Within this research the 4-factor analysis is the best option because it fulfils more requirements compared to the 5-factor. However, the results of the 4-factor are not significant so cannot be interpreted for the entire set of participants. There are no clear patterns in participant characteristics loading on the four factors, see for the overview of participants loading on the factors: Appendix C.2.3.3 Factor loading participants. The four factors are further analysed below.

Each factor can be visualised in a graph, see figures 15 till 18. Each factor consists of a Z-score on the horizontal axis and the distinguishing sustainability aspects for each factor specific on the vertical axis. The asterisk sign (*) shows the significance; one asterisk (*) meaning p<0.05 whereas two asterisks (**) means p<0.01. The lower the significance, the more distinguishing an aspect is, meaning the more it determines that factor. The colour distribution is comparable with previous charts, describing the average scores, namely yellow for sustainability aspects about people, green for planet and purple for profit.

To compare the found factors, the form, colour distribution and distinguishing sustainability aspects are further analysed below the figures.

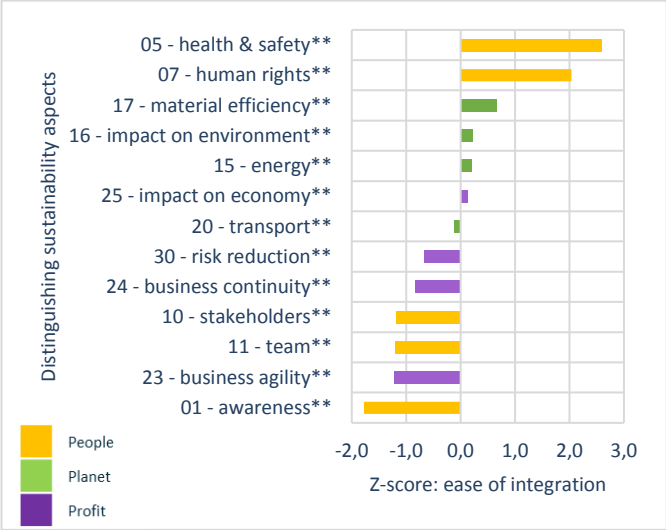

Figure 15 Distinguishing statements of factor 1

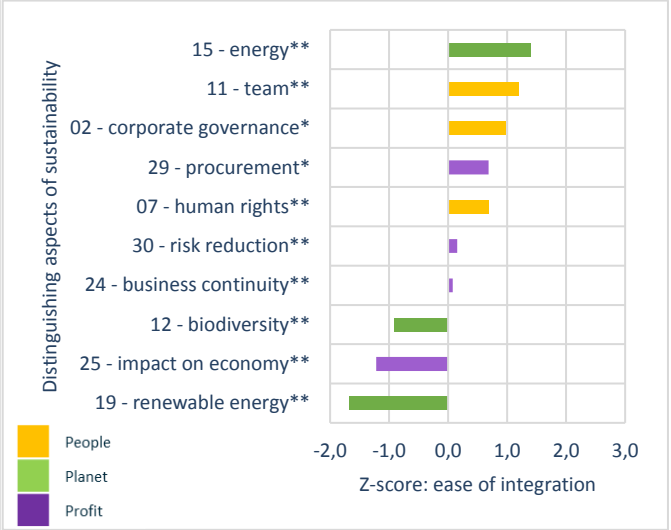

Figure 16 Distinguishing statements of factor 2

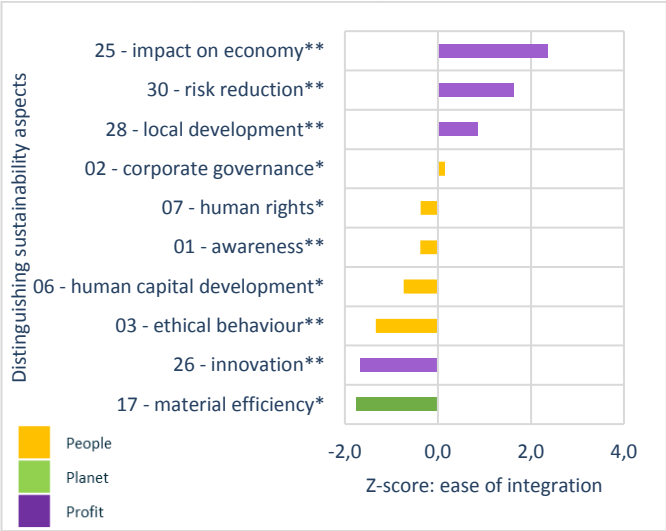

Figure 17 Distinguishing statements of factor 3

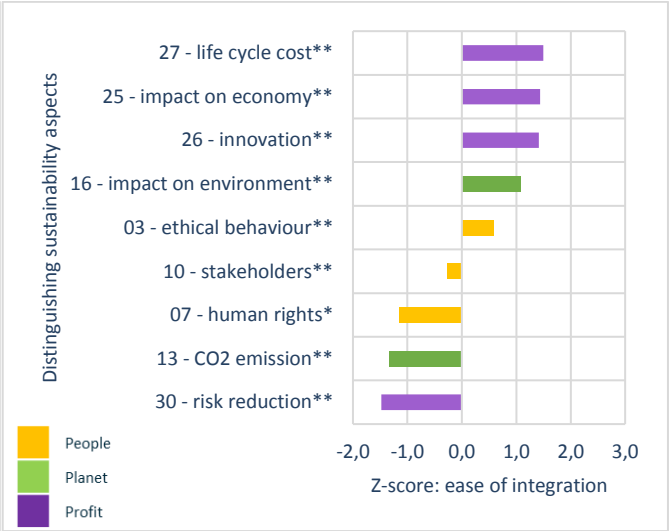

Figure 18 Distinguishing statements of factor 4

First, the **forms** of the graphs of the factors are compared. The first thing that stands out is that none of the figures are comparable as there are differences in the length of the graph so the number of distinguishing aspects, the width the aspects score on so the ease of integration, and the location on the 0-axis which distinguishes the positive and the negative scores so the percentage of the aspects which are easy to integrate and which are difficult to integrate per factor. For better analysis of the ease of integration, the scale of the Z-score (the horizontal axis) can be divided in five groups, see Table 4.

Table 4 Scale distribution in five levels of ease of integration

Level	Difficult	Bit difficult	Bit easy	Easy	Very easy
Z-score (z)	-2,0 ≤ z < -1,0	-1,0 ≤ z < 0	0 ≤ z < 1,0	1,0 ≤ z < 2,0	2,0 ≤ z < 3,0

The table shows there is no level 'very difficult'. This means no factor has aspects scoring below -2,0 in contrast, there is a level 'very easy', scored by two aspects of factor 1 and one of factor 3. So what stands out is the figures of factor 1 and 3 are wider, meaning stronger views on the ease of integration, than factor 2 and 4 which have scores closer to neutral.

Another thing that stands out in the figures of the four factors is the number of distinguishing aspects scored as easy compared to the numbers scored as difficult. Factor 1 has 46% of the distinguishing aspects on the positive side meaning in general the integration of sustainability aspect sin projects is seen as more difficult than easy. In comparison, factor 2 has 70% ranked as easy, factor 3 has 40% as easy, and factor 4 has 56% as easy ranked. So even though factor 1 and 3 have outliers towards the level 'very easy', the number of aspects show the participants loading on this factor have in general more difficulty with integrating sustainability, meaning more distinguishing aspects on the 'difficult' side than on the 'easy' side.

All factors contain distinguishing aspects of all three **colours**, meaning aspects about people in yellow, aspects about planet in green, and aspects about profit in purple. What stands out is that the there is no clear distinction in the colour distribution of the four factors, factors 1 and 4 have some people, planet and profit aspects as both easy and difficult. Factor 2 has no aspects about people on the difficult side and factor 3 has no distinguishing aspects about planet on the easy side.

Focusing on the **distinguishing aspects**, it stands out that there are aspects distinguishing in multiple factors. This shows there is no clear pattern in which a group of aspects loads on only one factor. An overview of all distinguishing aspects per factor can be found in Appendix C.2.3.2 Distinguishing statements 4- and 5-factor.

Participants loading on factor 1 score people aspects both as most easy and most difficult. However, there is a difference between the type of aspects. The most easy aspects 'health & safety' and 'human rights' are often part of laws or regulations. On the other hand, the most difficult aspects 'awareness', 'team' and 'stakeholders' are much more open for interpretation and not laid down in regulation, contracts or task descriptions.

Participants loading on factor 2 score planet aspects both as most easy and most difficult. Comparable with factor 1, there is a clear difference between the most easy and most difficult. 'Energy' is ranked as most easy while 'renewable energy' is ranked as most difficult to integrate.

Another thing what stands out is that factor 3 and 4, which both have a focus on economy, have opposite aspects ranked. In other words, participants loading on factor 3 find it easy to integrate risk reduction and difficult to integrate innovation, while participants loading on factor 4 score the opposite. It could show there is a negative correlation between risk reduction and innovation.

As shown in the comparison, there are no clear patterns or groups within the four factors. Some conclusions can be drawn from the data but four different perspectives on the ease of integrating sustainability aspects in projects, which is the common outcome of Q-methodology, is not feasible within this study. Besides, even though the 4-factor is the best option within this research, the perspectives are not representative for the whole sample. For these reasons, the further interpretation of these four factors, can be found in Appendix C.2.4.5 Interpretation results factor analysis. **An intermediate conclusion can be drawn that Q-methodology does not give significant results. For this reason, the focus in the next chapters is on the averages of the sorts and the motivations of the participants supporting their rankings and not on the perspectives derived from the factor analysis.**

4.3 Reasons influencing integration

As some aspects of sustainability are ranked as easier to integrate in projects than others, it is important to understand more about the reasons influencing these degrees of difficulty. In other words, it is necessary to determine why a sustainability aspect is relatively easy or difficult to incorporate within a project. The raw data of the reasons influencing integration can be found in Appendix C.3 Reasons influencing the ease of integration

The first thing that stands out is that the reasoning behind the aspects are mutually dependent, meaning the reasons are not specifically linked to one aspect or to the TBL: people-planet-profit, or with individual sustainability aspects.

Table 5 shows the reasons which positively or negatively influence the incorporation of sustainability aspects into projects, including one quote for each helping i.e. positively influencing (+) or hindering i.e. negatively influencing (-) reason in italic. The various reasons can be divided into five groups based on their subject: process, product, society, client, and supplier. The supplier is in this research Royal HaskoningDHV, the engineering company who fulfils the demands of the client. The reasons within the group process are about actions by the project team within the project. The reasons within the group product are laid down in documents of a project. The reasons within society, client and supplier are within the responsibility of the society, client and supplier.

The reasons which are most mentioned are seen as the most dominant by project managers. The results are analysed below the table. Top five most mentioned are shaded, the colours in the figure indicate: red as reasons which hinder (-), and blue as reasons which help (+) the integration of sustainability in projects.

Table 5 Overview of (positive, negative) reasons influencing incorporation of sustainability in projects

Group	Reasons influencing integration	Example sentences	# times mentioned Hinders% - Helps%
Process	Falls (not) within standard working practice	*(-) "it is difficult to act different than normal"* *(+) "integrating this aspect is part of our basic attitude"*	 41 34% - 66%
	Perceived as (un)important to the project goals	*(-) "focus of project was not on this aspect"* *(+) "this aspect is one of the project goals"*	 23 87% - 13%
	Perceived as (not) within responsibility or influence of project manager	*(-) "my influence to integrate this aspect in this project is limited"* *(+) "it is part of the tasks of the project manager"*	 18 44% - 56%
	Perceived as (not) discussed within project	*(-) "these (aspects) are not even discussed in our team or with the client"* *(+) "everyone likes to talk about this aspect"* and *"it is no issue, not even addressed"*	 6 50% - 50%
	Mindset/ motivation of project team	*(+) "incorporating aspect is fun"*	 2 0% - 100%
Product	(Not) within project scope	*(-) "not within our project requirements/ contract / scope"* *(+) "It (incorporating aspect) is one of the project goals"*	 41 44% - 56%
	Perceived as (no) room for improvements within contract	*(-) "design is determined by requirements, and so there is little room for improvements"* *(+) "the supervisor can propose to do the extra mile"*	 16 8% - 19%
	Perceived as presence within tools used in project	*(+) "we used [tools] in which the aspect is integrated"*	 10 0% - 100%
Supplier	(Limited) knowledge about degree of (financial) impact	*(-) "the available calculations for the impact of [aspect] are incomplete"* *(+) "invest now to have benefits in the future"*	 13 69% - 31%

	(Limited) knowledge about integrating aspect	*(-) "in the end integration does not work"* *(+) "it is easy to integrate aspect"*	 10 80% - 20%
	No business support or stimulants: time, attention, and capacity to influence client	*(-) "not enough available budget or time to influence [aspect]"* *(+) "within our organisation we have the facilities to [integrate aspect]"*	 5 40% - 60%
Client	Client act towards (un)importance of aspect	*(-) "[aspect] was for the client less relevant"* *(+) "the client took responsibility for this aspect"*	 15 20% - 80%
	Perceived as degree of awareness by client	*(+) "client has high awareness of this aspect"*	 5 0% - 100%
Society	Perceived as (not) part of culture	*(-) "there is an attitude of mind your own business"* *(+) "[integrating aspect] is vested in behaviour of stakeholders involved"*	 11 82% - 18%
	Perceived as (not) part of regulation or standard	*(-) "client just wants to fulfil regulation in which [aspects] is not integrated"* *(+) "there are local regulations which [integrate] aspect"*	 10 60% - 40%
	Perceived as (not) important to wider society	*(-) "there is no society broad awareness of this aspect"* *(+) "everyone wants [aspect]"*	 7 29% - 71%

What stands out is that process or product are most dominant in influencing the aspects of sustainability within the project, as these are mentioned most often as reasons influencing the integration. This is expected as the ranking was based on projects. These two groups are comparable with the groups of Eid (2009) who defined 'scope & objectives' and 'processes' as areas of integrating sustainability aspects in project management.

The **graphs** in the rightest column show how many times the reason was mentioned as negative influencer (green) or positive influencer (blue). There are three reasons mentioned which have a positive influence on the integration. There is only one graph 'perceived as (not) discussed within project' which is mentioned equally as a positive and a negative influencer. The other graphs are not equally distributed.

What is clear is that the five most mentioned reasons, are within the group 'process' or 'product'. This means that the process, in which the project manager can have influence, and the product, determined by the scope and contract of the client, are the first reasons which need investment if integrating sustainability aspects are to be made easier. As a result, the stakeholders, i.e. society, client and supplier, have less influence on integrating sustainability in projects or their influence is not directly linked to the ease of integration in projects.

5 DISCUSSION

This chapter discusses the relevance and applicability of the results of the previous chapter. This answers the fourth sub-question: '**How can the identified reasons be used in projects to achieve a higher level of sustainability?'** First the selection and application of sustainability aspects is discussed, followed by the ranking of these aspects resulting in the top five most easy and difficult, to conclude with a discussion of the determined reasons to achieve higher level of sustainability in projects.

Sustainability aspects

It was the aim to find a list of sustainability aspects which cover the topic sustainability in engineering projects. However, there were no SIAs specific for engineering projects which resulted in a list of sustainability aspects in general projects. Participants commented on the completeness of the list of sustainability aspects, saying that it was a broad and sometimes complex list. This complexity is in line with the study of authors like Martens & Carvalho (2016), Silvius & Schipper (2015) and Tam (2017) who emphasised that it is questionable whether consensus about measuring and assessing sustainability with a universal list of sustainability aspects is even possible. Even though the list is never perfect, it can be used as guideline to determine sustainability in projects.

Another important finding was that there are fewer aspects about profit compared to the aspects about people and planet. This finding is supported by the Sustainable Development Goals (United Nations, 2016), in which economy has a limited role as only one of the 17 Goals is about economy. It is possible to hypothesise that this result suggests that the link between economy and sustainability may be weak. This result further supports the idea of Raworth (2017) who emphasises on the necessary change of view on economy to reach sustainability goals. It can therefore be suggested that a changed view on economy could lead to different views of business models and new opportunities within the engineering sector, in order to achieve a higher level of sustainability.

Integration of sustainability in projects

The most interesting finding of the average score was the clear distinction between people and planet aspects. Within the top five most easy aspects, four aspects were about people. And within the top five most difficult aspects, four aspects were about planet. This was noted as an unexpected result by experts in the various validation sessions. Engineering has a stronger link with environment compared to society, so it is an interesting finding that aspects about planet are generally ranked as difficult.

The difficulty of integrating environmental aspects could be related to recent studies indicating that even though there is international concern about sustainability with reference to the Paris Agreement and the Sustainable Development Goals, the emissions have increased in the last two years (Speksnijder, 2018). The comprehensive role of the government could force diminishing emissions in spite of the high price of techniques to make this possible. The motivation for the easy aspects, about people, is linked to (inter)national laws and regulation as well. One of the reasons given by participants for the easy aspects, inclusion of the aspect in laws- and regulation to make it a standard, emphasises on the influence the government could have on integrating sustainability.

The theory of Eid (2009), showing different areas to integrate sustainability in project management, is supported by the results of this research. Project managers could apply the reasons of the process and product groups in the different phases the project, mentioned by Eid, to increase the integration of sustainability in their projects.

The result of the factor analysis shows that there are no shared perspectives towards the ease of integrating sustainability. This result has not previously been described in literature. Even though the main results of the factor analysis are insignificant, interesting conclusions can be drawn. For example, there is a negative correlation found between 'Innovation' and 'Risk reduction'. As the results of the factor analysis are insignificant, additional research could further investigate or prove this correlation.

Influences on the integration of sustainability in projects

The participants motivated their top five most easy and most difficult aspects to integrate. One interesting finding is that there is no direct link between the reasons and the Triple Bottom Line which categorizes the sustainability aspects, namely people – planet -profit, or with the individual sustainability aspects.

All motivations together were listed and five groups with shared reasons are found: process, product, supplier, client and society. Based on the reasons and the performed interviews, the relations between the groups can be shown in one figure, see Figure 19.

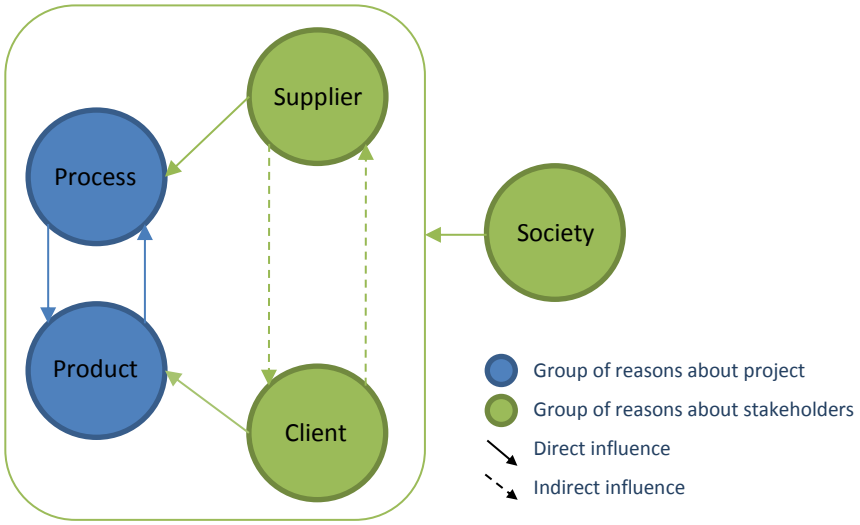

Figure 19 (Inter-) Relations between groups of reasons (own figure)

The blue circles show the two sides of a project: product and process. These two have a direct link with each other as the product influences the process and vice versa. The client prescribes the requirements which defines the project, so the client can directly influence the product. On the other hand, employees of the supplier perform the project and answer the demands of the client by executing the process of the project so the supplier directly influences the process. The client and supplier could influence each other by account management or sharing ideas as shown by the dotted arrows between supplier and client. As mentioned before, the role of society is overarching meaning that society could influence, directly or indirectly, the process and product of a project and the direct stakeholders: the client and the supplier.

These findings suggest that the reasons are interrelated and if the aim is to achieve a higher level of sustainability in projects, each group could influence the sustainable impact from their 'circle'. This corresponds with the principles of Stephan Covey (1989). He developed the circles of influence and concern, as shown in Figure 20. In this figure the inner circle is the circle of influence. The outer, blue, circle defines the circle of concern. The boundary of the inner circle, the green dotted line, can be influenced by the found reasons. Covey states that focussing on the level of influence, stretches this circle and opens up new opportunities. The society, client and supplier could support and facilitate the growth of the level of influence of the project manager even though it is his or her own responsibility.

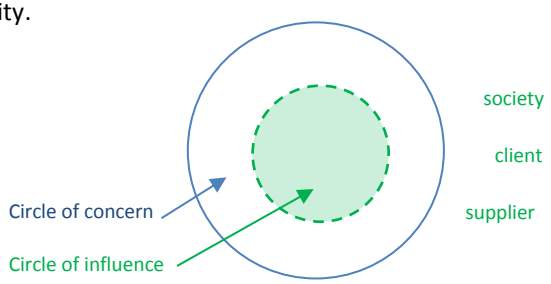

Figure 20 Circle of influence within circle of concern (Covey, 1989)

Another important finding was that the process of projects is seen as the most dominant group, influencing the integration of sustainability. Within the process, contributions of the project members are important. These results corroborate the ideas of Silvius (2018), who suggests that a shift in thinking is necessary; from managing time, budget and quality, to managing social, environmental and economic impact. This changing mindset combined with the level of influence, suggests that the project members can stretch their influence within projects by adjusting the process and in this way achieve higher levels of sustainability in their projects.

5.1 Validation

The groups of reasons and the actions influencing the reasons were validated in three one-to-one sessions. In each session the methodology, results and conclusions were presented. The experts were asked if they recognised the top most easy and most difficult aspects to integrate, the overview of reasons influencing the ease of integration and the recommendations for each group to stimulate the integration within their own work.

Top five most easy and difficult aspects to integrate
Expert A was surprised that the environmental aspects were in general ranked as difficult by the participants. The core business of engineering projects is closer related to environment than with society. However, the positive, easy 'people' aspects could be related to company guidelines about integrity which emphasises the ease of integration.

Expert B gave a side note by the ease of integrating sustainability: "*the approach in our work is based on the project requirements so it is easy to close your eyes for the bigger picture*". The difficulty of environmental aspects is in line with the opinion and experience of expert B. "*We have quite some knowledge about sustainability, but the step towards concrete execution is difficult. Projects are currently guided on price and a different way of looking towards costs, for example with the EMVI-criteria, could ease the integration of these aspects*". These criteria could be adjusted if the engineering party is involved in early phases of the project. If something is not prescribed, it could be included anyway. Another option is to change the procedure how projects are approached. For example, by developing a project and offer it to clients. An example is 'Nereda', this is a waste water treatment technology is intern developed and offered to companies as improvement on their existing waste water treatment plant.

EMVI-criteria means in Dutch 'Economisch Meest Voordelige Inschrijving'. The English translation is: Most Economically Advantageous Tender, i.e. MEAT. This criterion enables the contracting authority to take account of criteria that reflect qualitative, technical and sustainable aspects of the tender submission as well as price when reaching an award decision (FELP, 2015).

Expert C mentioned the ease of integrating people aspects could be linked to the ease which people relate to these aspects. The profit and planet aspects are seen as more difficult to relate to on personal level. He mentioned that within his projects, project members are always trying to use materials efficient as it minimises costs as well. The prevention or reduction of emissions is gaining more attention. This led to several initiatives to minimise emissions, signed by multiple engineering and construction companies. However, the execution of these plans is not integrated in all projects yet. This shows the current difficulty, but as well a prediction that planet aspect would be easier to integrate in the future. "*your study is very interesting, and it is good that you performed it. We are in a transition were more and more people realise everyone need to contribute to a better planet. This awareness is triggered by social media, business reports and researches like this*".

Reasons influencing ease of integration
Expert A recognized the five groups. "*1) the integration depends on the question of the client, 2) it is about how our people feel to do something with the sustainability aspects*". This quote supports the found groups 'process', influenced by the supplier, and the group 'product' influenced by the client. On the question 'do you miss group or a link between the groups?' the answer was no.

The first reason Expert B mentioned was money, as projects are mainly driven by money. Besides, he mentioned the proactive role of the project members needed if sustainability was not part of the contract. Expert B did recognize the groups found within this research. The group society includes all stakeholders involved from government to the local farmer which influences the project: "*it is, in almost all projects, impossible to put a fence around the project so there are always multiple stakeholders involved*".

Expert C mentioned awareness of the importance to integrate sustainability in projects as the main reason which influences the ease of integration. Another reason which influences the ease of integration is the attitude of the client. If he or she seems to be not open-minded for adjustments in the benefit of sustainability, there is a threshold to make suggestions. Expert C recognized the groups and links developed by the researcher to represent the influences on projects. He suggested that the dotted lines include about 10% of the communication from account managers and 90% of the influence between client and supplier goes via or about the content of projects and not direct from client to supplier and vice versa.

Actions for the groups process and supplier
Expert A mentioned there is a need to develop a simple framework which helps every employee within the company to integrate sustainability in their project and to define the added value of the projects.

Expert B mentioned the one who requires change, must take the lead: "*if you want to do something, you have to mention it explicit. Even if the contract looks boarded up, it does not mean there is no space*". The role of RHDHV is to give explicit examples and intern determine projects which are sold to the clients instead of reactive answering the need of the client.

Expert C mentioned the integration starts with the questions of the client. If he or she includes sustainability in the assignment, it is standard integrated. However, if he or she do not make sustainability part of the assignment the work is not paid and research has to be done in private time of the employees, "*if some people within advisory groups, depending on their function, get ..% of their time to do research in sustainable solutions, it would help*."

The role of facilitator and inspirator of the client, and the proactive behaviour in combination with account management and a mindset towards sustainable impact are consistent with the views of Expert A, B and C. There is no general overview available within RHDHV yet, which includes sustainability adjustments applicable in projects.

6 CONCLUSION

This research aims to increase the integration of sustainability in engineering projects. With the support of four sub-questions answered in the previous chapters, this research is guided towards answering the main question: '**What influences the integration of sustainability in engineering projects?'** The first sub-chapter in this conclusion answers the research question, followed by recommendations for the target audience of this research: engineering companies and their project managers. Interesting fields for further research are shown in third sub-chapter. The fourth sub-chapter shows the limitations of this research which discusses its validity and reliability.

6.1 Influences on integration of sustainability in engineering projects

To find the influences on integrating sustainability in engineering projects, the first step was to define which sustainability aspects are relevant for projects, 30 aspects were found. The second step was to define which of these aspects were most easy and most difficult to integrate. This resulted in a top five 'most easy' and top five 'most difficult' sustainability aspects, see Table 6.

Table 6 Overview most easy and difficult sustainability aspects to integrate

Second sorting			
Top five most easy		**Top five most difficult**	
Health & safety			Transport
Ethical behaviour			Local development
Fair and safe labour			CO2 emissions
Impact on economy			Harmful emissions
Human rights			Material efficiency

In supportive interviews, reasons influencing the ease of integration were collected. The given reasons why some aspects are more difficult to integrate than others are not directly linked to the individual aspects. No link has been found between the characteristics of the project manager or their reference project and the reasons influencing the integration of sustainability in projects. However, it can be concluded that there is a lot of consensus between the project managers about why some aspects are easier to integrate than others.

Five groups have been found which could influence the integration of sustainability from their own circle of influence or as collaborative actions. These are: process, product, supplier, client and society. The reasons per group are shown in Table 7.

Table 7 Overview reasons influencing the ease of integrating sustainability in projects

Group	Reasons influencing the ease of integrating sustainability
Process	standard way of working, level of influence of project manager, part of conversation, and perception of importance.
Product	project scope, room within contract, and part of tools in the project.
Supplier	knowledge about (financial) impact, knowledge about aspect, business support.
Client	awareness, perception of importance.
Society	laws and regulations, part of culture, perception of importance.

The integration of sustainability in engineering projects is mostly dependent on the process and product, as these two directly define the outcome of the project. Product and process have a direct, mutual relation. The reasons within these two groups are mentioned most by the participants, meaning these are seen as most dominant in influencing the integration.

The **process** requires a shift in thinking which helps to integrate sustainability in the way of working. This shift goes from time, budget and quality towards environmental, social and economic impact. The individual role of the project members is emphasised with this shift. The theory of Stephan Covey stimulates this shift by focusing on the influence one has, resulting in a growth of their influence.

The **product** is a shared responsibility of both the client and the project members influencing the process. Commitment and focus by both the client and the project members towards sustainability helps to influence the integration of sustainability. For example, determining which Sustainable Development Goal the project contributes to, could help to give focus to the product.

The **supplier** influences the integration of sustainability by a supporting, inspiring and facilitating role. Knowledge development could help to influence the client and stimulate her to integrate sustainability in the product. Business support for example with available hours for knowledge development or account management could help the project members to influence the project process. The inspiring role of the supplier could help to share examples and connect employees.

The **client** determines the main part of the product as he or she sets the requirements of the contract and the, in most cases, the project scope. An open attitude towards the ideas from the supplier could help to integrate sustainability.

The society has a comprehensive role where they influence the complete project and the involved stakeholders. Their influence is mainly based on laws and regulations. The interrelations of the five groups influencing the integration of sustainability in engineering projects including their role of influence, are summarized in Figure 21.
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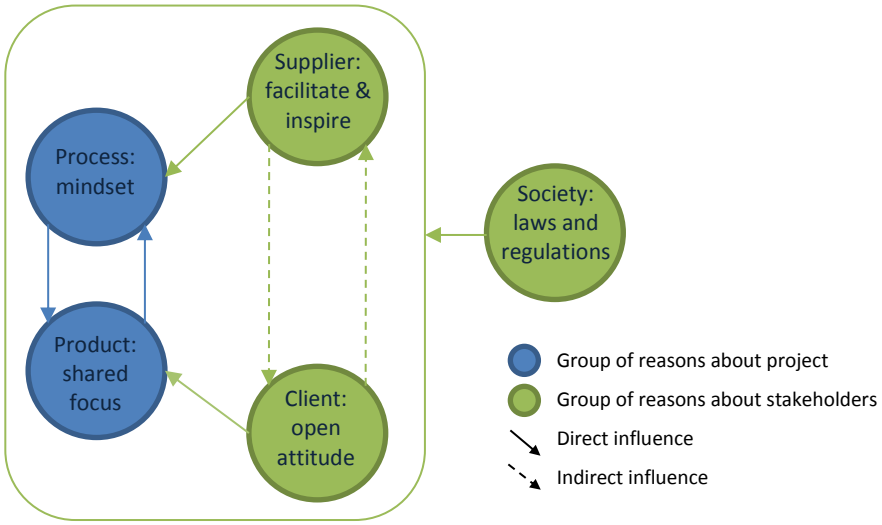

Figure 21 Groups with actions influencing the integration of sustainability in projects (own figure)

Each group could influence the integration of sustainability by focusing on their field of influence. This focus could stimulate the integration of sustainability. Even though the groups can be seen as individual parties, collaborative actions influence the integration of sustainability even more.

In conclusion, everyone involved in the project can contribute to better projects by integrating sustainability from their level of influence. The focus on which sustainability aspects the projects have impact can be determined in early stages or by finding creative ways of making projects better than what is described in the project requirements. Asking the right questions with a focus on actions and effects helps to determine the ambition of the project and the focus of the required impact.

6.2 Recommendations for engineering companies

Engineering companies have a specific role in which they influence their client and do research within their own company for better projects in the future. In this sub-chapter a selection of examples is listed which could be executed on strategic level within engineering companies, but as well for the project members influencing the process from the engineering companies.

As an inspirator, engineering companies can:

- Know and show what kind of projects the company wants to be associated with to strengthen the company vision, this could be realised by investigating and communicating why the company wants to be associated with the country – client – project execution and the (in)direct effects the project has on economy, environment and society.
- Share the success stories within and outside the organisation to create awareness and importance towards the incorporation of sustainability in projects and to stimulate the sharing of knowledge and experiences. For example, by labelling every project with one of the Sustainable Development Goals and communicate this internally and externally.

As a facilitator, engineering companies can:

- Support project members or employees by making extra budget and specialist available within a selection of projects to do research into new or better options or to perform account management to stimulate a long-term relationship with the client. For example, by including the impact one has within their project on sustainability in their review or by appointing a percentage of time to work on sustainability or account management.
- Name a growing number of specific 'sustainable-star' projects, which have the aim to become example projects for others in which sustainability plays a large role. This could require extra resources, time for publications and a client who is willing to work along. For example, companies can start with fiction projects to develop the most sustainable project as possible. Elements of this star project can be applied in 'real' projects.
- Set the boundaries, which are known by all employees, in which everyone could contribute to sustainability. For example, by developing a company wide database in which innovation, experiences and ideas for sustainability integration in projects can be shared. This can be linked to the Sustainable development Goals (SDGs), see Figure 4 for an overview of the 17 SDGs.

Project members within engineering companies are co-responsible for the project process. Their behaviour is based on their mindset and can influence the integration of sustainability in projects. It is recommended that they:

- Are aware of the impact everyone can have within their actions contributing to a project. For example, by researching the options to improve their work, and by being critical to the solutions they are used to give which could be improved with new technologies or new materials.
- Invest in the long-term relationships with clients to be involved in projects and to widen the level of influence of the project manager. For example, by sharing relevant innovations, news items or other relevant information which could be of use by the client.

6.3 Recommendations for further research

The recommendations mentioned in this part were either left out of the scope of this study due to focus on the current research scope or were identified during the research process itself.

This research consists of a top-down approach. The focus was on finding what influences the incorporation of sustainability aspects in projects, according to project managers. It is mentioned that the designers of projects have a high influence as they have the knowledge how to design different than standard, so performing a comparable research only this time from the perspective of the designers could be interesting.

The sustainability aspects are obtained from Sustainability Impact Assessments. Further research into the relevant sustainability aspects in projects could be interesting to see which are relevant and what is needed per aspect to stimulate incorporation of sustainability if wished for. Although this research touches upon the aspects the main focus is on a general exploratory approach.

A group of participants sorted the aspects. The results showed that there is limited consensus in the ease or difficulty of integration linked to the sustainability aspects or with project characteristics. This shows the influences on integration is likely person specific. It could be interesting to further investigate the person variables which influence the integration, a start for this research could be the five groups with reasons influencing the integration of sustainability.

Another option for future research is the distinction between the reasons and the different project process groups, as published by Eid (2009). The best areas to integrate sustainable development in projects is confirmed in the interviews but it could be interesting to focus on one of the areas, i.e. project phases, to come up with more specific recommendations and solutions to stimulate the integration of sustainability in that project phase.

Within the factor analysis, the results were insignificant. The cumulative explained variance (CEV) of the four factors is 48% which means the results are representative for less than half of the target group. Most Q-studies have a CEV of 55-60% (Suprapto, 2016) so the CEV of this research is below average. Extra participants could help to increase the CEV and so the applicability of the results. Another option is to redefine the sustainability aspects to specify the topic and by that increase the unity in people with similar opinions about integrating sustainability.

This research has been performed within one organisation. It could be interesting to do the same research with project managers across companies to determine the influence of the company culture onto the integration and to generate the results for a bigger group.

Lastly, it could be interesting to see if the indicated influencing reasons really stimulate the integration of aspects of sustainability. This could be researched in an action research (Sääksjärvi et al., 2011) or based on triangulation, in which the influencing reasons are checked by other participants and within documentation.

6.4 Limitations

Internal and external validity are applied to assess the validity and reliability of this research. Internal validity reflects on the soundness of the research design and methods. External validity reflects on the applicability of the results for the greater group. In this part, the limitations of the methodology and applicability of the results are discussed.

Q-sample
The credibility of Q-methodology relies on the concourse and the robustness of the statements generated for the research, in this research the sustainability aspects. To establish the validity of the sustainability aspects, systematic selection is used in which the occurrence of aspects within literature is counted. Even though this is a quantitative approach, the interpretation of the uniqueness or overlap between different aspects is partly own interpretation. The validity of the statements is checked in two rounds. First with a group of project managers within the company and second in a session with the first and second supervisor. After these rounds, the statements are slightly adjusted as a more robust selection was performed.

An ideal concourse within Q-methodology does not exist as the concourse evolves over time and from various perspectives. This is emphasised by the quote of Brown (1980) in the paper of Exel & De Graaf (2005): "*Because there is no external criterion for a person's point of view, the issue of validity of Q sorts does not apply*."

The completeness of the sample is found sufficient, only 5 out of the 20 participants commented that one or two aspects were missing (resp_12: climate adaptation and soil, resp_15: short and long-term decision, resp_5: chain collaboration and social return, resp_6: project phases, resp_10: Circular economy and recycling). In general, it was mentioned that the overview is complete and covers all aspects of sustainability, it even contained some aspects they were not aware of as part of sustainability.

Q-sorting
Part of the Q-sorts are computer-based and part interview-based. Reber, Kaufman and Cropp (2000) concluded that there is "*no apparent difference in the reliability of validity*". A side note is made by Exel & De Graaf (2005) that the researcher usually understands the results better in interview-based Q-sorts. Due to the limited time, 15 out of the 20 Q-sorts were collected digitally. To make sure the researcher understands the result in the right way, the Q-sort was evaluated in half an hour interview.

Three of the six first respondents who submitted the Q-sorts digitally, reflected that the submission was quite time consuming and took more than the prescribed 30 minutes. Based on their feedback, the researcher suggested a slight change to the following online respondents. The motivation on the extremes did not have to

be submitted in the format but would be discussed during the follow-up interview, while the researcher filled in the answers afterwards in the format. This prevented the other participants from cutting corners to save time.

Within the five interview-based Q-sorts, it was noticed that in most cases, the aspects were slightly interpreted in personal ways and not fully based on the listed definitions. Even though the respondents were asked to read the list of descriptions and examples before sorting the aspects, they sometimes sorted the aspects based on personal interpretation. This phenomenon forms a limitation to this research results, since some aspects could be interpreted differently based on personal preferences.

Participants
The diversity in participants was low. For example, there was only one female participant. Even though the number of female project managers in the engineering industry is very low, it would be better for the research to include more women. The distribution of age was fairly reflected.

All participants selected, worked at the same company. The perspectives they shared could be influenced by the company culture and the way of working they have at that company. This is already mentioned as a suggestion for further research.

Analysis
There was no ideal number of factors for the analysis of the Q-sorts. The 4-Factor had an CEV which was 2% below the minimum of 50% and the 5-Factor had to be manually adjusted and that version lacked adequate distinguishing aspects for good interpretation of the perspectives. One or two extra Q-sorts could already help to get a sufficient CEV, but due to limited time this was not possible.

The analysis of the averages of the first and second sorting by all participants, did give a good overview of how project managers approach the integration of sustainability in their projects.

Results
The quantitative results are derived from widely used software (PQMethod) and therefore considered valid. The next step of the gathering of the results was the qualitative analysis. The interpretation of comments of loading respondents was challenging as, even though the perspective did have very low correlation between them, there was no clear reason what determined the different factors based on personal or project background. The comments of the participants had big overlap to make the integration of sustainability easy or difficult. However, the overlapping comments did show what the dominant and most mentioned reasons are which need the first attention if integration of sustainability in projects is required.

Most of the influencing reasons mentioned have a positive and negative form, i.e. "*not in standard way of working*" is negative influencing the integration and 'in standard way of working' is making the integration of sustainability aspects easier. However, there are some reasons mentioned by project managers which have the same meaning but motivated differently. For example, some project managers mentioned "*the aspect is no issue within this project*" as a reason for why it was perceived as difficult to integrate it. Another observed "*the aspect is no issue in this project*" as reason for why it was perceived as easy to integrate it. This shows the complexity of this research and the level of concern of the project manager within integrating sustainability aspects.

External validity
The external validity depends on the definition of the domain to which the outcome of a research can be generalised (Yin, 2003). As the results of Q-methodology are based on perspectives of a limited group of participants, the results cannot be generalised to an entire population. However, the average results and comments about influencing reasons, can be considered as relevant for project managers within comparable engineering companies.

Each participant had one reference project in mind while answering the questions in the interview. This gives body to the answers but could limit the applicability of the results to other projects since projects can be seen as very specific.

Reliability of the research

Reliability is seen as follows: *"if the research could be done in the same way and with the same results*" (Gijzel, 2014)(p. 90). The sources and steps taken to get to the Q-sample and P-set are described in this research. The explanation of the steps taken by the researcher increases the reliability.

Another way of evaluating the reliability of results is with a sensitivity analysis. A sensitivity analysis refers to how the variation of variables or uncertainty can influence the final solution (Walker & Fox-Rushby, 2001). Since the procedure of selection and interviewing can involve risk relevant to scientific validity of findings, a short sensitivity analysis is performed to supplement the limitations in this research. This analysis helps to check how results would be changed by for example, a different selection of sustainability aspect, different sample of participants or by a different selection of the reasons influencing sustainability. This analysis is used within this chapter to mention the variables which could influence the research. The full sensitivity analysis requires to identify parameters, justification of all choices involved, choices of techniques to analyse uncertainty and interpret all data (Walker & Fox-Rushby, 2001). The exact influence each variable has is not part of this research scope so in this chapter only the parameters are defined which could influence the result are described.

The main weakness within this research can be divided in three processes:

1. Selection of sustainability aspects from literature resources by the researcher, with parameters:
    a. Number and type of source used as input for the collection of sustainability aspects;
    b. Selecting and merging of the collected set of sustainability aspects;
    c. Defining the selected sustainability aspects.
2. Determine most easy and difficult aspects to integrate by the participants, with parameters:
    a. The number of the top analysed, decision for five instead of more or less aspects;
    b. Moment and way of performing the Q-sorts and interviews.
3. Select reasons which influence the integration of sustainability by the researcher, with parameters:
    a. Interpretation of the reasons while coding them;
    b. Selecting and merging the listed reasons;
    c. Grouping selected reasons.

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APPENDICES

The appendices have a comparable structure as the content in the main body: literature review, methodology and results. If extra information was needed to support the content of previous chapters, a reference was made to this part.

Table of content Appendices

A LITERATURE REVIEW

A.1 Sustainability Impact Assessments

In this sub-chapter nine Sustainability Impact Assessments focused on projects, as mentioned in the literature review 2, are further elaborated. In each paragraph the name, authors, what the model does, how the model works, and two pictures of the model in which the layout and the design of the model are shown.

Similarities between the models lie in various sustainability criteria, mainly derived from similar sources, based on similar conceptual foundations, all models can be used as self-assessments or independent assessments, and all models consist a scale with various perspectives of sustainability, at least the Triple Bottom Line, and contain multiple sustainability aspects with relevant variables.
Most of the instruments are derived from the sustainable Guidelines for Reporting (GRI, 2011), several UN standards, and from a list of sustainability criteria as published by Silvius in 2010. The conceptual foundation from all models is the triple bottom line of Elkington and for most of the models the article of Labuschagne and Brent (2015).

Differences between the models are in the nature of the model, unit of analysis and in the design of the model. The nature variates between checklists, maturity models, assessment models and prioritizing models. The unit of analysis distinguished between the entire project, project process and project product. And the design is specific per method. A broader description per SIA can be found in in de next sub-chapters.

Table 8 Overview SIAs with descriptions

	Title model (author)	Description model
1	Sustainability criteria for projects (G. Silvius & Schipper, 2010; G. Silvius et al., 2012)	This checklist shows 36 variables of 11 aspects of sustainability and can be used to 'check' if all aspects of sustainability are included in the project. However, it is more often used as base for other maturity models than as tool used in practice.
2	Maturity model for the integration of sustainability in projects and project management (G. Silvius & Schipper, 2010)	This model assesses impact of sustainability with a questionnaire in which 11 sustainability aspects are scored on the occurrence in resources, business processes, business model, products/services, or non-existence. In both the actual and desired situation. This model is an extended version of model 1.
3	Sustainable Footprint Methodology (I Oehlmann, 2010)	In the Sustainable Footprint Methodology, the performance of 48 aspects of sustainability are separately scored (worst-best) in a matrix per pillar of the TBL and three project levels: pre-phase, execution and operation.
4	P5 Standard for Sustainability in Project Management Version 1 (GPM Global, 2014)	The P5 Standard consists of 5 perspectives on sustainability: people, planet, profit, process and product. All five consist of multiple sustainability aspects with a small description. Per project a risk matrix with impacts and actions is designed.
5	Project Sustainability Logbook (PSL) (FIDIC & EFCA, 2013)	The PSL is used as risk matrix in which 14 aspects of sustainability with multiple variables can be prioritised by importance. In an excel format, each variable is supplemented with benchmark targets, expected performance and assessment methodologies.
6	Sustainable Project Management Maturity Model (SPM3) (G. Silvius & Schipper, 2015)	SPM3 is the improved version of model 2. In this model, the sustainability aspects are updated and the scores are adjusted to: compliant–reactive–proactive–purpose. The questionnaire is two-fold and measures impact in project process and project product.
7	P5 Standard for Sustainability in Project Management Version 1.5.1 (GPM Global, 2016)	This renewed version of the P5 standard contains a reviewed and optimised group of sustainability aspects. The use and presentation of the results are the same as in model 4.
8	Project Sustainability Excellence Model (PSEM) (Szabó, 2016)	PSEM contains besides sustainability aspects, innovation and creativity to score as these are connected to reach project success. Each variable is scored numerically and the results are either shown in spider webs or used in sustainability equations.
9	Project Sustainability Impact Assessment (PSIA) (Tam, 2017)	PSIA consists of multiple steps in which project stakeholders come up with suitable sustainability aspects within their project context. These aspects are reviewed in every project phase for monitoring and controlling purposes, aspects of sustainability are not predefined.

A.1.1 Checklist for the integration of sustainability in projects and project management

The 'checklist for the assessment of the integration of the concepts of sustainability in projects and project management' is developed by G. Silvius & Schipper (2010) during a workshop at the 2010 IPMA Expert Seminar, 'Survival and Sustainability as challenges to projects'.

Silvius is professor Business, ICT and Innovation at the University of Applied Science and works at Consultants of Van Aetsveld Project and Change management. Schipper works as consultant at Van Aetsveld as well. The model is based on the concepts of the Global Reporting Initiative's (GRI) guidelines G3 (GRI, 2006) with a conceptual foundation in the TBL (Elkington, 1998).

The model shows the relevant aspects of sustainability and can be used as a checklist for integration of sustainability in projects and project management. There is no scoring per aspect of sustainability only a check if the aspects are available yes or no. The checklist can be used in various stages of the project to literally check if the aspects of sustainability are considered yes or no.

The model consists of 3 perspectives (economic-, environmental-, and social sustainability), with 11 aspects and 36 variables (see Figure 22).

Economic Sustainability	Return on Investment	- Direct financial benefits - Net Present Value
	Business Agility	- Flexibility / Optionality in the project - Increased business flexibility
Environmental Sustainability	Transport	- Local procurement - Digital communication - Traveling - Transport
	Energy	- Energy used - Emission / CO2 from energy used
	Waste	- Recycling - Disposal
	Materials and resources	- Reusability - Incorporated energy - Waste
Social Sustainability	Labor Practices and Decent Work	- Employment - Labor / Management relations - Health and Safety - Training and Education - Organizational learning - Diversity and Equal opportunity
	Human Rights	- Non-discrimination - Freedom of association - Child labor - Forced and compulsory labor
	Society and Customers	- Community support - Public policy / Compliance - Customer health and safety - Products and services labeling - Market communication and Advertising - Customer privacy
	Ethical behavior	- Investment and Procurement practices - Bribery and corruption - Anti-competition behavior

Figure 22 Checklist for integration of sustainability (G. Silvius & Schipper, 2010)

A.1.2 Maturity model for the integration of sustainability in projects and project management

The 'maturity model for the assessment of the integration of the concepts of sustainability in projects and project management' is a follow-up on the checklist from the previous sub-chapter. The model is designed by G. Silvius & Schipper (2010) to stimulate that the present standards for project management address the sustainability agenda. As "*integration of sustainability in projects and project management is not fully recognised yet*" (p6).

This maturity model (2012) is based on observations and experiences from the consultancy field and scientific knowledge.
The aim of this maturity model is to stimulate the incorporation of sustainability in projects and project management processes. The goal of the model is fourfold:

- to set standards and ambitions in accordance with company values;
- to monitor and report development;
- to translate abstract concepts into practically applicable prescriptive actions;
- to open discussion.

The model shows the actual and desired level of sustainability aspects and can be used as maturity model. The assessment is performed in the form of a questionnaire, submitted by someone in the organisation. It is not explicit mentioned whom from the organisation must fill in the questionnaire.

The model is divided in 3 perspectives (economic-, environmental-, and social sustainability), with 11 sustainability aspects and 36 variables. The level of consideration of sustainability is assessed for both the actual and desired situation on a 5-point scale in terms of: resources, business processes, business model, products/services, or non-existence at all are assessed. However, each point contains of a description instead of the terms mentioned before (see figure below).

In which way does the project try to minimize its waste?

	Actual situation	Desired situation	
A.	[ ]	[ ]	No specific policies on this point.
B.	[ ]	[ ]	Waste in the project is separated in recyclable and non-recyclable and collected by the local waste handling companies.
C.	[ ]	[ ]	The project has policies (e.g. double sided printing) to minimize waste and waste in the project is separated.
D.	[ ]	[ ]	The project is designed to minimize waste and necessary waste is as much as possible recycled in the project itself.
E.	[ ]	[ ]	The project and the result it delivers are designed to minimize waste and necessary waste is as much as possible recycled in the project or result itself.

To what extent does the project apply policies or standards for diversity and equal opportunity that reflects the society it operates in?

	Actual situation	Desired situation	
A.	[ ]	[ ]	The project does not have any specific policies on diversity and equal opportunity, but complies with the standards and regulations of the organization it operates in.
B.	[ ]	[ ]	The project explicitly seeks diversity and complies with applicable standards and regulations on equal opportunity in terms of gender, race, religion, etc.
C.	[ ]	[ ]	The project actively (re) designs its work processes in a way (e.g. by designing part-time jobs) that diversity and equal opportunity are promoted and stimulated.
D.	[ ]	[ ]	The project actively (re) designs its work processes in a way (e.g. by designing part-time jobs) that diversity and equal opportunity are promoted and stimulated, and requires its suppliers to practice diversity practices and provide equal opportunity in terms of gender, race, religion, etc.
E.	[ ]	[ ]	The project's result is designed to improve diversity and equal opportunity in the society it operates in and this reflects in the way the project is executed and in its suppliers and users.

Figure 23 Example of questions of maturity model 2 (G. Silvius & Schipper, 2010)

The results are presented in a graphical way, that allows organization to benchmark their maturity and to monitor their development (see Figure 24). A distinction is made between dark and light colours: the actual and desired situation.

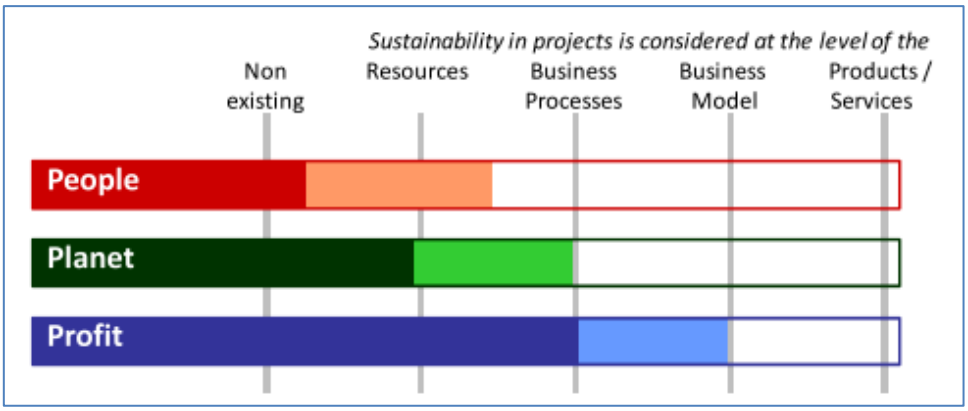


Figure 24 Format sustainability integration: actual (dark) and desired (light) (G. Silvius & Schipper, 2010)

A.1.3 Sustainable Footprint Methodology

The 'Sustainable Footprint Methodology' is developed by I. Oehlmann (2010), as part of her master thesis for the Technical University of Delft in collaboration with TAQA Energy.

The relevant pressure on companies to incorporate principles of sustainability development into policies and activities (Keeble, 2003) in combination with the lack of scientific basis on how to incorporate sustainability principles in the project management procedures (Silvius, Brink et al. 2009) let to this research.

This model is based on the (at that moment) existing models and sustainability indicators of Life Cycle Analysis (LCA), GRI Guidelines, World Wide Fund, Sweden's environment policy, United Nations (IUN) commission on sustainable development (p16), and literature of Silvius & van den Brink&Köhler, Labuschagne & Brent, Gareis&Huemann&Martinuzzi, and IPMA/ Turner.

The aim of the research was to improve understanding of sustainability in project management, as sustainability and project management are increasing in importance in the future (I Oehlmann, 2010).

The model is the result of an explorative study and can be used to balance trade-offs between the TBL, and evaluate and implement sustainability principles in project management, and to benchmark projects. "*Directors must stimulate the implementation of the new framework; project managers should use it and the whole project team should be updated on the measures and results*" (I Oehlmann, 2010)(p. 39).

The model consists of 3 perspectives (people, planet, profit), 3 levels (project pre-phase, project execution, operation of asset), and 48 sustainability aspects. These are assessed on a 5-point scale, from '1: no awareness and attention for sustainability in the performance' to '5: implementation is consistent over the relevant period' (see figure below).

Figure 25 Coloured scoring system maturity model (Oehlmann, 2010)

The assessment consists of several steps.

1. Select (with an expert panel) the aspects that are most relevant for each specific project you want to assess p38) while taking the long-term sustainability view in mind;
2. Score each selected aspect with the coloured score card based on several questions per aspect (see Figure 26);
3. Evaluate the score.

Some of the assessments include project life cycle. *"Typical phases in the project life cycle are: idea generation, pre-feasibility, feasibility, development and execution, commissioning, launch and post-implementation review (Buttrick 2000)."*(I Oehlmann, 2010)(p. 47)

Indicators on People

Level 1: Project Pre-Phase

1.1.1 Stakeholders (George 1999; Labuschagne and Brent 2005) (External Social Performance).

'Stakeholders' involves stakeholder analysis, information provisioning to the stakeholders and stakeholder influence.

- Stakeholder analysis
  - Are all groups or individuals affected by the project been identified and have the impacts on them been assessed?
- Information provisioning
  - Are stakeholder meetings organized?
  - Are there community forums, information brochures and/or information websites?
- Stakeholder influence
  - Do stakeholders have an effect during the project pre-phase?

1.1.2 Customers

'Customers' entails the impact on the quality of life by using the product, for the customer and for the whole community.

- By using the product, is the quality of life of the customer improved or nor hampered?
- By the existence of the product, is the quality of life of the whole community improved?

Figure 26 Example of indicators and questions to score each sustainability aspect (I Oehlmann, 2010)

The duration of the assessment is expected to take: 3 months to select indicators, 20 meetings to fill in indicators and evaluate the various projects. This selection, submission and evaluation is performed by internal employees who know the most about the projects.

A.1.4 P5 Standard for Sustainability in Project Management Version 1

The 'P5 Standard for Sustainability in Project Management, version 1' is developed by GPM Global (2014). GPM stands for Green Project Management and is registered as a global business association, the first project management professional development organization among its signatories. GPM designed the P5 Standard for Sustainability in Project Management Version 1 to serve as sustainability framework based on the PRiSM methodology, ISO standards, GRI G4 indicators and the UN Global Compact Ten Principles.

The reason for this research is to develop a tool to measure and report sustainability within projects. The model is based on the sustainability checklist of Silvius et al. from the 2010 IPMA Expert Seminar, 'Survival and Sustainability as challenges to projects'.

The model shows aspects of sustainability with a description what is meant with each variable. The GPM P5 Standard can be used to "*support the alignment of Portfolios, Programs and Projects with organizational strategy for sustainability and focuses on the impacts of project processes and deliverables on the environment, society, the corporate bottom line, and the local economy*" (GPM Global, 2014)(p6).
The tool helps to define what and how to measure the sustainability-related impacts of a project, and uses 5 perspectives (people, planet, profit, process and product), 11 sustainability aspects and 46 variables to do that.

There are several ways to perform a P5 Impact Analysis. The simplest and most effective way is to score each sustainability aspect on a 7-point scale depending on the positive or negative impacts (-3 -2 -1 0 +1 +2 +3) and document the outcome in a risk register. The lower the score, the better the indicator performs.

The output can be used to give key decision makers across various functions the actionable information they need, and to justify changes to the project scope in socially and environmentally responsible activities (P23). The results are presented in a risk register to get insight in what the problem areas, from a sustainability perspective (see Figure 27 and Figure 28). These risks can be collected and reported in a Sustainability Management Plan (SMP). The use of an SMP increases the likelihood for success for sustainability integration in project initiatives by managing change from a present state to a desired future state. By assessing the project frequently, a status report is developed to show what the previous and new score per sustainability aspect is, including the reason for change.

	Deliverable 1	Deliverable 2	Deliverable 3	Score
Carbon Emissions	+3 (high impact)	+1 (low impact)	-2 (medium impact)	+2

Figure 27 Example P5 scoring system (GPM Global, 2014)

P5 Category	P5 Sub Category	P5 Element	Reasoning	Score	Legal Regulation	Proposed Action
Social	Labor Practices and Decent Work	Employment	Hiring Practices do not meet the needs of the project.	+2	None	Propose a competency/skills assessment as part of the interview process
Environmental	Transport	Local Procurement	Components are being shipped from 8,000 Miles away	+2	Out of Compliance	Recommend local suppliers and cost benefits analysis.

Figure 28 Example SMP risk matrix based on P5 model (GPM Global, 2014)

The assessment must be performed during the initiation phase of a project according to the PRiSM methodology to define and prioritise sustainability risks and opportunities for project's value improvements.

A.1.5 Project Sustainability Logbook (PSL)

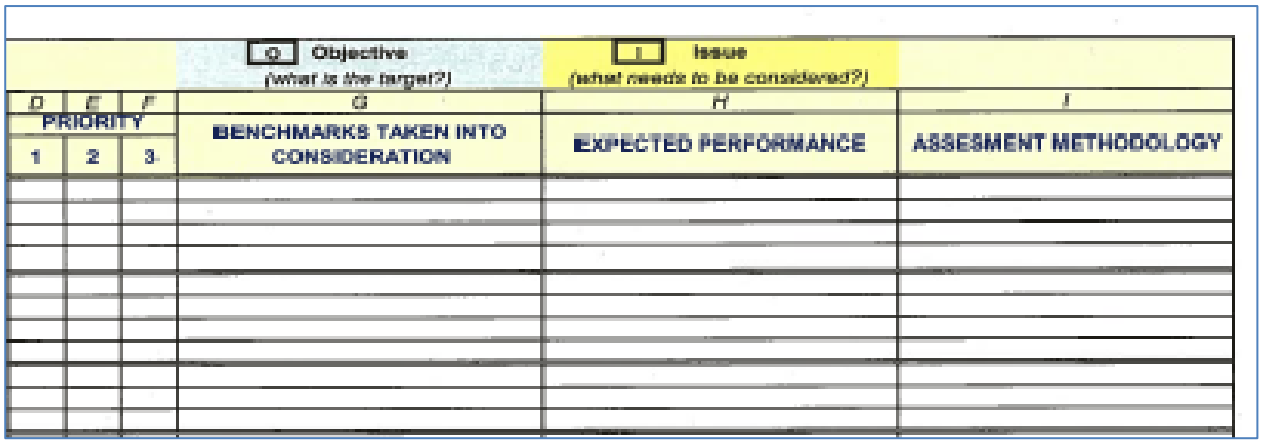
The 'Project Sustainability Logbook' (PSL) is the combined work of the two federations FIDIC & EFCA (2013). These federations represent the consulting engineering industry the world, and support the industry's development in Europe with pragmatic actions and tools which are needed to implement the goals of sustainable development within projects and programmes (FIDIC & EFCA, 2013)(p. 1).

PSL responds to the need to integrate the requirements of sustainable development, using a holistic approach, throughout the life of a project or programme from the initial planning stage to the end-of-life stage (FIDIC & EFCA, 2013). The model is based on the ISO 14001 environmental management standard, ISO 26000 guide to corporate social responsibility, and the Global City Indicators Facility indicators for urban services and quality of life.

The logbook, comprising a series of tables, offers a method of defining and monitoring the issues and objectives of sustainable development for a specific project or programme. It involves all stakeholders and aims to couch the planning, design, construction, operation and end-of-life of projects or programmes in a sustainable development perspective.
The table consists of 4 domains (governance, social/society, environment and economic), 14 themes of sustainability aspects with 63 variables**.** These are assessed on a 3-point priority level.

PSL can be used to facilitate discussions between political authorities, clients, project managers, engineers, designers, contractors, and operators and indeed all who aim to promote sustainable development. And can be used for all types of projects or programmes including buildings, services infrastructure and industrial plant - both new and existing - at all stages from planning and design through the construction, operation and end-of-life.

The assessment is performed as followed. For a project, the issues and objectives are selected and the priority is assigned to each of the selected issues or objectives. Not all variables have to selected as issue or objective. The tables evolve over time, with the obligation to keep an historical record and a justification of the choices.
The PSL show on overview of "*identification and ranking priorities of the main issues, the definition of the objectives for each issues, the implementation of actions to ensure objectives, and the adoption of a monitoring and evaluation procedure for each action*" (FIDIC & EFCA, 2013)(p4). It results in a clear overview of the issues thereby helping in ranking the issues and making the engagement for sustainable development more coherent.



			O Objective (what is the target?)		I Issue (what needs to be considered?)	
D	E	F	G	H	I	
PRIORITY			BENCHMARKS TAKEN INTO CONSIDERATION	EXPECTED PERFORMANCE	ASSESSMENT METHODOLOGY	
1	2	3				

Figure 29 Example overview results of PSL (FIDIC & EFCA, 2013)

A.1.6 Sustainable Project Management Maturity Model (SPM3)

The 'Sustainable Project Management Maturity Model' is the third model in this list developed by G. Silvius & Schipper (2015). The authors noticed that sustainability is understood by instinct but still difficult to express in concrete, operational terms. A condition for this operationalisation is the availability of an instrument that can be used for the assessment and development of the integration of sustainability in projects and project management (G. Silvius & Schipper, 2015).

The model consists of a questionnaire and assesses the actual and desired level of sustainability as foundation to develop organizational actions for integrating the concepts of sustainability in projects and project management.

The questionnaire is developed to be applied specifically to projects and to assess the integration of sustainability on the level of an individual project. Previous models can be used on products and processes and could have resulted in different outcomes for the same project. For this reason, the SPM3 assesses two sub-domains: project process and project product.

The model is developed with a core team coming from academia and industry, and based on various researches and existing models, among which: GRI G3 guidelines, UN Global Compact, SDI framework, SDGs, ISO 26000, 2010 IPMA Expert Seminar 'Survival and Sustainability as Challenges for Projects', and the TBL.

The assessment consists of three parts: the first part is about the respondent and the organisation part of the project (12 questions), the second part is about the integration of sustainability in the project process and the third part about the integration of sustainability in the project product. The two last parts consist both of 3 categories (economical, environmental and societal), each with 22 different sustainability aspects. These are assessed on a 4-point level (compliant, reactive, proactive or purpose) on which the different indicators of sustainability are integrated in the project (see example question below).

*Section A. Considering sustainability in the **process** of (executing) the project*

Question A.1. **Return on investment**

How is attention for creating value with the project, for example by developing and managing the business case, integrated in the project processes, the way the processes are organized and executed and the selection of resources in the project?

	Actual situation	Desired situation	
1.	[ ]	[ ]	This aspect is considered implicitly, in compliance with laws and (company) regulations. No specific policies are applied in the project.
2.	[ ]	[ ]	This aspect is considered explicitly, but reactively, and with the intention to not compromise the interests of different stakeholders of the project.
3.	[ ]	[ ]	This aspect explicitly considered as one of the areas that the project contributes to.
4.	[ ]	[ ]	Making a contribution to this aspect is one of the drivers behind the project and included in the justification of the project.

Figure 30 Example question sustainability aspect, actual and desired situation (G. Silvius & Schipper, 2015)

The results of the assessment are reported in a graphical way, showing both the actual levels and the desired levels of integration of the sustainability aspects. Based on the differences between actual and desired levels, organizations can discuss their improvement actions, develop an action plan to bridge the gap between actual and desired levels of maturity, and monitor their process. The results are two graphs: one for the project' process and one for the project' product. An example of the results of an assessment of the project' product is shown in the figure below.

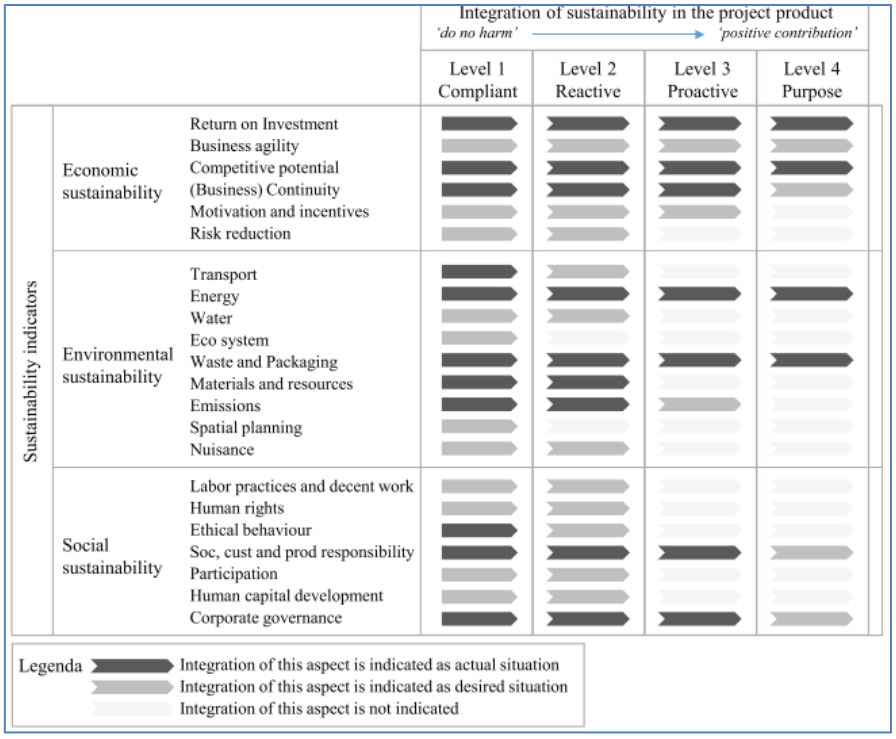


Figure 31 Example results SPM3 model on project product (G. Silvius & Schipper, 2015)

A.1.7 P5 Standard for Sustainability in Project Management Version 1.5.1

The 'P5 Standard for Sustainability in Project Management Version 1.5.1' is the new version of the P5 Standard version 1 of GPM Global (2016).

The reason for this research is that there is a demand for sustainable business practices with the global focus on sustainable development, climate change, ethical behaviour, social responsibility, and transparent supply chains has increased in recent years (GPM Global, 2016).
The release of this renewed version aligns with the publication of the Sustainable Development Goals (SDGs) to provide greater focus on shared value for project managers to be able to address global challenges.
The model is based on the previous P5 model (version 1), the SDGs, the Projects in a Controlled Environment (PRINCE2) and the Management Successful Programs (MSP).

The goal of GPM is to place sustainable development at the heart of project management, and placing projects at the heart of sustainable development. The renewed P5 model provides insight and guidance to lead to more sustainable projects.
P5 measures project objectives and deliverables, their intended life spans, servicing, and project process for sustainable maturity and project efficiency. The model consists of 5 Perspectives (people, planet, profit, process, and product), operationalised in 11 indicators with 43 potentially relevant variables form the model. These can be assessed on a 7-point scale.

"*To perform a thorough P5 impact analysis, a project manager's understanding of the business case, project charter, project requirements and organizational sustainability goals, as well as a reviewing lessons learned from previous projects, is critical*" (GPM Global, 2016)(p34). The project manager performs the analysis in the initial phase and sets the baseline for the project. By frequently performing a new check, several reports can be made to monitor and control projects, for example status or sustainability reports. Developing a risk register using each element as a category is the simplest and most used. The most effective way is to use a scoring system. Each product deliverable and project process is scored against each element of P5 ranging from neutral (0) high (+ or - 3), medium (+ or – 2), and low (+ or – 1). The lowest value means the lowest impact. All items that pose a risk (anything with a + score) should be sectioned off, reviewed and mapped to into a Sustainability Management Plan (SMP). See the figure below for an example.

P5 Category	P5 Sub Category	Element	Justification	Score	Legal Regulation	Proposed Action
Social	Labor Practices and Decent Work	Employment and Staffing	Staff are not provided safe working conditions	+ 3	Safety Violations	Immediate Safety Inspection

Changes						
P5 Category	**P5 Sub Category**	**Element**	**Previous Score**	**New Score**	**Justification**	**Comments**
Social	Labor Practices and Decent Work	Employment and Staffing	+ 3	-1	All Safety Code issues have been resolved	Follow up on project site is scheduled weekly. Budget

Figure 32 Two examples P5 SMP matrix and status reporting

Compared to the previous version is the way of reporting and scoring similar. Only the content and selection of sustainability aspects with variables are different as they are supplemented with aspects from the SDGs and the process is stronger included.

Some aspects are described in the context of the 'project life cycle'. For the interpretation these aspects, the definition what is meant with 'project life cycle is described: *"There is no set time period for a product or asset life cycle as the length of each phase of its existence varies depending on economic life. A project's life cycle may*

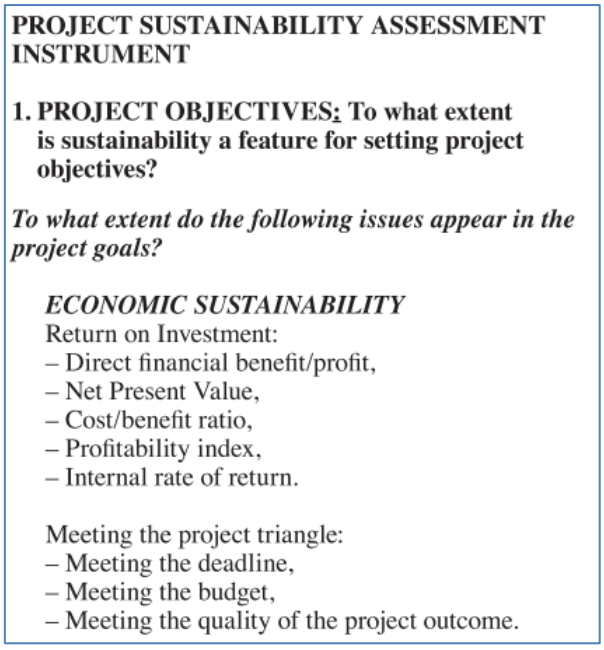
not be the same duration as its timeline as success may only be achieved at times such as 'benefits realization'. Therefore, its timeline may include a separate project for the period after a traditional contract project, which is the period of time between the traditional project period and the benefit being realised to the organization. One product's entire life cycle could be completed within a few months while another products could last for years." (GPM Global, 2016)(p.9). However P5 is mainly developed for cradle-to-grave measurement.
"Project management processes can be grouped into process groups as described in ISO 21500:2012. These process groups are initiating, planning, implementing, controlling, and closing." (GPM Global, 2016)(p. 12).
Product life cycle = life span of the product
Project life cycle = from the idea for the product until it is handed off in its final form.

A.1.8 Project Sustainability Excellence Model (PSEM)

The 'Project Sustainability Excellence Model' is developed by Szabó (2016), a University professor at the Corvinus University of Budapest.

The reason for this research is that there is "*no sustainability model yet which focus on the project rather than the organisation*" (Szabó, 2016)(p6). This model shows not only the aspects of sustainability but includes creativity and innovation of projects as well.
PSEM is based on the GPM P5 Standards, the EFQM Business / Project Excellence model, and 4 case studies of local development projects (cases: construction, pharmaceutical, development, mayor's office).

PSEM suggests a way for managers and consultants to integrate and evaluate sustainability, creativity and innovation into their strategies at project level. The strengths and weaknesses of the analysed project are identified and based on these results action plans can be developed in order to improve the project management system of the organization.
The focus is on the strategic decision-making process, including the strategy content at the corporate, business and functional levels. More specific: to get insight in (1) setting project goals, (2) achieve customer expectations and satisfaction, (3) extent achieve sustainability goals.
The assessment is performed during personal structured interview with selected project- and functional managers from the organisation. During these interviews, the interviewee must score each of the variables with a scale from 0-5 to what extent the features are objectives of the projects, see Figure 33 for a project example.



PROJECT SUSTAINABILITY ASSESSMENT INSTRUMENT

1. PROJECT OBJECTIVES: To what extent is sustainability a feature for setting project objectives?

To what extent do the following issues appear in the project goals?

ECONOMIC SUSTAINABILITY
Return on Investment:
– Direct financial benefit/profit,
– Net Present Value,
– Cost/benefit ratio,
– Profitability index,
– Internal rate of return.

Meeting the project triangle:
– Meeting the deadline,
– Meeting the budget,
– Meeting the quality of the project outcome.

Figure 33 Example question PSEM (Szabó, 2016)

The model contains 3 perspectives: (economic, environmental and social) sustainability, creativity and innovation, 9 evaluation criteria and 143 variables. These variables are assessed on a 5-point scale to what extent that variable is present.

Per evaluation criteria or perspective, a total score can be calculated with maximum scores to compare the different criteria. These scores can be calculated or visualised in spider schemes (see figure below). The score per dimension of PSEM can be calculated with the equation below.

$$Score = \sum points\ given\ by\ interview\ partners \cdot \frac{calculated\ maximum\ score}{maximum\ obtainable\ score\ of\ dimension}$$

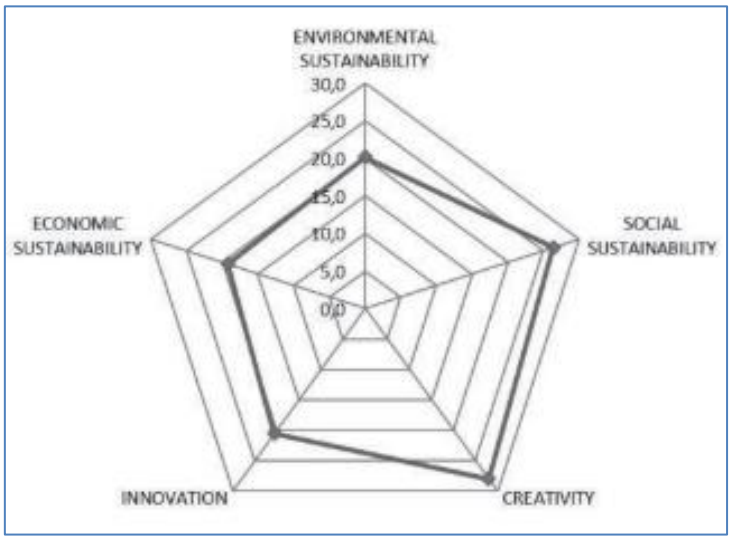


Figure 34 Visualisation of PSEM score for one project (Szabó, 2016)

A.1.9 Project Sustainability Impact Assessment (PSIA)

Project Sustainability Impact Assessment (PSIA) is the most recently developed model, developed by Tam (2017).

The goal of PSIA is to guide the process of sustainability-oriented decision-making by senior management and project managers with limiting trade-off considerations, to move the project toward greater and fuller sustainability. Sustainability assessment criteria must be designed to drive positive steps toward building a greater effort and leading to a sustainable society in a pragmatic manner. Absence of expertise, data, and support in a project or organisational context may hinder the implementation of such a sustainability assessment.

This assessment consists of a project sustainability impact assessment plan. There are two optional framework which can be used in this plan.
In 2010 Tam developed a project sustainability evaluation framework. In this frame work each phase of the project, concept – definition – implementation – handover & closeout, are connected to project review. In the project review the three pillars economic, environmental and societal sustainability aspects need review at various stages of the project lifecycle. There are no pre-determined aspects which influence the separate pillars. Another option is the sustainability evaluation framework for project management – principle based approach (Tam, 2013). In this framework, the project needs review at every stage of project lifecycle as well and more between-pillars considerations can be entertained due to different core principles for review than the three pillars in the previous model (see Figure 35 and Figure 36).

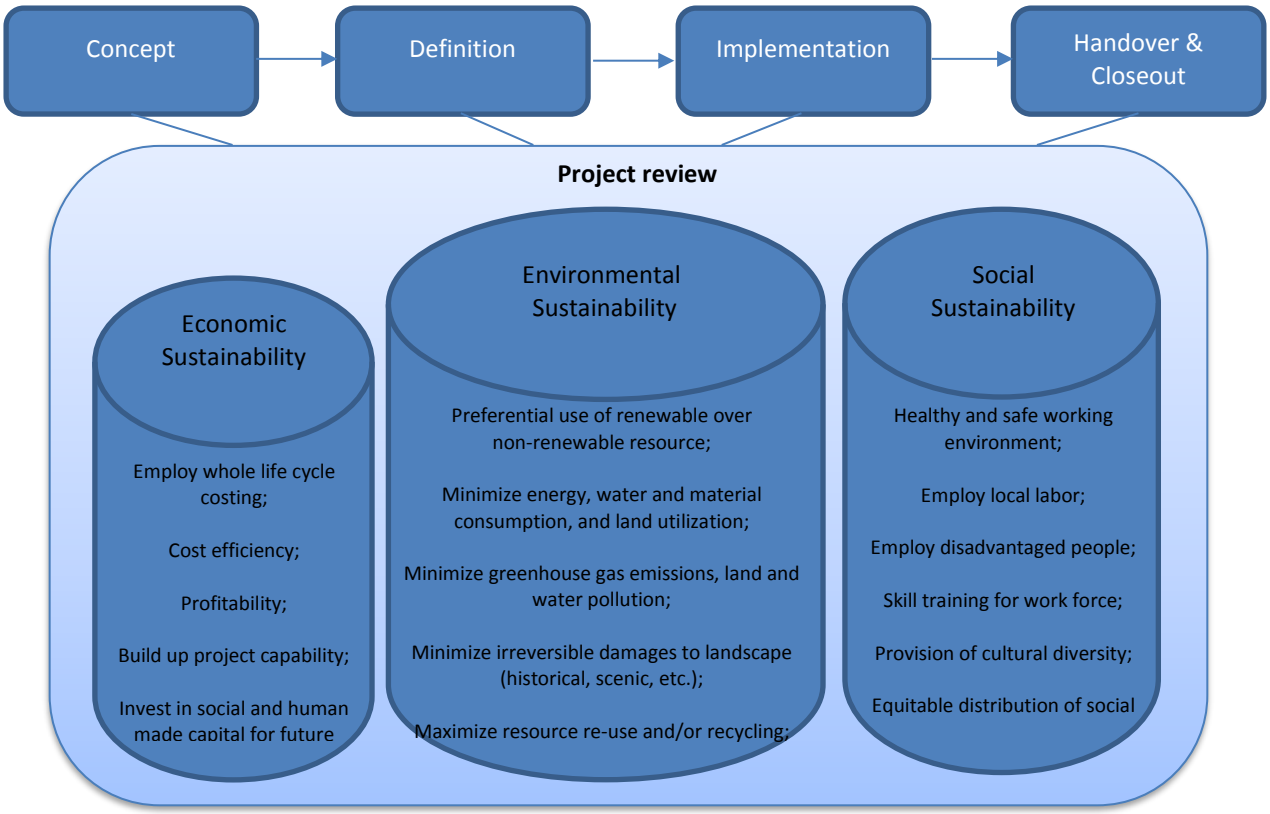


Figure 35 Sustainability evaluation framework for project management: three-pillars (Tam, 2010)

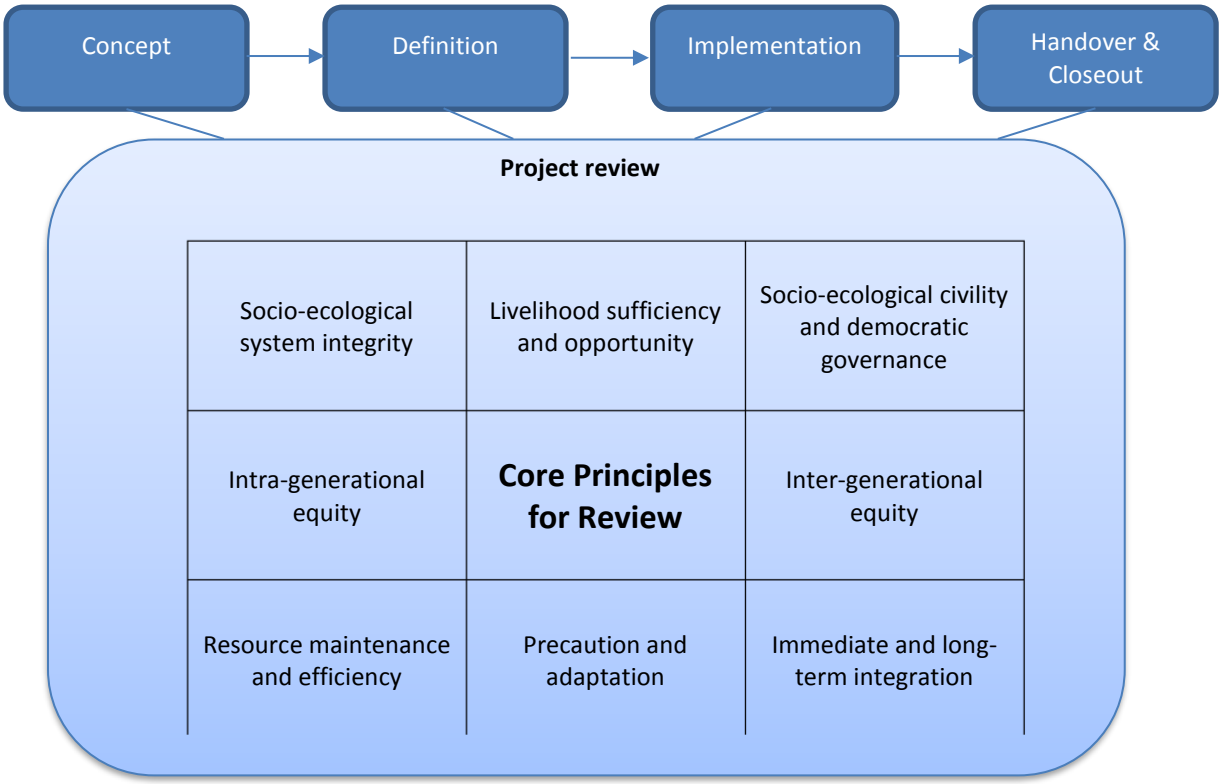


Figure 36 Sustainability evaluation framework for project management: principles-based (Tam, 2013)

After one of the two frameworks is selected, the project sustainability impact assessment plan can be developed. The plan describes the steps to be taken in the most logical and efficient order.

1. Scope of project sustainability impact assessment;
2. Assessment review plan;
3. Impact analysis; and
4. Optimization.

The impact assessment itself is performed by analysing economic, environmental, and social short- and long-term impacts within each pillar, and identifying within- and between-pillar synergies, conflicts, and trade-offs across these impacts.

PSIA is an approach to exploring the combined effects of economic, environmental, and social impacts of a range of interventions (policies, plans, programs, and projects), whether by way of ex-ante impact assessments or ex-post impact evaluation.
It is important that PSIA be fully integrated into the project's normal review process, integrating principles of sustainable development (both short-term and long-term effects) into project details.
They must also consider stakeholder involvement, specially to see if balanced views are represented, and emphasise the project team's transparent and accountable decisions (e.g., who is involved, what procedures and methodologies are used, and the reasons for chosen mitigation options and solutions).

The assessment of the impact can be both proactive and reactive and is performed by an assessor. No aspects are determined beforehand.

B METHODOLOGY: EXTRA INFORMATION AND EXAMPLES

In this chapter the steps from Figure 9, Figure 10, and Figure 11 in chapter 3 Methodology, are further motivated. Examples are given when interpretation of the researcher is involved.

B.1 Selecting sustainability aspects

(I) Select SIA from literature
The result from the concourse is a list of the most recent and relevant sustainability impact assessments. This is the basis for funnelling all aspects mentioned in the SIAs to a manageable amount of aspects of sustainability.

(II) Select only most recent SIA per author
Only the most recent version per author is selected as these are improvements on earlier versions. For example, GPM Global published a version *P5 Standard for Sustainability in Project Management Version 1* and a version *P5 Standard for Sustainability in Project Management Version 1.5.1*, only the aspects from the version 1.5.1 are included in this research.

(III) List all aspects in Excel
From the remaining SIAs, all aspects of the selected SIAs are listed in Excel. Not all SIAs use the word aspect, for example GPM uses components (2016) and Szabó uses indicators (2016) to define smaller parts of sustainability. In this research, the word ´aspect´ is used. The aspects are literally copied from the SIAs. The groups and sub-groups from each aspect are copied to an excel list. If there is no subgroup, the group name is copied in the subgroup and if there is no example, this field is left open (see examples below). The naming of the (sub)groups shows how the aspects can be sorted in a topic to prepare for the next step in which groups are renamed to ease the comparison of the different aspects.

The relevant literature which delivers the aspects of sustainability is called the concourse in Q-methodology. The word concourse comes from the Latin concursus, meaning "a running together", as when ideas run together in thought (Brown, 1993). In Q-methodology the concourse is the sum of everything people communicate about the subject of research.

The process to get from the concourse to a number of statements is "…more an art than science" (Brown, 1980). Too many statements minimise the outcome of shared perspectives, meaning it would be difficult to find patterns in the ranking of the statements by the various participants. On the opposite, too few statements do not represent the whole topic of research, meaning the statements or aspects which are sorted by the participants only broadly describe what the research is about or describe only parts from the topic. The best number of statements is between 30-50 aspects (Brown, 1996; Job Van Exel & Graaf, 2005). Each statement of the Q-sample needs to be of the same level of detail, clear and mutually comparable for ease of use (Job Van Exel & Graaf, 2005).

Table 9 Example of column aspects and groups copied into excel from relevant and recent SIA step III

SIA	Year	Group	Subgroup	Aspect	Description from SIA
3	2011	Environment	Project execution	Water	Incorporates the water withdrawal, the effect on the water sources and the percentage of water that is recycled and reused
5	2013	Economic	Economic development	Economic partnerships	
6	2016	Economic sustainability	Economic sustainability	Risk reduction	Preventing or reducing business and stakeholder risks

(IV) Rename group/ sub-groups to TBL
The groups are renamed to ease the selection and merging of aspects in the next step. The group and sub-groups of the five SIAs used within this research are divided in the three groups of the TBL, see table below for an example.

Table 10 Example renaming of groups of SIAs step IV (action researcher shaded)

SIA 3	SIA 5	SIA 6	SIA 7	SIA 8	New TBL group
Society/social	Society/social Governance	Social sustainability	Social bottom line	People results Social sustainability Processes Project leadership Creativity	People

Environment	Environment	Environmental sustainability	Environmental bottom line	Resources Environmental sustainability	Planet
Economic	Economic	Economic sustainability	(financial) bottom line	Economic sustainability Innovation	Profit

(V) Code all aspects initial and focused

Each aspect is coded based on commonalities in topic and/or example. Grounded Coding Theory is applied to code each aspect. This theory is an analytical way to categorize and cluster data (Charmax, 2006 cq. Sääksjärvi, Deken, & Person, 2011). The goal is to better understand the data and support the funnelling process from hundreds to 30-50 aspects of sustainability. Two phases of the Grounded Coding are used in this research: initial coding in which parts of texts are coded in active form and focused coding in which the initial codes are coded with single names (Charmax, 2006 cq. Sääksjärvi, Deken, & Person, 2011). Focused coding describes the aspects of sustainability for the Q-sample. After all aspects receive an initial code, from top till bottom all aspects receive a focused code. Aspects with the same focused code can be grouped together due to their overlapping character. This overlapping character are similarity in words, used in different aspects of different SIAs.

See for an example Table 11 in which the bold words have overlapping characters and shaded cells are actions from researcher. The new TBL group is similar. SIA 5 and 7 both mention transparency and communication in the sub-group, aspect or description so these two can be coded with the same name. SIA 6 mentions 'transparency' but no literally 'communication'. However, reporting can be seen as a way of communicating so for this reason this aspect receives the same focused code as the two aspects from SIA 5 and 7.

Table 11 Example coding aspects of SIA (overlapping characters bold and actions researcher shaded)

SIA	Aspect from SIA	Description from SIA	TBL group	Initial code	Focused code = new sustainability aspect
5	dedicated communications		People	dedicating **transparent communications**	corporate governance
6	corporate governance	**corporate governance**, for example by practicing sustainability **reporting** and creating **transparency** and accountability	People	practicing sustainability reporting and creating **transparency** and accountability	corporate governance
7	bribery and corruption	Policies, practices, and transparent **communications** with regards to forms of corruption, including extortion and bribery.	People	Policies, practices, and **transparent communications** with regards to forms of corruption, including extortion and bribery.	corporate governance

(VI) Exclude aspects which focused code is only in one SIA

The aspects with a focused code which are mentioned only one time in all SIAs are excluded from the list. This means the aspect has no overlapping character with other aspects and could be incidental. Each focused code is similar to one aspect for the final list of sustainability aspects, also called the Q-sample.

(VII) Merge initial codes to one description per focused code (= aspect)

Each focused code (called an aspect from now on) receives a description which covers the meaning of the aspect for the Q-sample. The aspects with overlapping character, with other words with the same focused code are merged to form one definition per aspect. The full overview of the raw data can be found in C.1.1 Initial and focused coding and C.1.2 TBL sub-group & occurrence >1 in SIAs.

Merging aspects is a grey area, it involves subjectivity. During the focused coding, groups are formed based on overlapping topics (for example transparency and communication in the example above). To find one definition and merge the aspects, the initial codes are listed and topics which are mentioned most in the initial codes of all SIAs are combined into one new definition. See for an example Table 12.

Table 12 Example merging aspects step IV (shaded columns are actions from researcher)

Merged initial codes from literature	TBL	Sustainability aspect	Description
Corporate governance, for example by practicing sustainability reporting and creating transparency and accountability; Policies, practices, and transparent communications with regards to forms of corruption, including extortion and bribery; Dedicated transparent communications	People	Corporate governance	create transparency and have clear accountabilities

B.2 Integration of sustainability aspects in projects

First, the selection criteria for the participants are motivated. In the second sub-chapter, the factor analysis is further motivated.

B.2.1 Selection of participants

(I) Select company
The company the participants work for. Different companies have different cultures which could influence how project managers approach sustainability in their projects. Only one company is chosen as source for participants to limit the number of variables. The P-set in this research is a representative selection of project managers within one engineering consultancy company, Royal HaskoningDHV (RHDHV).

(II) Select project managers
The role of the participant. As this research focuses on the approaches of project managers, the participants need to have a role as project manager of a minimum of one project.

(III) Select type of project
The type of projects the participants work in. Within RHDHV the different types of engineering projects are divided over four business lines: Transport & Planning (TP i.e. bridges, railways and highways), Industry & Building (IB i.e. factories, hospitals and offices), Maritime & Aviation (IB i.e. airports, airstrips and dikes) and Water (W i.e. water purification plants, reclamation designs and wastewater treatments). Together these four business lines (TP, IB, MA and W) represent the broad scale of possible engineering projects in the construction sector. The P-set for this research needs to represent all four types of projects to give a complete view about this sector.

(IV) Determine experience with sustainability
The experience with sustainability. The project managers need to have some experience with sustainability in their projects to make sure they understand what is meant with the aspects from the Q-sample. The participants are selected based on their experience as project manager of a minimum of one project showing some aspects of sustainability. Project managers are selected based on an internal database and also on recommendations.

(V) Determine project criteria
The characteristics of the projects the participants work, or worked, in. To make sure the projects are comparable and to limit the bias of the project managers, there are selection criteria determined for the projects. These selection criteria are:

- The finishing phase is in 2017 or later, so knowledge about the project is still relatively fresh in the mind of the project manager.
- The internal contract sum for RHDHV is >€50k, so there is a significant involvement of the project manager within the project.
- Paper projects are excluded. Paper projects are projects where only a report about an intangible project is the final product, for example research or advisory projects. These are excluded because there is no deliverable other than a report in this type of project which makes it difficult to determine how sustainability is integrated in the final design.
- The project manager is Dutch, so there are no biases based on background and culture and to limit the scope of this research.

The project managers are chosen based on the described project criteria. However, the project manager is not obligated to use the project where he or she is selected on as reference project within the Q-sort. The main goal of the criteria is that the project managers have comparable ideas and reasoning about sustainability in their projects.

(VI) Determine availability and equal representation of all project managers.
The type of project, country of execution, and type of client are expected to influence the ease of integrating sustainability in projects. After all project managers who comply with the first five criteria are selected, the project managers are selected to find an equal representative distribution of previous criteria. For example, if only five project managers came out of the selection criteria within MA and fifteen within W, then all five project managers of MA are contacted. From the fifteen of W the project managers which have different countries of execution and different clients are randomly contacted to participate to stimulate equal distributions.

Within this research, the participants are anonymised for privacy reasons. After the list of sustainability aspects (Q-sample) and the participants (P-set) are selected, the aspects can be sorted (Q-sorting).

B.2.2 Factor analysis

The analytical process of analysing the Q-sorts from raw data to factors are described in multiple sources, one of the most recent and elaborated is the article from Zabala and Pascual (2016). For the ones interested, this is one of the articles which can be consulted for further understanding. This sub-chapter will focus only on the decisions the researcher had to make in performing the factor analysis, see Figure 37.

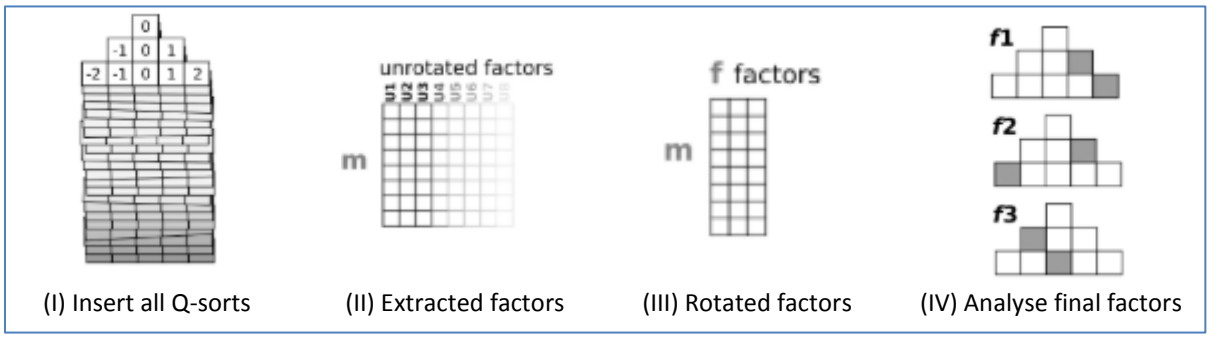


Figure 37 Analytical steps of analysing Q-sorts from raw data to a few factors

(I) Insert Q-sorts
In order to analyse the Q-sorts of the participants and extract the 'ideal set of factors' software can be used. In this research PQmethod version March 2014, Release 2.35 is used, which is developed especially for the analysis of Q-methodology. In this programme, the Q-sorts can be entered, and factors can be extracted, rotated and analysed as these are commonly applied steps within the statistical analysis of Q-data.

(II) Factor extraction
After the Q-sorts are entered, factors are extracted. Extracting factors means making groups of participants who sorted the aspects in similar ways. As mentioned by McKeown and Thomas, "*it makes little difference whether the specific factoring routine is the principal components analysis (PCA), centroid analysis, or any other available method*" (1988)(p.49).

This research used PCA. As PCA delivers the mathematically optimal number of factors (Ramlo, 2016). This method aims to transform a set of correlated variables into a set of uncorrelated variables. This is done by decreasing the numbers of variables which are seen as worth analysing. In this way the complexity of data is reduced by decreasing (Landau & Everitt, 2004). The factor extraction is based on the correlation matrix and can extract a maximum of eight factors.

(III) Factor rotation
The extracted factors are rotated to increase or decrease the mutual correlations of the q-sorts within the different factors. This means the more q-sorts load on only one of the factors and near-zero load on the other(s),

the more optimum the case is. The factor loadings are in effect correlation coefficients (Mckeown & Thomas, 1988), they represents to which extent the individual Q-sorts are associated with the factor. The higher this loading, the more the Q-sort weighs in determining the final factor. Rotation does not affect the consistency in sentiment throughout individual Q-sorts or the relationship between Q-sorts, it only shifts the perspective from which they are observed (du Plessis et al., 2006).

Within PQMethod, factors can be rotated manually or with Varimax. Manual is applicable when the researcher has relevant knowledge about a given participant which he or she wants to include in the rotation of factors. However, this is not applicable here as this research is exploratory about how project managers perceive the difficulty of integrating sustainability. Besides, the judgmental manual rotation is in literature mentioned as not favourable (Stephenson, 1953b; Thompson, 1962 cq. McKeown & Thomas, 1988). Varimax is a straightforward and transparent analysis which produces the factor solution that maximises the amount of variance explained on as few factors as possible (Webler et al., 2009). Besides, Varimax is the most frequently employed within Q-studies (Mckeown & Thomas, 2013). For this reason, Varimax rotation is used within this research. The Varimax rotation is performed six times to check the outcomes of different numbers of factors (two, three, four, five, six and seven perspectives). After the rotation of each number of factors, the factors are analysed based on a set of requirements.

(IV) Factor analysis
By following the set of requirements for the number of factors, a trade-off is made between simplicity (retaining as few as possible factors) and completeness (explaining most of the variation in the data). This trade-off is based on a set of requirements. A number of factors is accepted if it meets all of the following requirements:

1. **Cumulative Explained Variance > 50%** (Suprapto, 2016)

The Cumulative Explained Variance (CEV) shows the percentage of the sample which is covered by the factor(s). Each Q-sort has a loading on a factor. The sum of the square loadings of each Q-sort on the factor is the eigenvalue of that factor. The percentage of the eigenvalues divided by the number of Q-sorts, shows the percentages of the explained variance. This number shows the percentage of the sample which is covered by that factor. The limit is set on 50% to make sure the factor covers at least more than half of the sample. CEV is calculated as follows:

- CEV of n Q-sorts= % Explained variance $_1$ + % Explained variance $_2$ + … + % Explained variance $_n$
- % Explained variance per factor = (Eigen value / number of Q-sorts)*100%
- Eigen value = (loading of Q-sort$_1$ per factor)^2 + (loading of Q-sort$_2$ per factor)^2 + … + (loading of Q-sort$_n$ per factor)^2

2. **All factors are acceptable** (>2 Q-sorts are flagged per factor). A sort is 'flagged' if the following rules are applicable (Brown, 1980):
    b. Q-sort x is significant loaded at p<0,05 on a factor y if its loading $f_{xy} > 0{,}36$ (calculated from $f = x/\sqrt{N}$, where x = 1,96 (Van Exel & De Graaf, 2005)(p. 9) and N=30 (number of statements).
    c. Its highest square factor loading explains more than half of the common variance, $f^2 > h^2/2$ where h^2 is the sum of the squared factors loadings of a Q-sort.
    d. The cross-product of its two highest loadings exceeds twice the standard error (SE), with $SE = 1/\sqrt{N}$, so SE= 0,183 and f>0,365.

3. The **more defining sorts for the number of factors the better** (Job Van Exel & Graaf, 2005), as this strengthens the factor as more information is available.
4. The **more distinguishing statements per factor the better**, as these are characteristic statements for the factor (Job Van Exel & Graaf, 2005), in this research the statements are the sustainability aspects.
5. The **smaller the correlations between the factors the better**, as the perspectives are more distinctive for each other (Webler et al., 2009).

B.3 Reasons influencing integration

(I) Highlight topic of reasoning
First all reasoning for easy or difficult aspects and the solutions are run through while selecting the reasons and formatting them bold.

(II) Code all reasons which influence integration
After all reasons were read through, each aspect was coded based on the subjects highlighted in the previous step. The reasons by the participants were written in Dutch and the codes were written in English as the final list must be in English. An example is shown below.

Table 13 Example coding reasons behind extreme easy/ difficult aspects (interpretations researcher shaded)

Rank	Why was this aspect easy or difficult to integrate in your project?	What is needed to overcome difficulty?	Negative influence	Solution	Positive influence
-2	Niet van toepassing binnen dit project	Dit opnemen in de gunningscriteria of opnemen in projectdoelstellingen kan de impact verhogen. Dit moet vanuit de OG komen.	not applicable within this project	include H&S in award criteria or project goals (from client)	
2	De opdrachtgever had duurzaamheid hoog in het vaandel. Dit zorgde ervoor dat duurzaamheid ook een rol had in de gunningscriteria en uitvraag.				client highly valued sustainability and included it in award criteria

(III) Group codes with similar meaning to one overlapping reason
Groups of codes with similar meaning are listed and a matrix was designed. The number of quotes per code is summed up to find which code is mentioned most. The reasoning behind this step is if the code is mentioned most, it has a bigger importance than some incidental code of reasoning. In other words, when words were frequently used with the same meaning, it corresponded to one group, also called reasons which influence the integration of sustainability.

Table 14 Categorizing type of reasons (interpretations researcher shaded, key words bold)

	Influencing reasons	
Negative influence	Perceived as (not) part of culture	Perceived as (not) discussed within project
part of **culture** to meet, which stimulates transport and CO2 emission	x	
culture difference**,** aspect is not part of **vocabulary** of client, individual has no power as it is **part of society**	x	x

(IV) List influencing reasons
The reasons which influence positive or negative influence the integration of sustainability aspects in projects are listed, and the number how many project managers mentioned reasons is summed. The reasons which are mentioned by only one participant could be seen as incidental and are not included in the main text of this report.

The five groups of quotes which are mentioned most within the categories easy – difficult – and solutions for difficulties, are further motivated and analysed to get to know what companies or project managers themselves could do.

Table 15 Example columns previews step IV (interpretations researcher shaded)

Influencing reason	Keywords	Negative	Positive
Perceived as (not) discussed within project	Difficult conversation, (not) part of vocabulary client, is not bespoken, not on table, mention aspect, explicit mention to client	3	3

(V) Group reasons with overlapping topic
Based on overlapping characters in the reasons, some are merged to minimise the number of reasons into a manageable set.

C RESULTS: RAW DATA AND EXTRA ANALYSES

C.1 Sustainability aspects

C.1.1 Initial and focused coding

SIA	Year	Group	Subgroup	Aspects (N=204)	example	Initial coding	Focused coding
5	2013	social / society	social cohesion and employment	facilitating access to services (employment, education, etc.)		facilitating access to services (employment, education, etc.)	accessibility to services
3	2011	social / society	Project execution	communication	entails that the project manager makes sure that the stakeholders, including its employees, partners and end-users, are informed about the sustainability aspects of the project	inform employees, partners, end-users about the sustainability aspects of the project	awareness
5	2013	governance	stakeholder involvement	staff and user awareness		staff and user awareness	awareness
8	2016	project leadership	attention to sustainability	attention to sustainability	– reaching the financial goals? – the improvement of environmental protection? – the contribution to the social development? – fostering innovation? – support creativity and creative solution?	attention to sustainability	awareness
8	2016	People results	People results	selecting teammembers	– They should be able to reach the expected financial results. – They should work environmentally friendly. – They should have social sensibility. – They should know or be able to get to know existing social problems and to identify social needs. – They should be innovative. – They should be creative.	– They should be able to reach the expected financial results. – They should work environmentally friendly. – They should have social sensibility. – They should know or be able to get to know existing social problems and to identify social needs. – They should be innovative. – They should be creative.	awareness
3	2011	environment	project pre-phase	land & biodiversity	involves the land that is needed for building the asset, the impacts on biodiversity, the habitats that are protected and the compensation activities	impact of building asset has on biodiversity and habitats, activities for protection and compensation habitats	biodiversity
5	2013	environment	biodiversity	maintianing ecological corridors		maintianing ecological corridors	biodiversity
5	2013	environment	biodiversity	preservation of natural habitats		preservation of natural habitats	biodiversity
5	2013	environment	biodiversity	supporting inherited plant species		supporting inherited plant species	biodiversity
5	2013	environment	biodiversity	tackling light and sound pollution		tackling light and sound pollution	biodiversity
6	2016	environmental sustainability	environmental sustainability	eco system	maintaining or improving nature's eco system, for example by stimulating bio diversity and protecting or restoring natural habitats	maintaining or improving nature's eco system,	biodiversity
3	2011	Economic	Operation of the asset	long-term planning	tests if there is a long-term financial planning and if possible future scenarios for the business environment are analyzed	long term financial planning	business agility
3	2011	Economic	Operation of the asset	long-term planning	tests if there is a long-term financial planning and if possible future scenarios for the business environment are analyzed	analyse future business environment scenarios	business agility

5	2013	economic	economic justification	envisaged future of the project or programme; capability to evolve		envisaged future of the project or programme; capability to evolve	business agility
6	2016	economic sustainability	economic sustainability	business agility	creating agility with the project, for example by allowing for future decision making, flexible planning and changes in requirements	creating agility with the project	business agility
7	2016	economic (financial) bottom line	business agility	flexibility / optionality in the project	The ability to balance the business case, project scope, cost, quality, personnel, reporting, risk, and benefits to the highest level of social and environmental value once impacts are assessed.	The ability to balance the business case, project scope, cost, quality, personnel, reporting, risk, and benefits to the highest level of social and environmental value once impacts are assessed.	business agility
7	2016	economic (financial) bottom line	business agility	increased business flexibility	The ability to balance the organizational benefits that will be realized from the project with the needs of society and the environment.	The ability to balance the organizational benefits that will be realized from the project with the needs of society and the environment.	business agility
8	2016	processes	economic sustainability	business agility	– Agility/Flexibility in the project execution, – Agility/Flexibility in the business operation.	– Agility/Flexibility in the project execution, – Agility/Flexibility in the business operation.	business agility
3	2011	Economic	Project execution	capability management	investigates if there is a plan for technological development, competence management, information management, quality management and business continuity and disaster recovery	planning for technology development, competence management, information management, quality management, business continuity and disaster recovery	business continuity
3	2011	Economic	Project execution	commercial performance	tests if the project is not dependent on a limited number of stakeholders, if there is an innovation strategy, if long-term business is ensured and if is invested in new business.	independency of stakeholders, innovation strategy, long-term business ensurence	business continuity
3	2011	social / society	Project execution	society	entails non-corruption, competitive behavior and compliance with laws and regulations.	entails non-corruption, competitive behavior and compliance with laws and regulations.	business continuity
3	2011	Economic	project pre-phase	expected shareholder involvement	measures if shareholders and management decisions have a long-term focus and if long-term changes require shareholder approval.	long-term focus of shareholders and management decisions, approval necessary by long-term changes by shareholders	business continuity
5	2013	economic	economic development	economic partnerships		economic partnerships	business continuity
5	2013	governance	oversight	strategies for selecting: site, materials, multi/criteria decision analysis		strategies for selecting: site, materials, multi/criteria decision analysis	business continuity
6	2016	economic sustainability	economic sustainability	(business) continuity	long term continuity and sustainability of the organization's business, business processes and resources	long term continuity and sustainability of the organization's business, business processes and resources	business continuity
6	2016	economic sustainability	economic sustainability	competitive potential	innovation and creating competitive potential, for example by developing or applying new technologies, building (community) relationships and demonstrating sustainable leadership	creating competitive potental	business continuity
7	2016	social bottom line	Labor practices and decent work	organizational learning	An organization's approach to knowledge management that enhances its collective ability to	An organization's approach to knowledge management that enhances its collective ability	business continuity

					accept and make use of new knowledge to benefit the organization's advancement and mitigate risk.	to accept and make use of new knowledge to benefit the organization's advancement and mitigate risk.	
8	2016	processes	social sustainability	learning organization and knowledge management	– Accumulation and documentation of project ma-nagement knowledge	– Accumulation and documentation of project management knowledge	business continuity
5	2013	governance	transparancy	implementing certification		implementing certification	certification
3	2011	environment	project pre-phase	environmental plan	includes the plan for separating waste and treating dangerous chemicals	treating dangerous chemicals	chemicals
5	2013	environment	climate change	adapting to climate change		adapting to climate change	climate change
5	2013	environment	controlling emissions	protection of water tables, watercources and soils		protection of water tables, watercources and soils	coastal protection
7	2016	social bottom line	Society and customers	community support	The degree of acceptance and support provided by the community at large that the project will have a direct impact on.	The degree of acceptance and support provided by the community at large that the project will have a direct impact on.	community support
5	2013	governance	transparancy	dedicated communications		dedicated transparant communications	corporate governance
6	2016	social sustainability	social sustainability	corporate governance	corporate governance, for example by practicing sustainability reporting and creating transparency and accountability	corporate governance, for example by practicing sustainability reporting and creating transparency and accountability	corporate governance
7	2016	social bottom line	ethical behavior	bribery and corruption	Policies, practices, and transparent communications with regards to forms of corruption, including extortion and bribery.	transparent communications	corporate governance
8	2016	resources	creativity	creativity	– apply creativity tools and technics in the idea generation during the planning phase, – identify business and financial problems, – develop creative solution for the identified problems, – identify opportunities and threats and to use these for setting up the project strategy	– apply creativity tools and technics in the idea generation during the planning phase, – identify business and financial problems, – develop creative solution for the identified problems, – identify opportunities and threats and to use these for setting up the project strategy	creativity
5	2013	social / society	cultural diversity	enhancing the cultural identity		enhancing the cultural identity	cultural diversity
5	2013	social / society	cultural diversity	respect for the built heritage		respect for the built heritage	cultural diversity
5	2013	social / society	cultural diversity	respect for the natural heritage		respect for the natural heritage	cultural diversity
3	2011	environment	Operation of the asset	decomposing of the asset	involves the possibilities of environmental friendly decomposing of the asset and the effect on the environment after the asset is decomposed	decomposing of the asset	decomposing asset

C.1.2 TBL sub-group & occurrence >1 in SIAs

Nr.	TBL	focused coding N=30)	Initial coding	3	5	6	7	8	total	Description	Example or extra description for PM
1	people	awareness	**staff and user awareness** ; – They should be able to **reach the expected financial results**. – They should **work environmentally friendly**. – They **should have social sensibility.** – They should know or be able to get to **know existing social problems** and to identify social needs. – They should be innovative. – They should be creative. **attention to sustainability** inform employees, partners, end-users about the sustainability aspects of the project	1	1			1	3	make sure all stakeholders act with awareness of the (sustainable) impact of the project	
2	people	corporate governance	corporate governance, for example by practicing **sustainability reporting and creating transparency and accountability**; Policies, practices, and **transparent communications** with regards to forms of corruption, including extortion and bribery. dedicated transparant communications		1	1	1		3	create transparency and have clear accountabilities	
3	people	ethical behaviour	non-corruption, compliance with laws and regulations; ethical behaviour, for example **preventing bribery**, anti-competitive behaviour, anti-**trust,** and monopoly practices; An organization's policy and actions and reporting on anti-competitive behaviour, including any legal action or complaints from regulatory organizations; Policies, practices, with regards to forms of **corruption,** including extortion and **bribery.** ; The project sponsor, project manager, and project team should at all times a**ct in an ethical manner** and report issues; deals with the rules, regulations and tenders that have to be satisfied before construction can start, the interest and influence of politics and non- corruption.	1		1	1		3	act in an ethical manner	for example by stimulating trust, and preventing bribery or corruption (more than in compliance with laws and regulations)
4	people	fair and safe labour	job creation, fair wages of employees compared to project budget, non-discrimination and prevent child-labour; **fair** wage level; **job creation**; forced displacement of people; job creation; professional insertion and return to work; fair labour practices and decent work, for example health and safety of workers, **equal opportunities, diversity and fair compensation;** Work for which the child is either too young – work done below the required minimum age – or work which, because of its detrimental nature or conditions, is altogether considered unacceptable for children and is prohibited. Or, work that deprives children of their childhood, their potential and their dignity, and that is harmful to physical and mental development.; Policies and measures that safeguard against forced or compulsory labour practices; policies and practices regarding **non-discrimination of project personnel and resource**s; The employment and staffing practices for the individuals who will comprise the project organization, r**anging from the project steering committee (or board) to the project team**; An organization's approach as it relates to the project owner/sponsor/stakeholders with regards to interfering with each other's legitimate and human rights, including: implementing policies for addressing issues, risks and individual performance; and procedures for mediation where disputes arise; The project ensured an **adequate working environmen**t; – **Equal opportunities** for employees	1	1	1	1	1	5	stimulate fair labour with equal opportunities, diversity and fair compensation for all stakeholders	(more than in compliance with laws and regulations)
5	people	health & safety	monitor and advise in health and safety programs; **decrease work-related injuries and prevent illness**; – **Minimize Health and Safety Risks**; hygiene and air quality; other health risks (electromagnetic, laser light, etc.); safety: access and exits, operation, etc. by neighbours, users and others; monitor and advise in health and safety programs health & safety plan for safe **execution;** An organization's approach and procedures for health, safety and emergency management as they relate to the project, project team the project environment **during the project life cycle**; ensuring safety and security during maintenance	1	1		1	1	4	minimize health and safety risks for all stakeholders during the entire life cycle of the project	*The used definition of project life cycle is: "from the idea of the product until it is handed off in its final form" (more than in compliance with laws and regulations)
6	people	human capital development	human capital development, for example **training and learning of team members and other stakeholders**; An organization's approach to ongoing skills development and learning that supports the ability of project personnel to carry out project activities, maximizing value to the project and positive contributions to their careers;			1	1		2	stimulate learning and development of the project team (and relevant stakeholders)	
7	people	human rights	human rights, for example non-discrimination, freedom of association, compulsory or child labour, gender neutrality, etc; Policies for non-discrimination due of race, colour, national or ethnic origin, age, religion, disability, sex, sexual orientation, gender identity and expression, veteran status, pregnancy status or any other characteristic protected under applicable law.; – **Respect for Human Right**			1	1	1	3	respect human rights	for example non-discrimination, freedom of association, compulsory or

											child labour, gender neutrality, etc
8	people	impact of project on people	impact on quality of life of customer and community by using product; – Provided the project **outcome with a significant added value for the customers**, – Provided the project outcome as innovative as possible for the customers, – Solved existing problems of the customers, – Satisfied the needs of the customers.	1				1	2	provide added value for customers by meeting their needs and/or solving one or more of their problems	
9	people	stakeholder responsibility	**society, customer and product responsibilit**y, for example customer privacy, transparent product labelling, realistic advertising and community support; The measures taken to ensure that a customer / consumer is **not injured by the project** and or project outcome(s). Project management must be socially and environmentally responsible.; The organizational policies and procedures that pertain to the handling of customer **information,** complaints, regulatory issues or loss of customer information. Project management should ensure that systems and safeguards are in place to ensure customer privacy during the project lifecycle.; The labelling of the project's product and service **information to ensure accuracy of content,** safe use, disposal and any factors that may have environmental or social impacts			1	1		2	ensure safe and responsible advertising of information, handling of data and customer privacy	(more than in compliance with laws and regulations)
10	people	stakeholders	stakeholder analysis and information provisioning; **information, consultation** and **coordination** for and with stakeholders; specific organisational aspects of the construction phase; **proactive stakeholder engagement**, for example with stakeholders in the value chain of the project	1	1	1			3	engage stakeholders proactively	
11	people	team	entails securing that in the team, **someone is responsible for sustainability**, and that sustainability criteria are applied when team members, contractors, suppliers and specialist are selected; – They should be able to reach the expected financial results. – They should work environmentally friendly. – They should have social sensibility.	1				1	2	appoint someone in the team who is responsible for the application of sustainbility criteria in the project	
12	planet	biodiversity (flora & fauna)	impact of building asset has on biodiversity and habitats, activities for **protection and compensation habitats;** maintaining ecological corridors; preservation of natural habitats; supporting inherited plant species; tackling light and sound pollution; **maintaining or improving nature's eco system**, for example by stimulating bio diversity and protecting or restoring natural habitats	1	1	1			3	protect and compensate biodiversity and habitats by maintaining or improving nature's ecosystem	for example by maintaining ecological corridors (more than in compliance with laws and regulations)
13	planet	CO2 emission	measure emission, **reduce** emission; controlling emissions for the project or programme; controlling emissions from induced traffic; **preventing** or reducing emissions into air, water and soil; CO2 emission during **project life cycle;** Reduction in CO2 and other emissions both during the project and over the useful life of the asset produced	1	1	1	1		4	prevent or minimize CO2 emissions during both the product and project life cycle	*within the statement this definition of "product life cycle" is used: "both the entire span of the product, and all phases of the project from idea to hand over" (more than in compliance with laws and regulations)
14	planet	emission	measure emission, **reduce** emission; controlling emissions for the project or programme; controlling emissions from induced traffic; **preventing** or reducing emissions into air, water and soil; CO2 emission during **project life cycle;** Contamination or pollution of the **air, water, or soil t**hrough the introduction of foreign or unwanted materials, chemicals, or fumes that results in the temporary or permanent degradation of an environment or ecosystem.; **limiting air pollution** Policies and procedures that pertain to the impact on water quality that the project and or the project's outcome will have. air quality impact during the project's product life cycle	1	1	1	1		4	prevent or minimize emissions into air, water and soil over the product life cycle (CO2 emission excluded)	*within the statement this definition of "product life cycle" is used: "the entire span of the product, so from cradle-to-grave" (more than in compliance with laws and regulations)
15	planet	energy	energy consumption, use energy **efficient,** increase energy-efficiency; controlling energy production, consumption and distribution; **prevent or reduce** energy and the negative effects of that; energy consumed by project team and in production of project outputs **throughout project life cycle**; – **Minimize** the Energy used throughout the **Project Life Cycle**, – Minimize the Emission, – Minimize the Energy the project's product will consume during its life span	1	1	1	1	1	5	prevent or reduce energy usage over the entire project life cycle	*The used definition of project life cycle is: "from the idea of the product until it is handed off in its final form" (more than in compliance with laws and regulations)

16	planet	impact of project on environment	Look at **alternatives** of product, environmental friendly decomposing product; Contamination or pollution of the air, water, or soil through the introduction of foreign or unwanted materials, chemicals, or fumes that results in the temporary or permanent degradation of an environment or ecosystem.; **impact of the project's product** end-of-life disposal on society and the environment.; – Provided the project outcome as **environmentally friendly as possible**. Project execution was as environmentally friendly as possible	1			1	1	3	examine alternative products and production processes with reduced impact on the environment	
17	planet	material	**consideration of materials life-cycle**; **controlling raw materials' consumption**; the sustainability **footprint of the materials and resources** used in the project;	1	1	1			3	minimize quantity of materials and resources used	
18	planet	nuisance	noise and vibration; **preventing or reducing nuisance in the product**	1		1			2	prevent or reduce nuisance as a result of the product during its life cycle	noise and vibrations caused by the project *within the statement this definition of "product life cycle" is used: "the entire span of the product, so from cradle-to-grave"
19	planet	renewable energy	**increase renewable energy**; renewable energy use; **use renewable energy;** The type and amount of renewable energy that be generated by the project or project's product that can be returned and re-allocated.; The types of energy from renewable sources that is incorporated into the project's product and the consumption of renewable energy during the project's useful life.	1	1	1	1		4	increase use of renewable energy	
20	planet	transport	**preventing or reducing transport and the negative effects of that,** for example by favouring local procurement of materials and encouraging digital communication as a replacement of face-to-face meetings; Local procurement: the policies and procedures to procure resources, goods and services putting a stronger emphasis on sourcing from local suppliers.; **travelling by members of the team, products, goods and materials**; preventing or reducing transport and the negative effects of that; Policies and procedures on the transportation of goods or materials that ensures the transportation and the packaging of products are as **environmentally friendly as possible**; Policies and procedures that **limits** unnecessary travel and ensures that the use of travel-related resources has to have as little impact on the environment as possible; **– Local procurement (local suppliers), – Digital Communication (instead of paper based),** – Minimize the Travel, – Minimize the Transport of Goods, Materials and Machinededicated communications; preventing or reducing transport and the negative effects of that, for example by favouring local procurement of materials and encouraging digital communication as a replacement of face-to-face meetings; Utilizing technology for project (digital) communication to reduce the consumption of non-renewable resources.	1		1	1	1	4	prevent or reduce transport and the negative effects of that, for members of the team, products, goods and materials	digital communication, local procurement
21	planet	waste	initiative to **reduce** waste, method for disposal and spills; separate waste; waste management; **preventing or reducing (hazardous) waste**, packaging and the negative effects of that, for example by segregating waste, **reduce and recycle packaging, etc;** waste disposal, the handling of waste during the project's lifecycle, and the type and amount of waste created by the project's product.; – Minimize the waste, – **Use** of **recyclable** materials and methods, – Environmentally friendly disposal of waste the sustainability footprint of the materials and resources used in the project; the project's adherence to recycling practices of materials and products; – Minimize the waste of Materials, – Apply reusable Materials, – Use of Materials with less energy consumption ;recycle materials now or in the future	1	1	1	1	1	5	increase efforts to prevent, reduce, recycle and reuse waste during the project life cycle	The used definition of project life cycle is: "from the idea of the product until it is handed off in its final form"
22	planet	water	water withdrawal, **recycle** and **reuse** water; **controlling** water resources; **preventing** or **reducing** the use of water; The amount of water that will be withdrawn by the project and or project's product during its life cycle.; – **Minimize** the Water used throughout the **Project Life Cycle**, – Minimize the Water used during the utilization of the project's product, – Recycle and purify before Disposal. effect on water sources;	1	1	1	1	1	5	prevent, reduce or recycle the water use in the project life cycle	The used definition of project life cycle is: "from the idea of the product until it is handed off in its final form"

23	profit	business agility	creating agility with the project for example by allowing for future decision making, flexible planning and **changes in requirements**; – Agility/Flexibility in the project **execution,** – Agility/Flexibility in the business **operation.;** The ability to **balance the organizational benefits that will be realized from the project with the needs of society and the environment**; The ability to balance the business case, project scope, cost, quality, personnel, reporting, risk, and benefits to the highest level of social and environmental value once impacts are assessed. **long term financial** planning; analyse future business environment scenarios; envisaged future of the project or programme; capability to evolve	1	1	1	1	1	5	enable flexible planning and decision making in the project	for example, long-term planning, flexible decision making, allow future changes in requirements
24	profit	business continuity	independency of stakeholders, innovation strategy, **long-term business ensurence**; **long term continuity and sustainability of the organization's business, business processes** and resources; planning for technology development, competence management, information management, quality management, business continuity and disaster recovery, **knowledge management**; competitive behaviour; creating competitive potential; strategies for selecting: site, materials, multi/criteria decision analysis; An organization's approach to knowledge management that enhances its collective ability to accept and make use of new **knowledge** to benefit the organization's advancement and mitigate risk.; – Accumulation and documentation of project management knowledge **long-term focus** of shareholders and management decisions, approval necessary by long-term changes by shareholders; economic partnerships	1	1	1	1	1	5	ensure long-term focus for sustainable business processes	for example by knowledge management
25	profit	impact of project on economy	involves the increase in economic activity due to the project, the contribution to GDP and the market share performance; direct economic impacts; induced and indirect economic impacts; creating value with the project, for example by developing and managing the business case; The **financial benefits to the economy (society and environment**) to be realized as a result of the portfolio, program or project that are not defined in the business case but materialize as a direct consequence of the investment. Projects induce side effects and consequences, intermediate benefits, other end benefits and end benefits; **Provided the project outcome at a suitable value-price relation**. ;The project was organized in an economically efficient way	1	1	1	1	1	5	realize financial benefits with the project for the economy (society and environment)	
26	profit	innovation	innovation; **innovation and creating competitive potentia**l, for example by developing or applying new technologies, building (community) relationships and demonstrating sustainable leadership; – to **promote technical innovation** in the product / service / construction / other project outcome, – to promote process innovation in the project out- come, – to promote marketing innovation in the project outcome		1	1		1	3	promote technical innovation within the project life cycle	The used definition of project life cycle is: "from the idea of the product until it is handed off in its final form"
27	profit	life cycle cost	expected profits, CAPEX, OPEX, donations, financial implications; simple evaluation (investment & operation & maintenance); whole life-cycle costing (including external costs, dismantling and cost avoided) simple evaluation (investment & operation & maintenance); BCR as indicator to summarize overall value for money of a project Monetary gains that are derived from project outcomes; External Rate of Return; Internal Rate of Return is the interest rate at which a project breaks even; Net Present Value (NPV) is the difference between the present value of cash inflows and the present value of cash outflows; – Direct financial benefit/profit, – Net Present Value, – Cost/benefit ratio, – Profitability index, – Internal rate of return	1	1		1		3	apply the principle of life cycle costing in the project	
28	profit	local development	**financial** impact to local economy; impact on local skill developmeent due to a large project; – **Contribute to social development**, – Solve existing **social** problems, – Satisfy the needs of the local society, – Contribute to social wealth. Create new jobs for local people,				1	1	2	contribute to the local community's economical and social development	stimulate financial impact, improve skill development, solve social problems, contribute to social wealth, create new jobs
29	profit	procurement	apply **sustainability criteria when selecting suppliers**; The practices of selecting which project to invest in and the procurement practices that will supply the project with resources.	1			1		2	apply sustainability criteria when selecting suppliers	
30	profit	risk reduction	financial risk management, make financial reservations in time; risk management; **preventing or reducing business and stakeholder risks**; financial implications and risks due to climate change; risk limitation costs	1	1	1			3	reduce or prevent financial risks for all stakeholders	

C.1.3 Validation statements

Please score the importance of each statement within the context of sustainability in projects, from your experience and point of view. You can score each statement in the last column on a scale from: very important (5) - important (4) – neutral (3) – not important (2) – not important at all (1). If there are statements missing from your point of view, you can add them in the last rows.

	nr	Aspect	Selected / adjusted statements **Within my project it is important to..**	Score importance
People	1	accessibility to services and public space	facilitate access to services and safe (green) public spaces (employment, education, health care, etc.)	
	2	air quality	improve air quality	
	3	ethical behaviour	reduce corruption, bribery, or anti-competitive behaviour in all forms	
	4	fair labour	include fair labour practices and decent work, by for example stimulate equal opportunities, diversity and fair compensation, policies and measures against child labour, young workers' or forced or compulsory labour practises	
	5	human rights	include human rights by for example promoting and ensuring equality of all, enforcing non-discriminatory rights, and ensuring freedom of association	
	6	impact of the product	enhance a positive impact on the quality of life for the customer and community by using the product	
	7	job creation	stimulate employment by job creation and professional insertion and return to work	
	8	local development	support local development by for example improve health and safety conditions in the community with the project	
	9	natural heritage	promote cultural diversity with respect for landscape quality, built heritage and natural heritage	
	10	project education	improving education environment within the project by training and organizational learning	
	11	society, customer and product responsibility	include society, customer and product responsibility by for example including customer privacy, product labelling, realistic advertising and community support	
	12	partnership	encourage and promote (international) partnership for cooperation and collaboration for example by involving decision makers in all dimensions	
	13	stakeholder requirements	meet the requirement of most stakeholders involved	
	14	emission	prevent or reduce emissions into air, water and soil	
	15	transport	prevent or reduce transport by favouring local procurement and replace face-to-face meetings with digital communication	
Planet	16	CO2 emission	minimise CO2 emission during project life cycle	
	17	energy infrastructure	expand energy infrastructure	
	18	energy use	prevent or reduce energy by for example improving of energy efficiency	
	19	renewable energy	increase share of renewable and clean energy	
	20	ecosystem	conserve and sustainable use of biodiversity and ecosystems for example by protecting or restoring natural habitats	
	21	ecosystem	conserve and sustainable use of biodiversity and ecosystems for example by protecting or restoring natural habitats	
	22	resource sharing	promote sharing (of benefits) of utilization of genetic resources	
	23	materials	reduce sustainable footprint of materials, for example by selecting materials based on reuse capabilities, value and minimum pollution	
	24	resource efficiency	increase resource-use efficiency	
	25	waste	increase waste prevention, reduction, recycling and reuse	
	26	water quality	improve water quality by for example minimizing pollution	

	27	water use	minimise water usage by for example minimizing consumption and efficient use	
Process	28	health and safety plan	include a health and safety plan and minimise health risk	
	29	sustainability awareness	promote awareness and policies for sustainable development, consumption and production	
	30	ecosystem awareness	integrate ecosystem awareness	
	31	monitoring and certification	implement monitoring, certification	
	32	partnership	encourage and promote (international) partnership for cooperation and collaboration for example by involving decision makers in all dimensions	
	33	procurement	Promote public procurement practices that are sustainable, in accordance with national policies and priorities for example by using investment evaluation methods	
	34	project agility	include agility and optionality in the project, for example: allow future decision making; include flexible and long-term planning; allow changes in requirements	
	35	report	integrate sustainable information in reporting	
	36	resource and energy	meet client's demand while using a minimum of natural resources and energy	
	37	stakeholders	meet the requirement of most stakeholders involved	
	38	sustainability awareness and development	promote awareness and policies for sustainable development, consumption and production	
	39	technologies	stimulate and promote the use of technologies	
	40	transparency and accountability	create transparency and accountability in the project processes	
	41	team	secure in the team that someone is responsible for sustainability and that sustainability criteria are applied by team members, contractors, suppliers and specialist	
	42	management	improve management of waste, water and sanitation	
product	43	add value	serve additional value for the client and society as a whole	
	44	future-proof	result is lasting and future proof	
profit	45	innovation strategies	include commercial performance with innovation strategies, long-term business investments and collaboration	
	46	(financial) benefits	increase economic growth and profitability by direct and indirect (financial) benefits	
	47	business continuity	include long term continuity and sustainability of the organization's business	
	48	Life cycle costing	take into account the life cycle costing of the project	
	49	risks	prevent or reduce business and stakeholder risks by corporate governance (participation and involvement)	

After this validation, the central question changed from ‘importance’ to ‘ease of integration’. From these sustainability aspects, 19 were removed from this list as these were double or were seen as less important to the participants validating this list.

C.1.4 Sustainability aspects ENG – NL

TBL	Nr.	Sustainability aspect	Definition	Example or extra description	Nr.	Duurzaamheids aspect	Definitie	Voorbeeld of extra beschrijving
people	1	awareness	make sure all stakeholders act with awareness of the (sustainable) impact of the project		1	bewustzijn	ervoor te zorgen dat alle belanghebbenden handelen met inachtneming van de (duurzame) impact van het project	
people	2	corporate governance	create transparency and have clear accountabilities		2	ondernemingsbestuur	verantwoordelijkheden helder te maken en transparantie te creëren	
people	3	ethical behaviour	act in an ethical manner	for example, by stimulating trust, and preventing bribery or corruption (more than in compliance with laws and regulations)	3	ethisch gedrag	te handelen op een ethische manier	door vertrouwen te stimuleren en omkoping of corruptie te voorkomen; (meer dan in overeenstemming met wet- en regelgeving)
people	4	fair and safe labour	stimulate fair labour with equal opportunities, diversity and fair compensation for all stakeholders	(more than in compliance with laws and regulations)	4	eerlijke en veilige arbeid	eerlijke arbeid met gelijke kansen, diversiteit en een billijke vergoeding voor alle belanghebbenden te stimuleren	(meer dan in overeenstemming met wet- en regelgeving)
people	5	health & safety	minimise health and safety risks for all stakeholders during the entire life cycle of the project	*The used definition of project life cycle is: "*from the idea of the product until it is handed off in its final form*" (more than in compliance with laws and regulations)	5	Gezondheid & Veiligheid	gezondheids- en veiligheidsrisico's voor alle belanghebbenden binnen de volledige levenscyclus van het project te minimaliseren	*Voor deze statement wordt de volgende definitie van 'levenscyclus' gehanteerd: "*de levensduur van het project, van initiatief tot overdracht*" (meer dan in overeenstemming met wet- en regelgeving)
people	6	human capital development	stimulate learning and development of the project team (and relevant stakeholders)		6	ontwikkeling van menselijk kapitaal	leren en ontwikkeling van teamleden (en andere belanghebbenden waar relevant) te stimuleren	
people	7	human rights	respect human rights	for example, non-discrimination, freedom of association, compulsory or child labour, gender neutrality, etc	7	mensenrechten	mensenrechten te respecteren	bijvoorbeeld non-discriminatie, vrijheid van vereniging, verplichte of kinderarbeid, genderneutraliteit, enz
people	8	impact of project on people	provide added value for customers by meeting their needs and/or solving one or more of their problems		8	impact van project op mensen	waarde toe te voegen voor consumenten door aan behoeften te voldoen en/of bestaande problemen op te lossen	
people	9	stakeholder responsibility	ensure safe and responsible advertising of information, handling of data and customer privacy		9	verantwoordelijkheid van de belanghebbenden	verantwoordelijkheid te nemen over het verzamelen en distribueren van (consumenten) data	bijvoorbeeld door door het verstrekken van eerlijke, deugdelijke informatie over het product, privacy-beleid en data security
people	10	stakeholders	engage stakeholders proactively		10	stakeholders	belanghebbenden proactief te betrekken	

people	11	team	appoint someone in the team who is responsible for the application of sustainability criteria in the project		11	team	een van de teamleden binnen de organisatie verantwoordelijk te stellen voor het toepassen van duurzaamheidscriteria in het project	
planet	12	biodiversity (flora & fauna)	protect and compensate biodiversity and habitats by maintaining or improving nature's ecosystem	for example by maintaining ecological corridors (more than in compliance with laws and regulations)	12	biodiversiteit (flora & fauna)	biodiversiteit en habitats te beschermen en compenseren door het ecosysteem van de natuur te onderhouden of te verbeteren	Bijvoorbeeld door het maken van ecologische verbindingen (meer dan in overeenstemming met wet- en regelgeving)
planet	13	CO2 emission	prevent or minimise CO2 emissions during both the product and project life cycle	*within the statement this definition of "product life cycle" is used: "both the entire span of the product, and all phases of the project from idea to hand over" (more than in compliance with laws and regulations)	13	CO2-uitstoot	CO2-emissies gedurende de gehele levenscyclus van het project en het product te voorkomen of tot een minimum te beperken	*Voor deze statement wordt de volgende definitie van "levenscyclus" gehanteerd: "de totale levensduur van het project en het product" (meer dan in overeenstemming met wet- en regelgeving)
planet	14	emission	prevent or minimise emissions into air, water and soil over the product life cycle (CO2 emission excluded)	*within the statement this definition of "product life cycle" is used: "the entire span of the product, so from cradle-to-grave" (more than in compliance with laws and regulations)	14	schadelijke emissies	schadelijke emissies in lucht, water en bodem gedurende de gehele levenscyclus van het product te voorkomen of tot een minimum te beperken (geen CO2-uitstoot)	*Voor deze statement wordt de volgende definitie van "levenscyclus" gehanteerd: de levensduur van het product van cradle-to-grave, dus van wieg tot graf" (meer dan in overeenstemming met wet- en regelgeving)
planet	15	energy	prevent or reduce energy usage over the entire project life cycle	*The used definition of project life cycle is: "from the idea of the product until it is handed off in its final form" (more than in compliance with laws and regulations)	15	energie	energieverbruik gedurende de levenscyclus van het project te voorkomen of verminderen	*Voor deze statement wordt de volgende definitie van "levenscyclus" gehanteerd: "de levensduur van het project, van initiatief tot overdracht" (meer dan in overeenstemming met wet- en regelgeving)
planet	16	impact of project on environment	examine alternative products and production processes with reduced impact on the environment		16	impact van het project op het milieu	alternatieve producten en productie processen met een verminderde impact op het milieu te onderzoeken	
planet	17	material efficiency	minimise quantity of materials and resources used		17	materiaal efficiëntie	de hoeveelheid gebruikte materialen en middelen te minimaliseren	
planet	18	nuisance	prevent or reduce nuisance as a result of the product during its life cycle	noise and vibrations caused by the project *within the statement this definition of "product life cycle" is used: "the entire span of the product, so from cradle-to-grave"	18	overlast	overlast als gevolg van het project tijdens de levenscyclus van het project te voorkomen of verminderen	*Voor deze statement wordt de volgende definitie van "levenscyclus" gehanteerd: "de levensduur van het project, van initiatief tot overdracht" (meer dan in overeenstemming met wet- en regelgeving)
planet	19	renewable energy	increase use of renewable energy		19	hernieuwbare energie	toename van het gebruik van hernieuwbare energie te verhogen	
planet	20	transport	prevent or reduce transport and the negative effects of that, for members of the team, products, goods and materials	digital communication, local procurement	20	vervoer-	transport en de negatieve effecten daarvan, voor leden van het team, producten, goederen en materialen te voorkomen of verminderen	Bijoorbeeld door stimuleren van digitale communicatie of lokale inkoop

planet	21	waste	increase efforts to prevent, reduce, recycle and reuse waste during the project life cycle	The used definition of project life cycle is: "from the idea of the product until it is handed off in its final form"	21	afval	meer inspanningen te doen om de hoeveelheid afval te voorkomen, verminderen, recycleren en hergebruiken gedurende de levenscyclus van het project	*Voor deze statement wordt de volgende definitie van "levenscyclus" gehanteerd: "de levensduur van het project, van initiatief tot overdracht" (meer dan in overeenstemming met wet- en regelgeving)
planet	22	water use	prevent, reduce or recycle the water use in the project life cycle	The used definition of project life cycle is: "from the idea of the product until it is handed off in its final form"	22	water gebruik	het watergebruik in de levenscyclus van het project te voorkomen, verminderen of recyclen	*Voor deze statement wordt de volgende definitie van "levenscyclus" gehanteerd: "de levensduur van het project, van initiatief tot overdracht" (meer dan in overeenstemming met wet- en regelgeving)
profit	23	business agility	enable flexible planning and decision making in the project	for example, long-term planning, flexible decision making, allow future changes in requirements	23	bedrijfsflexibiliteit	flexibiliteit in planning en besluitvorming in te bouwen	bijvoorbeeld langetermijnplanning en flexibele besluitvorming, waardoor toekomstige veranderingen in de vereisten mogelijk worden
profit	24	business continuity	ensure long-term focus for sustainable business processes	for example by knowledge management	24	bedrijfscontinuïteit	te zorgen voor een langetermijnfocus voor duurzame bedrijfsprocessen	bijvoorbeeld door kennisbeheer
profit	25	impact of project on economy	realise financial benefits with the project for the economy (society and environment)		25	impact van het project op de economie	financiële voordelen te realiseren met het project voor de economie (gericht op maatschappij en milieu)	
profit	26	innovation	promote technical innovation within the project life cycle	The used definition of project life cycle is: "from the idea of the product until it is handed off in its final form"	26	innovatie	technische innovatie in de levenscyclus van het project te bevorderen	*Voor deze statement wordt de volgende definitie van "levenscyclus" gehanteerd: "de levensduur van het project, van initiatief tot overdracht"
profit	27	life cycle cost	apply the principle of life cycle costing in the project		27	levenscycluskosten	life cycle costing in het project toe te passen	
profit	28	local development	contribute to the local community's economical and social development	stimulate financial impact, improve skill development, solve social problems, contribute to social wealth, create new jobs	28	lokale ontwikkeling	bij te dragen aan de economische en sociale ontwikkeling van de lokale gemeenschap	stimuleer financiële impact, verbeter de ontwikkeling van vaardigheden, los sociale problemen op, draag bij aan sociale welvaart, creëer nieuwe banen
profit	29	procurement	apply sustainability criteria when selecting suppliers		29	inkoop	duurzaamheidscriteria toe te passen bij het selecteren van leveranciers	
profit	30	risk reduction	reduce or prevent financial risks for all stakeholders		30	risico beperking	financiële risico's voor alle belanghebbenden te verminderen of voorkomen	

C.2 Ease of integrating sustainability in projects

C.2.1 Instructions sorting process

Bedankt voor uw deelname aan dit onderzoek!

Het doel van dit onderzoek is om de factoren te identificeren die de toepassing van duurzaamheid in projecten beïnvloeden en inzicht krijgen in wat projectmanagers nodig hebben om duurzaamheidsaspecten te integreren in hunprojecten. Dit doel ligt in lijn met de ambitie van RHDHV "Enhance Society Together" en de internationaal groeiende aandacht rondom duurzaamheid. De resultaten van dit onderzoek zullen hopelijk bijdragen aan het concretiseren van deze ambities.

Omdat dit een subjectief onderwerp is maak ik gebruik van Q-methodologie, waarbij ik u vraag verschillende aspecten te prioritiseren volgens een vast format in een aantal stappen. Verzamelde gegevens worden anoniem behandeld.

Instructies

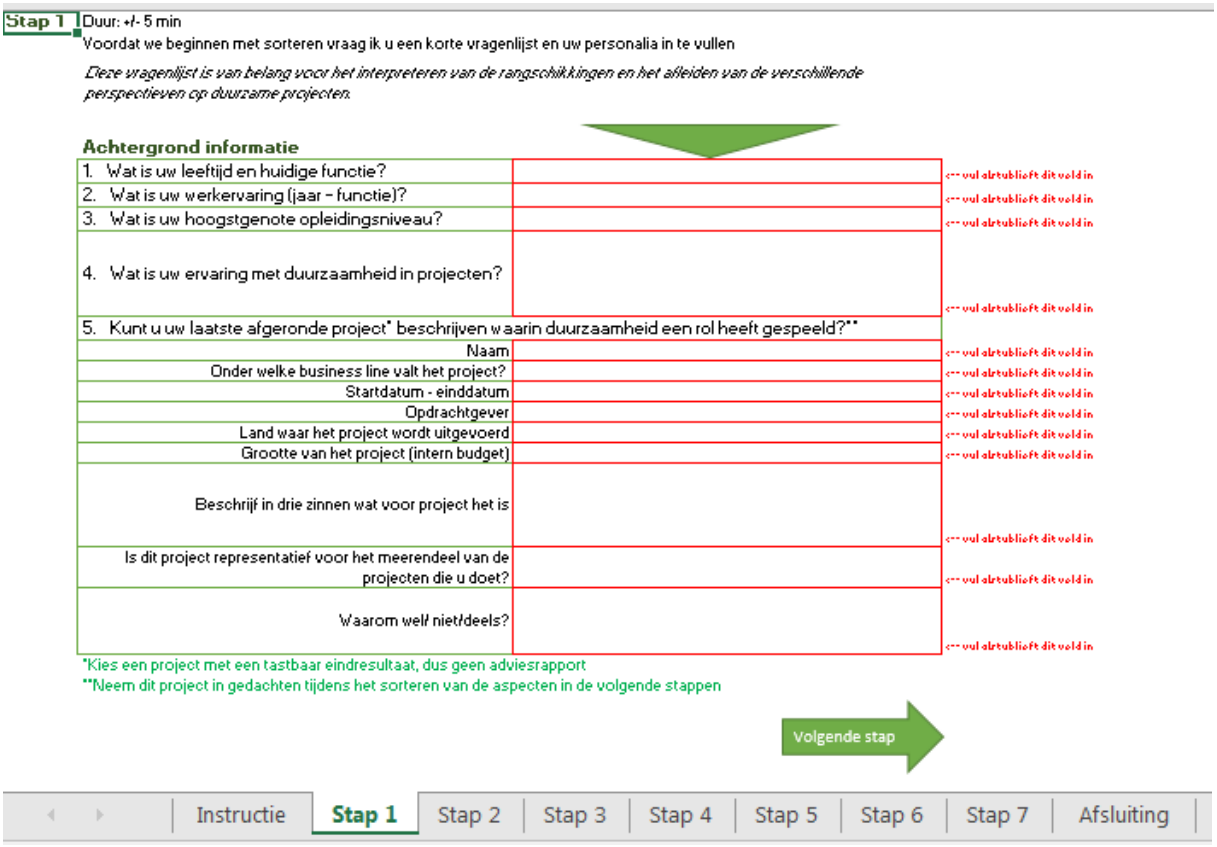
In totaal zijn er 30 aspecten van duurzaamheid door te nemen en te rangschikken aan de hand van een centrale vraag, genoemd in stap 2. U wordt aan de hand van de volgende stappen door het proces geleid, volg deze stappen chronologisch. Zie ook de tabbladen onderaan de pagina.

Zorg dat u **alle** lege vlakken invult (zie ook de pijlen). De methode die voor dit onderzoek gebruikt wordt vereist dat alleen volledig ingevulde versie gebruikt worden. Als u onzeker bent over een bepaald antwoord, geef dit dan aan in de tekstblokken.

Stap 1	Voordat het sorteren begint, vraag ik u een aantal achtergrond informatie vragen in te vullen
Stap 2	Typ een L (lastig), N (neutraal) of M (makkelijk) achter elk aspect
Stap 3	Selecteer de twee minste en meest belangrijke aspecten
Stap 4	Licht uw keuzes toe
Stap 5	Sleep de blokjes in de figuur naar mate van hoe belangrijk u het aspect vindt
Stap 6	Licht uw keuzes toe
Stap 7	Vul een korte vragenlijst in
Afsluiting	Sla uw resultaten op en mail deze naar rosanne.stel@rhdhv.com

Ga naar stap 1

Instructie | Stap 1 | Stap 2 | Stap 3 | Stap 4 | Stap 5 | Stap 6 | Stap 7 | Afsluiting



Stap 1 Duur: +/- 5 min

Voordat we beginnen met sorteren vraag ik u een korte vragenlijst en uw personalia in te vullen

Deze vragenlijst is van belang voor het interpreteren van de rangschikkingen en het afleiden van de verschillende perspectieven op duurzame projecten.

Achtergrond informatie

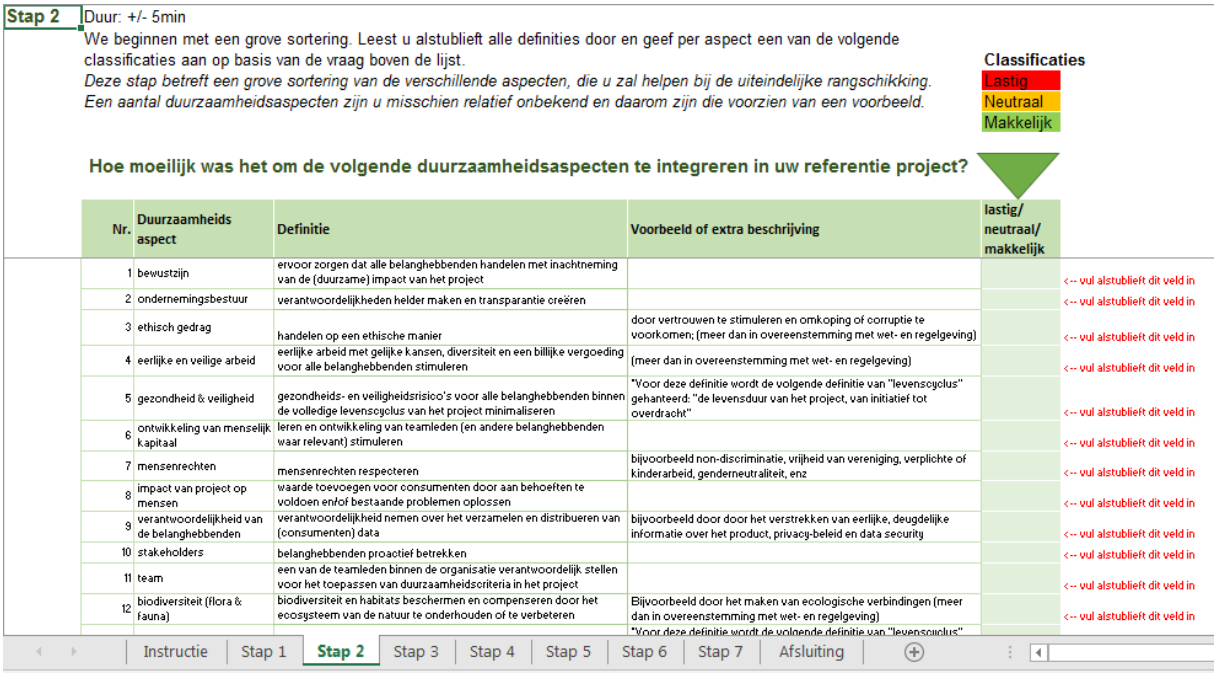
1. Wat is uw leeftijd en huidige functie?		<-- vul alstublieft dit veld in
2. Wat is uw werkervaring (jaar - functie)?		<-- vul alstublieft dit veld in
3. Wat is uw hoogstgenote opleidingsniveau?		<-- vul alstublieft dit veld in
4. Wat is uw ervaring met duurzaamheid in projecten?		<-- vul alstublieft dit veld in
5. Kunt u uw laatste afgeronde project* beschrijven waarin duurzaamheid een rol heeft gespeeld?**		
Naam		<-- vul alstublieft dit veld in
Onder welke business line valt het project?		<-- vul alstublieft dit veld in
Startdatum - einddatum		<-- vul alstublieft dit veld in
Opdrachtgever		<-- vul alstublieft dit veld in
Land waar het project wordt uitgevoerd		<-- vul alstublieft dit veld in
Grootte van het project (intern budget)		<-- vul alstublieft dit veld in
Beschrijf in drie zinnen wat voor project het is		<-- vul alstublieft dit veld in
Is dit project representatief voor het meerendeel van de projecten die u doet?		<-- vul alstublieft dit veld in
Waarom wel/ niet/deels?		<-- vul alstublieft dit veld in

*Kies een project met een tastbaar eindresultaat, dus geen adviesrapport

**Neem dit project in gedachten tijdens het sorteren van de aspecten in de volgende stappen

Volgende stap

Instructie | **Stap 1** | Stap 2 | Stap 3 | Stap 4 | Stap 5 | Stap 6 | Stap 7 | Afsluiting



Stap 2 Duur: +/- 5min

We beginnen met een grove sortering. Leest u alstublieft alle definities door en geef per aspect een van de volgende classificaties aan op basis van de vraag boven de lijst.

Deze stap betreft een grove sortering van de verschillende aspecten, die u zal helpen bij de uiteindelijke rangschikking.
Een aantal duurzaamheidsaspecten zijn u misschien relatief onbekend en daarom zijn die voorzien van een voorbeeld.

Classificaties
Lastig
Neutraal
Makkelijk

Hoe moeilijk was het om de volgende duurzaamheidsaspecten te integreren in uw referentie project?

Nr.	Duurzaamheids aspect	Definitie	Voorbeeld of extra beschrijving	lastig/ neutraal/ makkelijk	
1	bewustzijn	ervoor zorgen dat alle belanghebbenden handelen met inachtneming van de (duurzame) impact van het project			<-- vul alstublieft dit veld in
2	ondernemingsbestuur	verantwoordelijkheden helder maken en transparantie creëren			<-- vul alstublieft dit veld in
3	ethisch gedrag	handelen op een ethische manier	door vertrouwen te stimuleren en omkoping of corruptie te voorkomen; (meer dan in overeenstemming met wet- en regelgeving)		<-- vul alstublieft dit veld in
4	eerlijke en veilige arbeid	eerlijke arbeid met gelijke kansen, diversiteit en een billijke vergoeding voor alle belanghebbenden stimuleren	(meer dan in overeenstemming met wet- en regelgeving)		<-- vul alstublieft dit veld in
5	gezondheid & veiligheid	gezondheids- en veiligheidsrisico's voor alle belanghebbenden binnen de volledige levenscyclus van het project minimaliseren	"Voor deze definitie wordt de volgende definitie van "levenscyclus" gehanteerd: "de levensduur van het project, van initiatief tot overdracht"		<-- vul alstublieft dit veld in
6	ontwikkeling van menselijk kapitaal	leren en ontwikkeling van teamleden (en andere belanghebbenden waar relevant) stimuleren			<-- vul alstublieft dit veld in
7	mensenrechten	mensenrechten respecteren	bijvoorbeeld non-discriminatie, vrijheid van vereniging, verplichte of kinderarbeid, genderneutraliteit, enz		<-- vul alstublieft dit veld in
8	impact van project op mensen	waarde toevoegen voor consumenten door aan behoeften te voldoen en/of bestaande problemen oplossen			<-- vul alstublieft dit veld in
9	verantwoordelijkheid van de belanghebbenden	verantwoordelijkheid nemen over het verzamelen en distribueren van (consumenten) data	bijvoorbeeld door door het verstrekken van eerlijke, deugdelijke informatie over het product, privacy-beleid en data security		<-- vul alstublieft dit veld in
10	stakeholders	belanghebbenden proactief betrekken			<-- vul alstublieft dit veld in
11	team	een van de teamleden binnen de organisatie verantwoordelijk stellen voor het toepassen van duurzaamheidscriteria in het project			<-- vul alstublieft dit veld in
12	biodiversiteit (flora & fauna)	biodiversiteit en habitats beschermen en compenseren door het ecosysteem van de natuur te onderhouden of te verbeteren	Bijvoorbeeld door het maken van ecologische verbindingen (meer dan in overeenstemming met wet- en regelgeving)		<-- vul alstublieft dit veld in
			"Voor deze definitie wordt de volgende definitie van "levenscyclus"		

Instructie | Stap 1 | **Stap 2** | Stap 3 | Stap 4 | Stap 5 | Stap 6 | Stap 7 | Afsluiting

Stap 3 Duur: +/- 2 min

In deze stap kiest u de twee meest lastige en meest makkelijke aspecten om te integreren in uw referentieproject.

Kies twee aspecten uit de rode categorie 'lastig' die u het aller lastigst vindt, duidt deze aan met een 'x' en een 'y' (weging is even zwaar)

Kies twee aspecten uit de groene categorie 'makkelijk' die u het aller makkelijkst vindt, duidt deze aan met een 'x' en een 'y' (weging is even zwaar)

Hoe moeilijk was het om de volgende duurzaamheidsaspecten te integreren in uw referentie project?

Plaats één x voor aspect met een rood vakje
Plaats één Y voor aspect met een rood vakje

Meest lastig	Duurzaamheids aspect	Lastig
	1 - bewustzijn	
	2 - ondernemingsbestuur	
	3 - ethisch gedrag	
	4 - eerlijke en veilige arbeid	
	5 - gezondheid & veiligheid	
	6 - ontwikkeling van menselijk kapitaal	
	7 - mensenrechten	
	8 - impact van project op mensen	
	9 - verantwoordelijkheid van de belanghebbenden	
	10 - stakeholders	
	11 - team	
	12 - biodiversiteit (flora & fauna)	
	13 - CO2-uitstoot	
	14 - schadelijke emissies	
	15 - energie	
	16 - impact van het project op het milieu	
	17 - materiaal efficiëntie	

Plaats één x voor aspect met een groen vakje
Plaats één Y voor aspect met een groen vakje

Meest makkelijk	Duurzaamheids aspect	Makkelijk
	1 - bewustzijn	
	2 - ondernemingsbestuur	
	3 - ethisch gedrag	
	4 - eerlijke en veilige arbeid	
	5 - gezondheid & veiligheid	
	6 - ontwikkeling van menselijk kapitaal	
	7 - mensenrechten	
	8 - impact van project op mensen	
	9 - verantwoordelijkheid van de belanghebbenden	
	10 - stakeholders	
	11 - team	
	12 - biodiversiteit (flora & fauna)	
	13 - CO2-uitstoot	
	14 - schadelijke emissies	
	15 - energie	
	16 - impact van het project op het milieu	
	17 - materiaal efficiëntie	

Instructie | Stap 1 | Stap 2 | **Stap 3** | Stap 4 | Stap 5 | Stap 6 | Stap 7 | Afsluiting

Stap 4 Duur +/- 3 min ***Deze stap kunnen we ook tefelonisch bespreken***

Kunt u uw keuze toelichten?

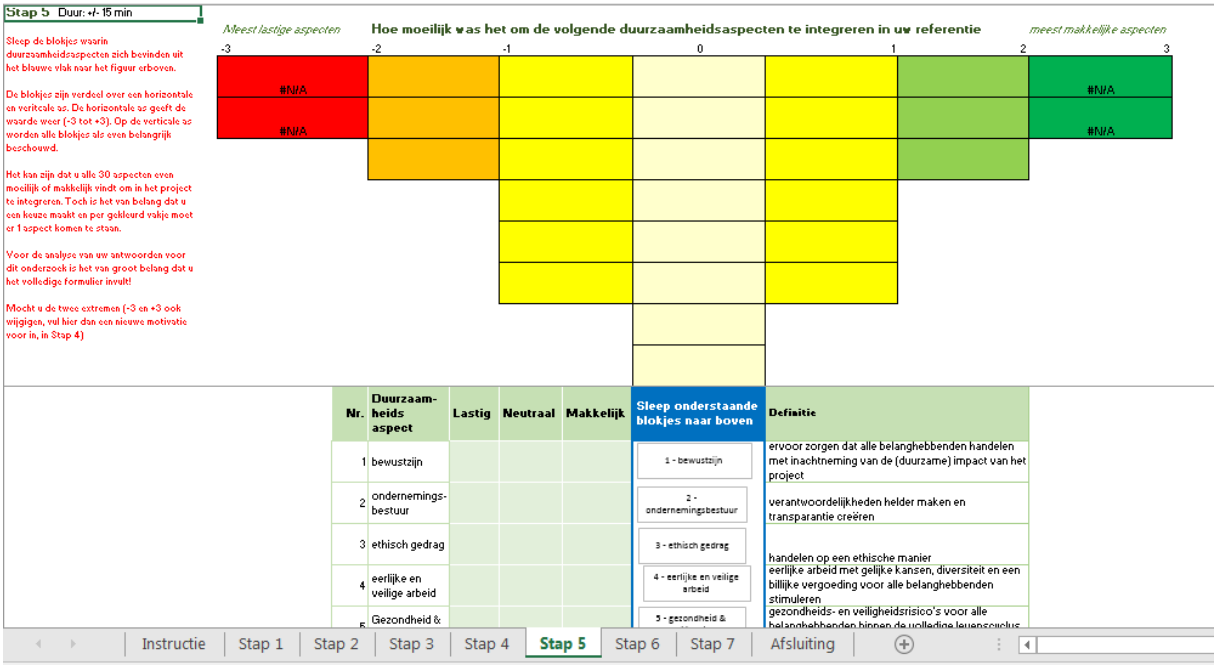
De motivatie die u hier invult zal gebruikt worden als onderbouwing voor de gekozen ordening in stap 5

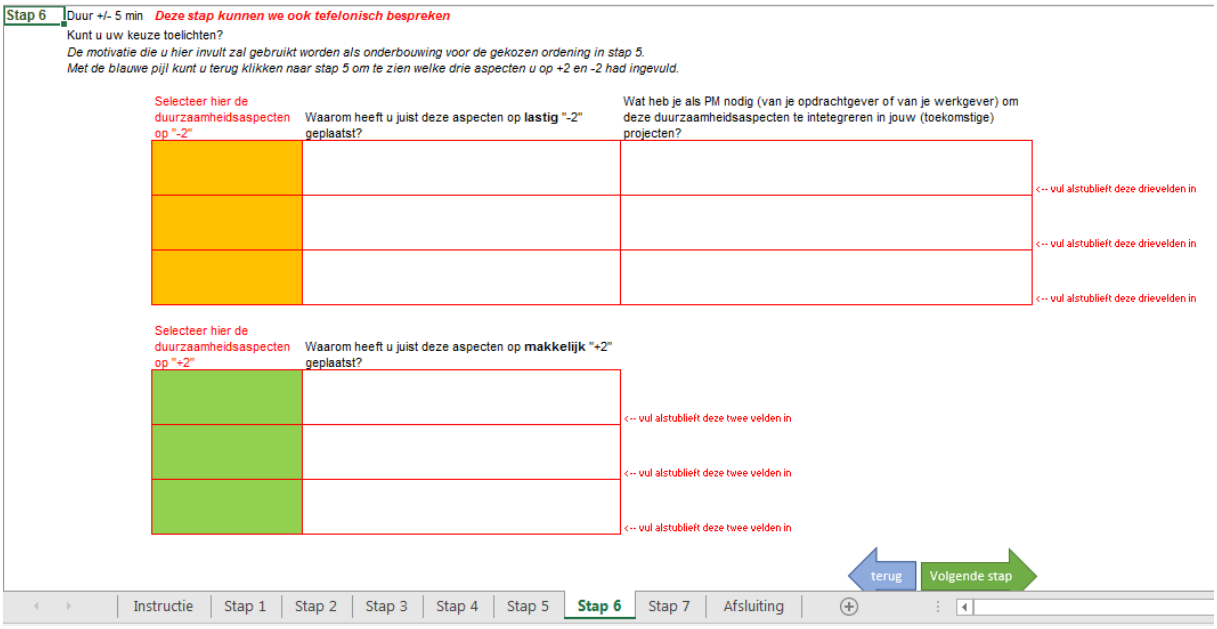
	Waarom heeft u juist deze aspecten op **meest lastig** "-3" geplaatst?	Wat heeft u als project manager nodig om deze duurzaamheidsaspecten te integreren in uw (toekomstige) projecten?	
#N/A			<-- vul alstublieft dit veld in
#N/A			<-- vul alstublieft dit veld in

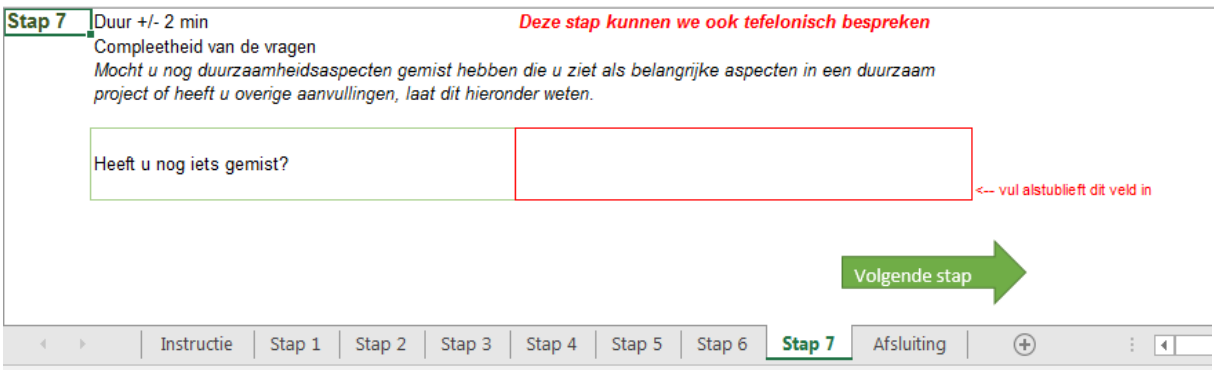
	Waarom heeft u juist deze aspecten op **meest makkelijk** "+3" geplaatst?	
#N/A		<-- vul alstublieft dit veld in
#N/A		<-- vul alstublieft dit veld in

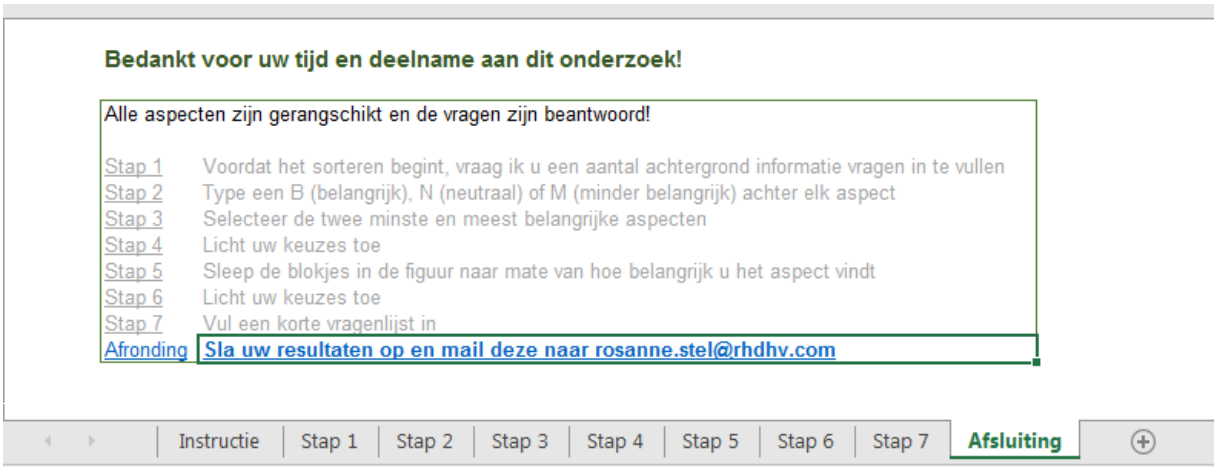
Volgende stap

Instructie | Stap 1 | Stap 2 | Stap 3 | **Stap 4** | Stap 5 | Stap 6 | Stap 7 | Afsluiting

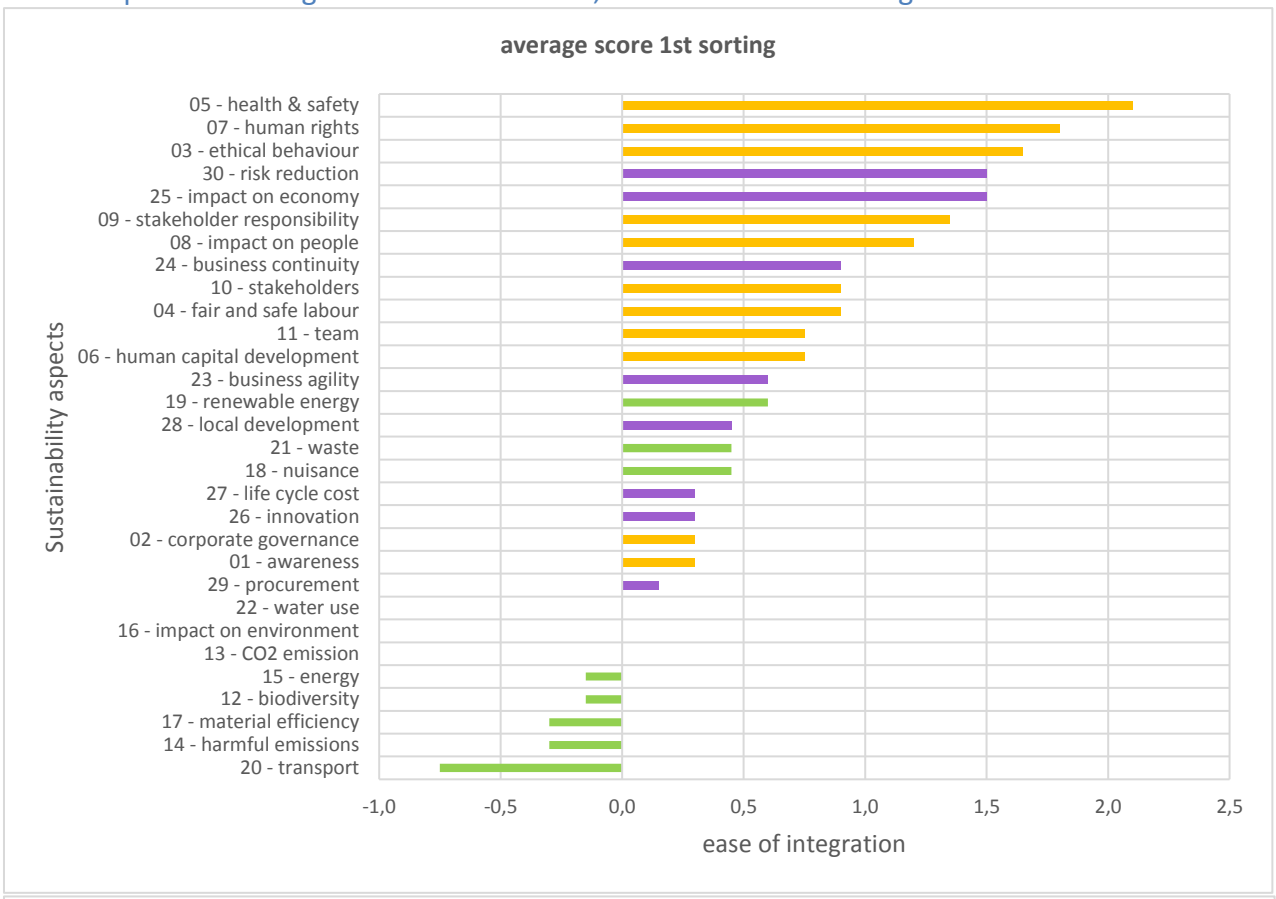

Stap 5 Duur: +/- 15 min
Sleep de blokjes waarin duurzaamheidsaspecten zich bevinden uit het blauwe vlak naar het figuur erboven.
De blokjes zijn verdeel over een horizontale en verticale as. De horizontale as geeft de waarde weer (-3 tot +3). Op de verticale as worden alle blokjes als even belangrijk beschouwd.
Het kan zijn dat u alle 30 aspecten even moeilijk of makkelijk vindt om in het project te integreren. Toch is het van belang dat u een keuze maakt en per gekleurd vakje moet er 1 aspect komen te staan.
Voor de analyse van uw antwoorden voor dit onderzoek is het van groot belang dat u het volledige formulier invult!
Mocht u de twee extremen (-3 en +3 ook wijzigen, vul hier dan een nieuwe motivatie voor in, in Stap 4)
Meest lastige aspecten
Hoe moeilijk was het om de volgende duurzaamheidsaspecten te integreren in uw referentie
meest makkelijke aspecten
-3
-2
-1
0
1
2
3
#N/A
#N/A
#N/A
#N/A
Nr.
Duurzaam-heids aspect
Lastig
Neutraal
Makkelijk
Sleep onderstaande blokjes naar boven
Definitie
1 bewustzijn
1 - bewustzijn
ervoor zorgen dat alle belanghebbenden handelen met inachtneming van de (duurzame) impact van het project
2 ondernemings-bestuur
2 - ondernemingsbestuur
verantwoordelijkheden helder maken en transparantie creëren
3 ethisch gedrag
3 - ethisch gedrag
handelen op een ethische manier
4 eerlijke en veilige arbeid
4 - eerlijke en veilige arbeid
eerlijke arbeid met gelijke kansen, diversiteit en een billijke vergoeding voor alle belanghebbenden stimuleren
5 Gezondheid &
5 - gezondheid &
gezondheids- en veiligheidsrisico's voor alle
Instructie
Stap 1
Stap 2
Stap 3
Stap 4
Stap 5
Stap 6
Stap 7
Afsluiting

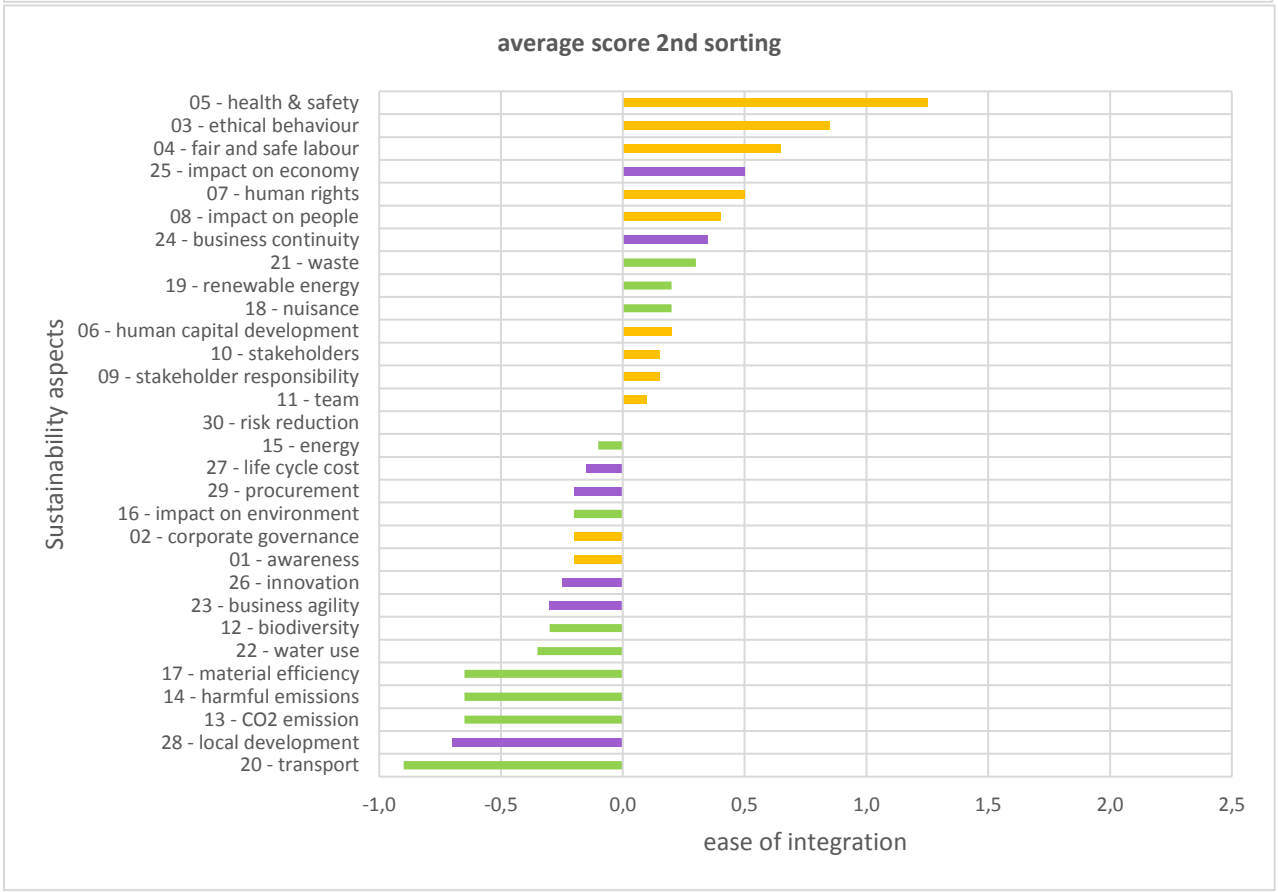

Stap 6 Duur +/- 5 min Deze stap kunnen we ook tefelonisch bespreken
Kunt u uw keuze toelichten?
De motivatie die u hier invult zal gebruikt worden als onderbouwing voor de gekozen ordening in stap 5.
Met de blauwe pijl kunt u terug klikken naar stap 5 om te zien welke drie aspecten u op +2 en -2 had ingevuld.
Selecteer hier de duurzaamheidsaspecten op "-2"
Waarom heeft u juist deze aspecten op lastig "-2" geplaatst?
Wat heb je als PM nodig (van je opdrachtgever of van je werkgever) om deze duurzaamheidsaspecten te intetegreren in jouw (toekomstige) projecten?
<-- vul alstublieft deze drievelden in
<-- vul alstublieft deze drievelden in
<-- vul alstublieft deze drievelden in
Selecteer hier de duurzaamheidsaspecten op "+2"
Waarom heeft u juist deze aspecten op makkelijk "+2" geplaatst?
<-- vul alstublieft deze twee velden in
<-- vul alstublieft deze twee velden in
<-- vul alstublieft deze twee velden in
terug
Volgende stap
Instructie
Stap 1
Stap 2
Stap 3
Stap 4
Stap 5
Stap 6
Stap 7
Afsluiting

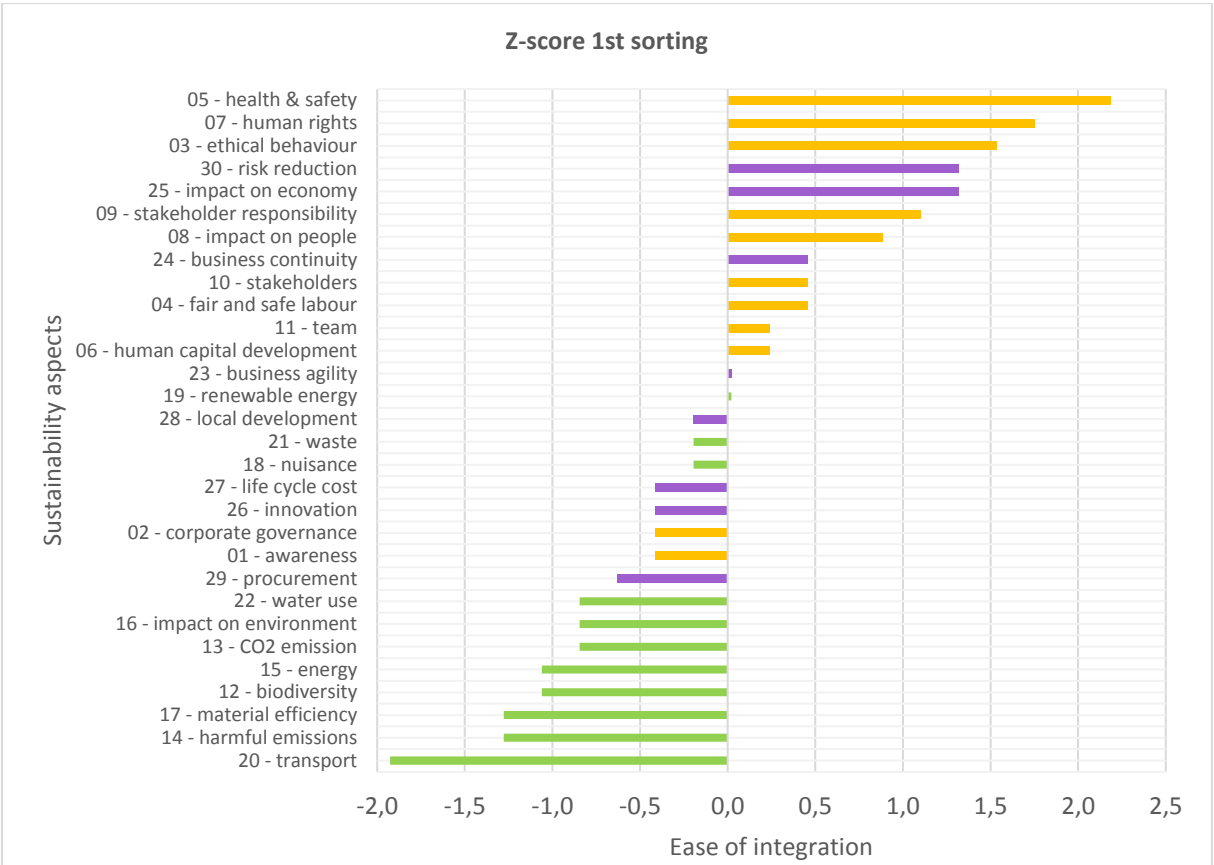

Stap 7 Duur +/- 2 min
Deze stap kunnen we ook tefelonisch bespreken
Compleetheid van de vragen
Mocht u nog duurzaamheidsaspecten gemist hebben die u ziet als belangrijke aspecten in een duurzaam project of heeft u overige aanvullingen, laat dit hieronder weten.
Heeft u nog iets gemist?
<-- vul alstublieft dit veld in
Volgende stap
Instructie
Stap 1
Stap 2
Stap 3
Stap 4
Stap 5
Stap 6
Stap 7
Afsluiting

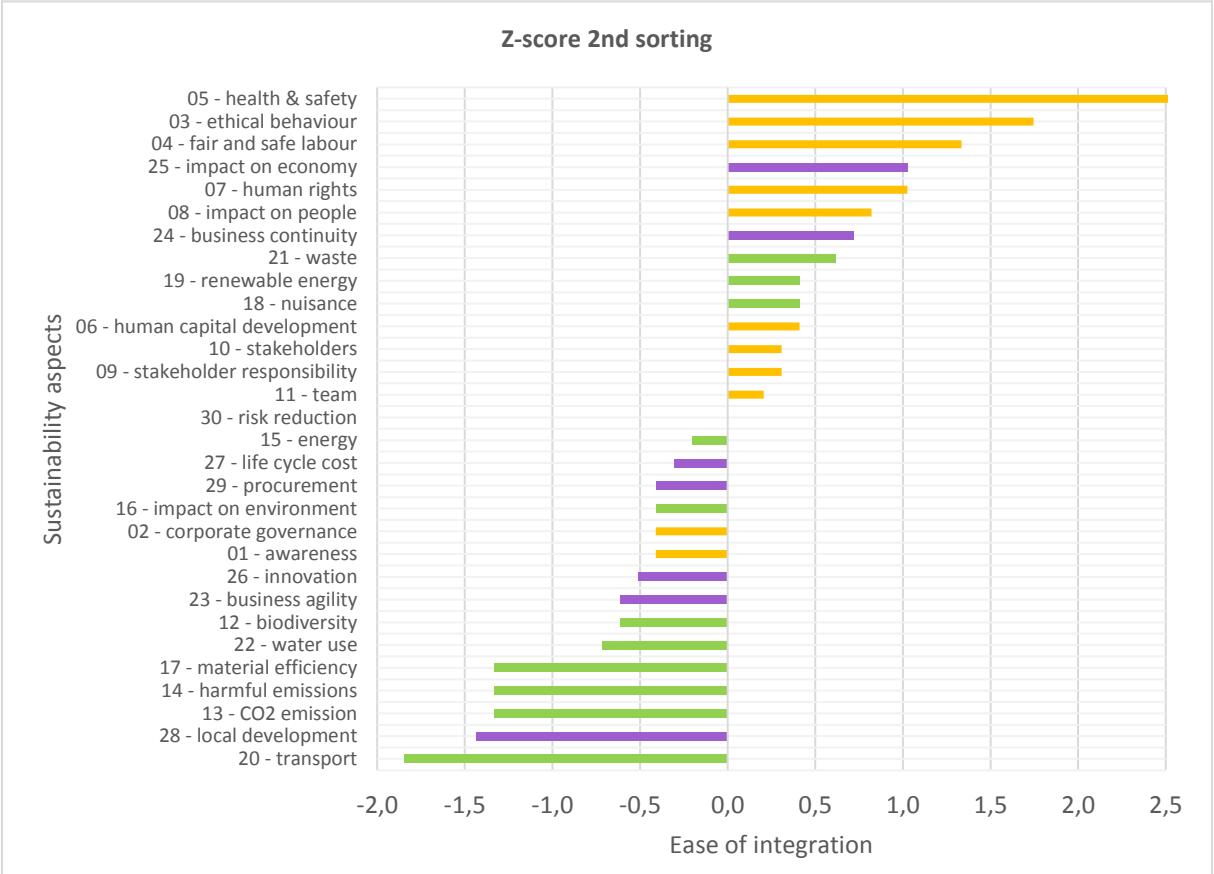

Bedankt voor uw tijd en deelname aan dit onderzoek!
Alle aspecten zijn gerangschikt en de vragen zijn beantwoord!
Stap 1 Voordat het sorteren begint, vraag ik u een aantal achtergrond informatie vragen in te vullen
Stap 2 Type een B (belangrijk), N (neutraal) of M (minder belangrijk) achter elk aspect
Stap 3 Selecteer de twee minste en meest belangrijke aspecten
Stap 4 Licht uw keuzes toe
Stap 5 Sleep de blokjes in de figuur naar mate van hoe belangrijk u het aspect vindt
Stap 6 Licht uw keuzes toe
Stap 7 Vul een korte vragenlijst in
Afronding Sla uw resultaten op en mail deze naar rosanne.stel@rhdhv.com
Instructie
Stap 1
Stap 2
Stap 3
Stap 4
Stap 5
Stap 6
Stap 7
Afsluiting

C.2.2 Graph with average scores and Z-scores, first and second sorting






Z-score 1st sorting
05 - health & safety
07 - human rights
03 - ethical behaviour
30 - risk reduction
25 - impact on economy
09 - stakeholder responsibility
08 - impact on people
24 - business continuity
10 - stakeholders
04 - fair and safe labour
11 - team
06 - human capital development
23 - business agility
19 - renewable energy
28 - local development
21 - waste
18 - nuisance
27 - life cycle cost
26 - innovation
02 - corporate governance
01 - awareness
29 - procurement
22 - water use
16 - impact on environment
13 - CO2 emission
15 - energy
12 - biodiversity
17 - material efficiency
14 - harmful emissions
20 - transport
Sustainability aspects
-2,0 -1,5 -1,0 -0,5 0,0 0,5 1,0 1,5 2,0 2,5
Ease of integration


Z-score 2nd sorting
05 - health & safety
03 - ethical behaviour
04 - fair and safe labour
25 - impact on economy
07 - human rights
08 - impact on people
24 - business continuity
21 - waste
19 - renewable energy
18 - nuisance
06 - human capital development
10 - stakeholders
09 - stakeholder responsibility
11 - team
30 - risk reduction
15 - energy
27 - life cycle cost
29 - procurement
16 - impact on environment
02 - corporate governance
01 - awareness
26 - innovation
23 - business agility
12 - biodiversity
22 - water use
17 - material efficiency
14 - harmful emissions
13 - CO2 emission
28 - local development
20 - transport
Sustainability aspects
-2,0 -1,5 -1,0 -0,5 0,0 0,5 1,0 1,5 2,0 2,5
Ease of integration

C.2.3 Factor analysis

Acceptable factors, results factor analysis, distinguishing statements and interpretation of the results.

C.2.3.1 Acceptable factors

Factor Matrices with an X Indicating a defining Sort, and in red highlighted non-loaders.

2-factor

		Loadings	
QSORT		1	2
1	MvdV	-0.4443X	0.4167
2	RS	-0.0863	0.4194X
3	WP	-0.0122	-0.4936X
4	NG	-0.0725	0.4852X
5	RK	0.4483	0.6596X
6	RvU	-0.0974	0.0400
7	TvdW	0.4253X	-0.2542
8	PM	0.2447	0.0210
9	SR	0.3308	0.3258
10	WdH	-0.1008	-0.1724
11	JA	0.7859X	-0.1852
12	BM	-0.4905X	-0.1304
13	AT	-0.0424	0.5664X
14	MT	0.6172X	0.1420
15	FH	0.5970X	-0.0493
16	EB	0.4517X	-0.1144
17	LdB	-0.3047	-0.1923
18	RB	0.3160	0.2546
19	DB	0.4363X	0.0859
20	JB	0.5346	-0.6302X
% expl.Var.		16	12

3-factor

		Loadings		
QSORT		1	2	3
1	MvdV	-0.3237	0.5056X	0.2730
2	RS	-0.0507	0.4399X	0.0108
3	WP	0.1808	-0.3481	0.5295X
4	NG	0.0603	0.5734X	0.2090
5	RK	0.3844	0.5934X	-0.3691
6	RvU	0.1312	0.2041	0.5165X
7	TvdW	0.4389X	-0.2499	-0.0061
8	PM	0.0230	-0.1424	-0.5444X
9	SR	0.3818X	0.3494	-0.0227
10	WdH	0.1081	-0.0188	0.5173X
11	JA	0.7015X	-0.2598	-0.3113
12	BM	-0.2162	0.0778	0.7340X
13	AT	0.0108	0.5960X	0.0104
14	MT	0.5931X	0.1087	-0.2104
15	FH	0.6878X	0.0027	0.0868
16	EB	0.5037X	-0.0857	0.0445
17	LdB	-0.1609	-0.0802	0.4200X
18	RB	0.3487	0.2668	-0.0453
19	DB	0.5589X	0.1620	0.1628
20	JB	0.5941	-0.5896	0.1496
% expl.Var.		15	12	11

4-Factor

Loadings

QSORT	1	2	3	4
1 MvdV	-0.5178X	0.4067	0.3121	-0.0046
2 RS	-0.2179	0.4100X	0.0182	-0.0027
3 WP	0.2597	-0.2115	0.5874X	0.0756
4 NG	-0.1698	0.5366X	0.1222	0.2169
5 RK	0.1521	0.6961X	-0.3568	-0.0680
6 RvU	-0.0071	0.3483	0.6591X	-0.0510
7 TvdW	0.5004X	-0.0653	0.0283	-0.0123
8 PM	0.0951	-0.0631	-0.3735	-0.4244X
9 SR	0.2127	0.5166X	0.0596	-0.0824
10 WdH	0.1092	-0.1429	0.1714	0.6987X
11 JA	0.7595X	0.0502	-0.1912	-0.2048
12 BM	-0.2792	0.0288	0.7215X	0.2105
13 AT	-0.1798	0.3695	-0.3694	0.6086X
14 MT	0.5277X	0.2807	-0.2555	0.0781
15 FH	0.6392X	0.2129	0.0145	0.2147
16 EB	0.4724X	0.2293	0.2806	-0.2990
17 LdB	-0.1173	-0.2665	0.1405	0.5356X
18 RB	0.2097	0.4527X	0.0890	-0.1757
19 DB	0.4763	0.2040	-0.1280	0.5653X
20 JB	0.7553X	-0.2808	0.2716	-0.0942
% expl.Var.	16	11	11	10

5-Factor

Loadings

QSORT	1	2	3	4	5
1 MvdV	-0.5120	0.3631	0.0246	-0.0441	-0.3747
2 RS	-0.1892	0.3585X	-0.1849	0.0051	-0.1523
3 WP	0.0053	-0.0573	0.8400X	0.1245	-0.0280
4 NG	-0.2886	0.4811X	0.0197	0.2877	-0.1271
5 RK	0.1439	0.6375X	-0.4669	0.0627	0.1755
6 RvU	0.0379	0.4332	0.3275	-0.1120	-0.5116
7 TvdW	0.7145X	-0.0136	-0.1424	-0.0838	-0.1369
8 PM	-0.2656	0.0120	0.1970	-0.1841	0.7808X
9 SR	-0.0016	0.5670X	0.1560	0.0863	0.1820
10 WdH	-0.0831	-0.1906	0.3819	0.7270X	-0.0450
11 JA	0.5932X	0.1759	0.1441	-0.0261	0.5091
12 BM	-0.1942	0.0539	0.3856	0.0552	-0.6725X
13 AT	-0.2083	0.1681	-0.4201	0.6544X	0.0031
14 MT	0.1884	0.3254	0.1779	0.3360	0.5779X
15 FH	0.6719X	0.2493	-0.0255	0.2581	-0.0068
16 EB	0.2710	0.3994	0.4468	-0.1582	0.1858
17 LdB	-0.0113	-0.3510	0.0284	0.4034	-0.3353
18 RB	0.2182	0.4997X	-0.0579	-0.1185	-0.0465
19 DB	0.3874	0.1518	-0.0252	0.6503X	0.0888
20 JB	0.7653X	-0.1073	0.3888	-0.0930	0.0419
% expl.Var.	14	11	10	10	12

6-factor

Loadings

QSORT	1	2	3	4	5	6
1 MvdV	-0.4882	-0.4136	-0.0146	0.0719	0.5706	-0.0694
2 RS	-0.1907	0.3299	-0.4022	-0.1388	0.1309	0.5282
3 WP	0.0390	0.0457	0.8238X	0.0695	0.1872	0.1251
4 NG	-0.3180	-0.0106	-0.1140	0.2666	0.2655	0.4155
5 RK	0.0770	-0.6144	-0.5001	0.3124	-0.0116	0.2264
6 RvU	0.0907	-0.1454	0.1324	-0.0579	0.6835X	0.2467
7 TvdW	0.7198X	0.0558	-0.1966	-0.0147	0.0328	-0.0274
8 PM	-0.2930	-0.4080	0.3345	-0.1339	-0.6172	0.1312
9 SR	-0.0293	-0.0660	-0.0200	0.0701	-0.0051	0.6877X
10 WdH	-0.1307	0.2447	0.4757	0.6571X	0.0660	-0.1056
11 JA	0.5560	-0.1504	0.1219	0.0417	-0.4400	0.3716
12 BM	-0.1303	0.1703	0.2663	-0.0048	0.7279X	-0.0433
13 AT	-0.3002	0.2026	-0.4119	0.6116X	-0.0580	0.1138
14 MT	0.1101	-0.1149	0.1633	0.3557	-0.4316	0.5220
15 FH	0.6281X	-0.2113	-0.0499	0.4222	0.0597	0.0893
16 EB	0.2867	0.0215	0.2489	-0.2057	-0.0310	0.6876X
17 LdB	-0.0108	0.8758X	-0.0431	0.1205	0.0890	0.0338
18 RB	0.2139	-0.3050	-0.1895	0.0032	0.1838	0.3309
19 DB	0.3005	-0.1338	0.0424	0.7754X	-0.0347	-0.0034
20 JB	0.7871X	-0.0201	0.3738	-0.0299	-0.0372	0.0158
% expl.Var.	13	10	10	10	11	11

7-factor

Loadings

QSORT		1	2	3	4	5	6	7
1	MvdV	-0.6452X	-0.4512	0.1959	0.0273	-0.2248	0.1536	0.1146
2	RS	-0.0651	0.3093	-0.2597	-0.2039	-0.1057	0.5868X	0.2492
3	WP	0.1069	0.0487	0.8425X	0.0748	0.0847	0.0028	-0.0378
4	NG	-0.1344	-0.1409	0.0342	0.1523	-0.1077	0.7221X	-0.0526
5	RK	0.0884	-0.6372X	-0.4457	0.2513	-0.0220	0.2375	0.2520
6	RvU	-0.0132	-0.2542	0.3939	-0.1215	-0.5033	0.3097	0.1673
7	TvdW	0.5079	0.0851	-0.1796	0.0423	-0.3317	-0.3461	0.2954
8	PM	-0.0372	-0.2249	0.1088	-0.1115	0.8476X	-0.1283	0.0753
9	SR	0.0866	0.0628	0.0684	0.0487	0.2209	0.3420	0.6397X
10	WdH	-0.0573	0.1609	0.4482	0.6497X	0.0279	0.1114	-0.3266
11	JA	0.7475X	-0.0945	-0.0170	0.0440	0.2886	0.0031	0.1718
12	BM	-0.4351	0.1930	0.5202	0.0268	-0.4498	-0.0995	0.3334
13	AT	-0.2326	0.1594	-0.3847	0.5747	0.0139	0.3660	-0.0055
14	MT	0.3557	0.0057	0.0553	0.3516	0.5162	0.1893	0.3383
15	FH	0.6148X	-0.3330	-0.0352	0.3892	-0.2957	0.0696	-0.0425
16	EB	0.5599	0.0009	0.2862	-0.2727	0.0964	0.4751	0.1780
17	LdB	-0.0445	0.8594X	0.0020	0.1525	-0.2142	0.0957	-0.0223
18	RB	0.0404	-0.1600	-0.0597	0.0308	-0.0728	-0.0929	0.7519X
19	DB	0.1856	-0.0908	0.0264	0.8145X	-0.0138	-0.1795	0.2587
20	JB	0.7584X	-0.0530	0.3160	-0.0003	-0.1664	-0.2646	-0.0249
% expl.Var.		15	9	10	10	10	9	9

C.2.3.2 Distinguishing statements 4- and 5-factor

4-factor

Distinguishing Statements for Factor 1 → noted in overview Excel with * and **

(P < .05 ; Asterisk (*) Indicates Significance at P < .01)

Both the Factor Q-Sort Value (Q-SV) and the Z-Score (Z-SCR) are Shown.

		Factors							
			1		2		3		4
No.	Statement	No.	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR	
5	Gezondheid & Veiligheid	5	3	2.59*	3	1.64	1	0.80	2	1.15	
7	mensenrechten	7	3	2.03*	1	0.68	-1	-0.37	-1	-1.14	
17	materiaal efficiëntie	17	1	0.66*	-1	-0.95	-3	-1.76	-1	-0.84	
16	impact op het milieu	16	1	0.23*	-1	-1.01	-1	-0.71	1	1.08	
15	energie	15	1	0.21*	2	1.40	-3	-1.69	-2	-1.20	
25	impact op de economie	25	0	0.13*	-2	-1.22	3	2.35	2	1.44	
20	vervoer	20	0	-0.12*	-3	-1.68	-2	-1.25	-2	-1.31	
30	risico beperking	30	-1	-0.67*	0	0.16	3	1.62	-3	-1.48	
24	bedrijfs-continuïteit	24	-1	-0.83*	0	0.08	2	1.03	1	1.09	
10	stakeholders	10	-2	-1.18*	1	0.63	2	1.32	0	-0.28	
11	team	11	-2	-1.21*	2	1.20	0	0.22	0	-0.44	
23	bedrijfs-flexibiliteit	23	-2	-1.22*	0	0.03	0	0.29	1	0.75	
1	bewustzijn	1	-3	-1.78*	1	1.02	-1	-0.38	3	1.44	

Distinguishing Statements for Factor 2

(P < .05 ; Asterisk (*) Indicates Significance at P < .01)

Both the Factor Q-Sort Value (Q-SV) and the Z-Score (Z-SCR) are Shown.

		Factors							
			1		2		3		4
No.	Statement	No.	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR	
15	energie	15	1	0.21	2	1.40*	-3	-1.69	-2	-1.20	
11	team	11	-2	-1.21	2	1.20*	0	0.22	0	-0.44	
2	ondernemings-bestuur	2	-3	-1.22	1	0.97	0	0.15	-1	-0.67	
29	inkoop	29	-1	-0.40	1	0.69	0	-0.22	-1	-0.57	
7	mensenrechten	7	3	2.03	1	0.68*	-1	-0.37	-1	-1.14	
30	risico beperking	30	-1	-0.67	0	0.16*	3	1.62	-3	-1.48	
24	bedrijfs-continuïteit	24	-1	-0.83	0	0.08*	2	1.03	1	1.09	
12	biodiversiteit (flora & fauna)	12	0	-0.04	-1	-0.91*	0	0.27	0	0.37	
25	impact op de economie	25	0	0.13	-2	-1.22*	3	2.35	2	1.44	
19	hernieuwbare energie	19	2	0.86	-3	-1.67*	1	0.81	1	1.07	

Distinguishing Statements for Factor 3

(P < .05 ; Asterisk (*) Indicates Significance at P < .01)

Both the Factor Q-Sort Value (Q-SV) and the Z-Score (Z-SCR) are Shown.

		Factors							
		1		2		3		4	
No. Statement	No.	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR
25 impact op de economie	25	0	0.13	-2	-1.22	3	2.35*	2	1.44
30 risico beperking	30	-1	-0.67	0	0.16	3	1.62*	-3	-1.48
28 lokale ontwikkeling	28	0	-0.35	-2	-1.43	1	0.86*	-1	-0.82
2 ondernemings-bestuur	2	-3	-1.22	1	0.97	0	0.15	-1	-0.67
7 mensenrechten	7	3	2.03	1	0.68	-1	-0.37	-1	-1.14
1 bewustzijn	1	-3	-1.78	1	1.02	-1	-0.38*	3	1.44
6 ontwikkeling menselijk kapitaal	6	1	0.51	0	0.11	-1	-0.74	0	0.15
3 ethisch gedrag	3	2	1.39	3	1.42	-2	-1.33*	1	0.59
26 innovatie	26	-1	-0.50	-1	-0.42	-2	-1.67*	2	1.42
17 materiaal efficiëntie	17	1	0.66	-1	-0.95	-3	-1.76	-1	-0.84

Distinguishing Statements for Factor 4

(P < .05 ; Asterisk (*) Indicates Significance at P < .01)

Both the Factor Q-Sort Value (Q-SV) and the Z-Score (Z-SCR) are Shown.

		Factors							
		1		2		3		4	
No. Statement	No.	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR
27 levenscyclus-kosten	27	0	-0.23	-1	-0.45	-1	-0.35	3	1.50*
25 impact op de economie	25	0	0.13	-2	-1.22	3	2.35	2	1.44*
26 innovatie	26	-1	-0.50	-1	-0.42	-2	-1.67	2	1.42*
16 impact op het milieu	16	1	0.23	-1	-1.01	-1	-0.71	1	1.08*
3 ethisch gedrag	3	2	1.39	3	1.42	-2	-1.33	1	0.59*
10 stakeholders	10	-2	-1.18	1	0.63	2	1.32	0	-0.28*
7 mensenrechten	7	3	2.03	1	0.68	-1	-0.37	-1	-1.14
13 CO2-uitstoot	13	0	-0.24	-1	-0.43	0	-0.20	-2	-1.34*
30 risico beperking	30	-1	-0.67	0	0.16	3	1.62	-3	-1.48*

5-factor

Distinguishing Statements for Factor 1

(P < .05 ; Asterisk (*) Indicates Significance at P < .01)

Both the Factor Q-Sort Value (Q-SV) and the Z-Score (Z-SCR) are Shown.

		Factors									
			1		2		3		4		5
No. Statement	No.	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR
4 eerlijke en veilige ar ...	4	3	2.00	2	1.36	0	0.00	-1	-0.61	-1	-0.48
25 impact op de economie ...	25	1	0.44	-1	-0.97	3	1.90	2	1.31	-2	-1.21
15 energie ...	15	-1	-0.34*	3	1.42	-3	-1.90	-3	-1.57	1	0.71
11 team ...	11	-2	-1.34*	2	1.30	1	0.63	0	0.00	1	0.61
23 bedrijfs-flexibiliteit ...	23	-2	-1.57*	0	-0.03	0	0.00	0	0.26	0	-0.18
10 stakeholders ...	10	-3	-2.14*	1	0.63	0	0.00	0	-0.17	0	0.03

Distinguishing Statements for Factor 2

(P < .05 ; Asterisk (*) Indicates Significance at P < .01)

Both the Factor Q-Sort Value (Q-SV) and the Z-Score (Z-SCR) are Shown.

		Factors									
			1		2		3		4		5
No. Statement	No.	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR
15 energie ...	15	-1	-0.34	3	1.42	-3	-1.90	-3	-1.57	1	0.71
4 eerlijke en veilige ar ...	4	3	2.00	2	1.36	0	0.00	-1	-0.61	-1	-0.48
2 ondernemings-bestuur ...	2	-1	-0.54	1	0.94*	-1	-0.63	-1	-0.44	-3	-1.24
1 bewustzijn ...	1	-3	-1.61	1	0.89	-3	-1.90	3	1.64	-1	-0.85
19 hernieuwbare energie ...	19	1	0.63	-2	-1.53*	2	1.27	1	1.12	0	-0.08
20 vervoer ...	20	-1	-0.37	-3	-1.67	-1	-0.63	-1	-0.61	2	1.37

Distinguishing Statements for Factor 3

(P < .05 ; Asterisk (*) Indicates Significance at P < .01)

Both the Factor Q-Sort Value (Q-SV) and the Z-Score (Z-SCR) are Shown.

			Factors									
			1		2		3		4		5	
No.	Statement	No.	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR
14	schadelijke emissies	... 14	0	0.14	-3	-1.73	2	1.27	-3	-1.99	0	-0.35
3	ethisch gedrag	... 3	2	1.28	2	1.39	-1	-0.63*	2	1.29	2	1.39

Distinguishing Statements for Factor 4

(P < .05 ; Asterisk (*) Indicates Significance at P < .01)

Both the Factor Q-Sort Value (Q-SV) and the Z-Score (Z-SCR) are Shown.

			Factors									
			1		2		3		4		5	
No.	Statement	No.	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR
1	bewustzijn	... 1	-3	-1.61	1	0.89	-3	-1.90	3	1.64	-1	-0.85
26	innovatie	... 26	0	0.06	-1	-0.51	-2	-1.27	3	1.38*	0	-0.16
13	CO2-uitstoot	... 13	0	-0.00	-1	-0.31	0	0.00	-2	-1.56*	-1	-0.44

Distinguishing Statements for Factor 5

(P < .05 ; Asterisk (*) Indicates Significance at P < .01)

Both the Factor Q-Sort Value (Q-SV) and the Z-Score (Z-SCR) are Shown.

			Factors									
			1		2		3		4		5	
No.	Statement	No.	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR
20	vervoer	... 20	-1	-0.37	-3	-1.67	-1	-0.63	-1	-0.61	2	1.37*
15	energie	... 15	-1	-0.34	3	1.42	-3	-1.90	-3	-1.57	1	0.71
1	bewustzijn	... 1	-3	-1.61	1	0.89	-3	-1.90	3	1.64	-1	-0.85
5	Gezondheid & Veilighei	... 5	3	2.34	3	1.72	1	0.63	1	0.77	-1	-0.90*

C.2.3.3 Factor loading participants

Table 16 Loading of participants on factors 1,2,3 and 4 (X shows the factor loading)

QS	1	2	3	4
1	-0.5178X	0.4067	0.3121	-0.0046
7	0.5004X	-0.0653	0.0283	-0.0123
11	0.7595X	0.0502	-0.1912	-0.2048
14	0.5277X	0.2807	-0.2555	0.0781
15	0.6392X	0.2129	0.0145	0.2147
16	0.4724X	0.2293	0.2806	-0.2990
20	0.7553X	-0.2808	0.2716	-0.0942
2	-0.2179	0.4100X	0.0182	-0.0027
4	-0.1698	0.5366X	0.1222	0.2169
5	0.1521	0.6961X	-0.3568	-0.0680
9	0.2127	0.5166X	0.0596	-0.0824
18	0.2097	0.4527X	0.0890	-0.1757
3	0.2597	-0.2115	0.5874X	0.0756
6	-0.0071	0.3483	0.6591X	-0.0510
12	-0.2792	0.0288	0.7215X	0.2105
8	0.0951	-0.0631	-0.3735	-0.4244X
10	0.1092	-0.1429	0.1714	0.6987X
13	-0.1798	0.3695	-0.3694	0.6086X
17	-0.1173	-0.2665	0.1405	0.5356X
19	0.4763	0.2040	-0.1280	0.5653X

C.2.3.4 Overview distinguishing statements per each factor of the 4-factor

Table 17 Q-sort values per factor for each aspect of sustainability (distinguishing aspect blue shaded)

		Factor			
	Aspects of sustainability	**1**	**2**	**3**	**4**
People	01 - awareness	-3	1	-1	3
	02 - corporate governance	-3	1	0	-1
	03 - ethical behaviour	2	3	-2	1
	04 - fair and safe labour	2	2	0	0
	05 - health & safety	3	3	1	2
	06 - human capital development	1	0	-1	0
	07 - human rights	3	1	-1	-1
	08 - impact on people	-1	1	2	-1
	09 - stakeholder responsibility	0	0	0	0
	10 - stakeholders	-2	1	2	0
	11 - team	-2	2	0	0
Planet	12 - biodiversity	0	-1	0	0
	13 - CO2 emission	0	-1	0	-2
	14 - harmful emissions	1	-2	0	-3
	15 - energy	1	2	-3	-2
	16 - impact on environment	1	-1	-1	1
	17 - material efficiency	1	-1	-3	-1
	18 - nuisance	1	0	1	0
	19 - renewable energy	2	-3	1	1
	20 - transport	0	-3	-2	-2
	21 - waste	0	0	1	1
	22 - water use	-1	0	-1	0
Profit	23 - business agility	-2	0	0	1
	24 - business continuity	-1	0	2	1
	25 - impact on economy	0	-2	3	2
	26 - innovation	-1	-1	-2	2
	27 - life cycle cost	0	-1	-1	3
	28 - local development	0	-2	1	-1
	29 - procurement	-1	1	0	-1
	30 - risk reduction	-1	0	3	-3

C.2.4.5 Interpretation results factor analysis

As Moura et. al (2018) mention in their article do skills, knowledge and attitudes of project managers directly affect project performance. This is confirmed in this research.

Based on the reflection in the previous sub-chapters, a distinction can be made between the four factors on the level of activeness and project approach. Project manager has a reactive or proactive attitude and a more task or relationship-oriented leadership style. If a project manager has a reactive attitude, he or she will do what it told or laid down in contracts and requirements. If a project manager has a proactive attitude, he or she has an attitude to do more than what is laid down in contracts with for example the ambition to stretch the project requirements.

From reactive to proactive the factors can be ranked as follows:

1 – Experts: are good in what they are asked and focus on rules and regulation
2 – Team-players: react upon the culture of the members of their team and what is seen as 'normal' behaviour
3 – Economists: focus on business development and business stability which requires a more proactive attitude as economic trends change over time so need a proactive attitude
4 – Pioneers: integrate innovation even though it is not a standard in projects

Project managers who have a task-oriented approach focus on activities and the goal of a project. The main importance is to stay within the project boundaries of time, quality and budget. A relationship approach focuses on the relations and the social requirements of multiple stakeholders. The culture and vision of the company with (unwritten) rules of behaviour determine the activities of the project manager more than focussing on only the tasks within the project contract.

In this research, the factors can be sorted from task to relationship oriented:

1 – Expert: as they are good in executing their tasks and focus on rules and regulation
3 – Economists: focus on business development and business stability within the project
4 – Pioneers: integrate innovation in projects which requires collaboration
2 – Team-players: react upon the culture of the organisations involved

The models of Blanchard & Hersey and Tulders et al. are combined in Table 18, in which each factor has a unique spot.

The **relationship-oriented** approach focuses on the relations involved in the project. This engages two-way or multi-way communications and a more facilitating role (Blanchard & Hersey, 1988). In this research relationship orientation focuses on the culture and how the vision of the company is propagated. An advantage of this approach is that it energises stakeholders and stimulates engagement to feel part of a project's success. However, team-members might get overwhelmed if the direction is not clear (Friedman, 2013). This may result in ineffective decisions as more people are involved in the decision-making process.

The **task-oriented** approach means that activities are linked to achieve the goal of a project by explaining the duties and responsibilities of an individual or group (Blanchard & Hersey, 1988). In this research task orientation focuses on the project description. An advantage of this approach is that things are done in a manner that is both proficient and on time. These managers create clear, easy-to-follow work schedules and focus on optimal efficiency. The disadvantage of this approach is that it can lead to a lack of autonomy and creativity when team members work under strict deadlines (Friedman, 2013).

The main part of the respondents within the sample (7/20) are loading on the factor of the Expert. These project managers are mainly task oriented and reactive. The respondents within this group commented that they do not feel supported to have a more proactive approach as the incentives to finish the project lie within time, budget and quality so if sustainability is not part of their task, they are not stimulated to do something extra within their projects.

Team-players adjust their tasks based on the expectations of the organisation they work in or for. They react not only on the task description but also on the demands of the stakeholders.

The Economists group was the smallest within these results, only 3 respondents loaded on this factor. The focus for this group is on economic aspects. Task description plays a central role in the execution of the project. However, this group has a more proactive attitude to focus on growing economic impacts as part of the project tasks. This means looking towards smart financial solutions to integrate in their projects.

The last group is the Pioneers. They apply innovations in their projects. Good teamwork increases the success of innovative projects so an orientation towards relationships is important (Hoegl & Gemuenden, 2001). This demands a proactive attitude, as innovation is new and often requires steering during the process.

Table 18 Overview factors project managers regarding integration of sustainability aspects

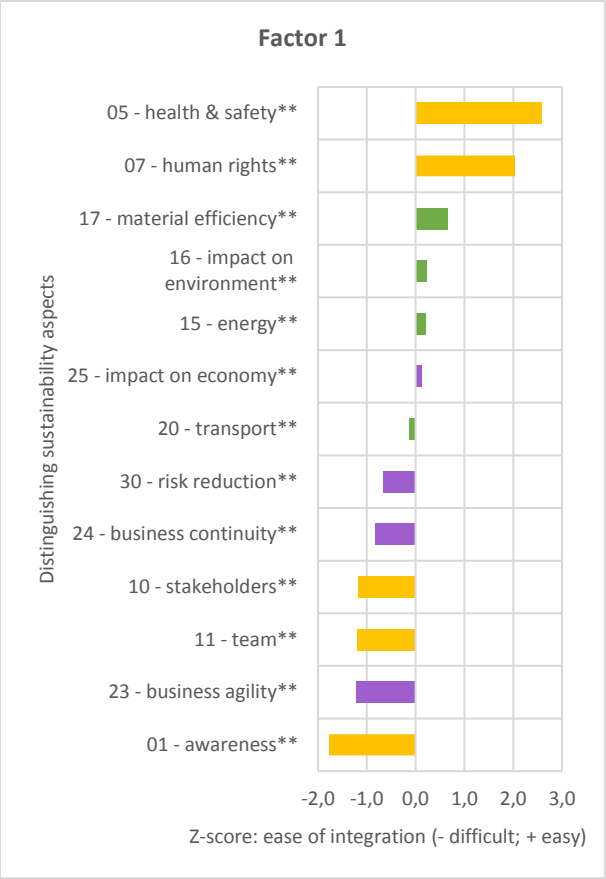
	Task oriented (TO)	**Relationship oriented (RO)**
Reactive (R)	**1 – Experts** PMs follow rules and regulation, presumed that these are well arranged in the Netherlands.	**2 – Team-players** PMs do what is needed to stay competitive, focusing on positive attitudes of the stakeholders
Proactive (P)	**3 – Economists** PMs focus on numbers and business development within projects	**4 – Pioneers** PMs focus on innovation, in which sustainability could help but technology will fix it

None of the four factors are good or wrong. However, they do give an idea on how project managers could approach integration of sustainability. It is vital for project managers to establish what phase their companies are in before applying interventions (Tulders, Tilburg, Francken, & Rosa, 2013). Besides, there is not one approach which fits all situations, as Slevin & Pinto mention (2004): "*successful project managers have shown to employ a great deal of flexibility I their use of leadership approaches*".

The project managers within this group need the following type of projects to integrate sustainability:

1. R/TO: sustainability is part of the project requirements and lies down in the contract;
2. R/RO: sustainability is part of the culture of the client or the company of the project manager in which it is assumed to include sustainability in projects;
3. P/TO: sustainability is in some way part of the project requirements, and there is space available for the PM to do something extra;
4. P/RO: sustainability is in some way part of the culture of the client or company of the project manager and tools are used in which sustainability can be carried to a new level.

It can be concluded that, no matter what the factor is, all project managers are aware of sustainability, but action lags. Tulders et. al (2013) mention that the more coherent the company strategy with expectations and perceptions of employees is, the easier it is to make the transition towards sustainability. For this reason, it has to be clear why companies decide to choose their projects to work on, to make sure it suits their strategy.



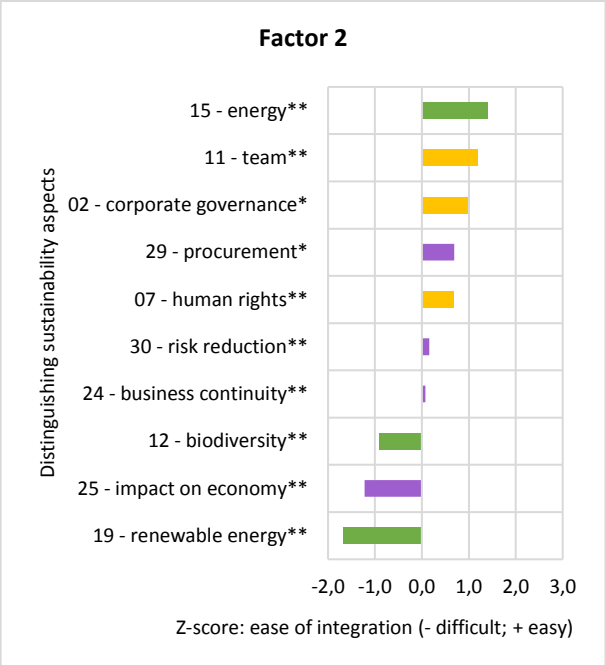
Factor 1 – Experts
This factor is defined by seven respondents (1, 7, 11, 14, 15, 16, 20). These respondents do not share the same characteristics. This factor is shared by most of the respondents (7/20) which means this is the most common factor within this sample.

Project managers who hold this factor act in a reactive manner, based on the requirements of their task and the regulations they are known with. These requirements are partly described by regulation or by the client his/her demand. The aspects which are vested in Dutch regulation are ranked as most easy. The aspects which are impossible to regulate or where regulation is in consolidation, are considered most difficult. The more conscious actions are needed from the PM to integrate aspects (for example raising awareness among stakeholders), the more difficult the aspects are to integrate.

Project managers linked to this factor have a quality in executing tasks in the way they are subscribed and based on the vested laws and regulation. An increase in regulation of sustainability could help to ease the difficulty of integrating sustainability aspects for this project manager. Project managers holding this factor are called the **experts** as they are good in what they are asked and focus on regulation.

Implications for the company
The solution to overcome the difficulty is either a more proactive behaviour from the project manager or more regulation. This means the company must show the importance to stimulate awareness about sustainability. More regulation will come no matter what but as a company you want to be prepared and have a position in the market in which you are prepared to the change. Another option for the company is to tighten the selection criteria of projects to be associated with.

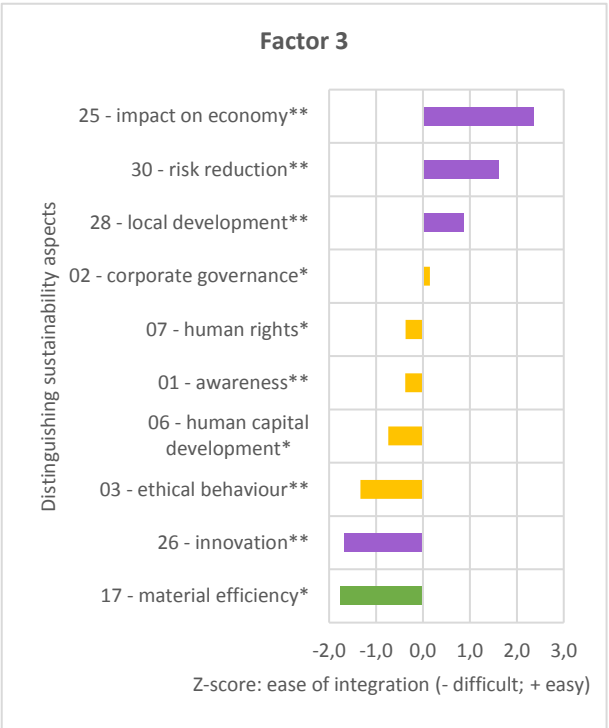
To make sure clients choose your company and employees want to work for the company, it follows that awareness of sustainability needs some extra attention. Options to stimulate awareness at the client or at the project manager are suggested as follows: "*include a permanent sustainability specialist in the team to share knowledge and motivation about integration of sustainability*" or "*choose the type of client which help drive towards sustainable decisions*".



Factor 2 – Team-players
This factor is defined by five respondents (2, 4, 5, 9, 18). All reference projects from this group are executed in the Netherlands.

Within this factor the ease of integrating sustainability aspects is dependent on the culture and insights in costs and benefits of aspects. In general, the social aspects are ranked as easy as these are well established in the habits of the project managers and culture of the (project) organisation. This is supported by literature which show a sustainable strategy increases sustainability integration and positive performance (Galpin, Whittington, & Bell, 2015). The only aspect of environment, energy, is easy due to the clear insight in costs and benefits after integrating this aspect and because it is part of the culture of the Dutch clients to reduce energy. Project managers holding this factor are called **team players** as they react upon the culture of the members of their team.

Implications for the company
What is needed to overcome the difficulty is a raise in stakeholder awareness of the importance of difficult aspects. This is comparable with factor 1, however the motivation to integrate sustainability goes further than regulation. This can be realised by investing in long-term relationships with the client could help raise awareness. Time is needed to form these relationships, however. Another option is to involve the stakeholders with the focus on sustainability and together find a way to integrate aspects. Tools could stimulate the visibility on importance of sustainability aspects.



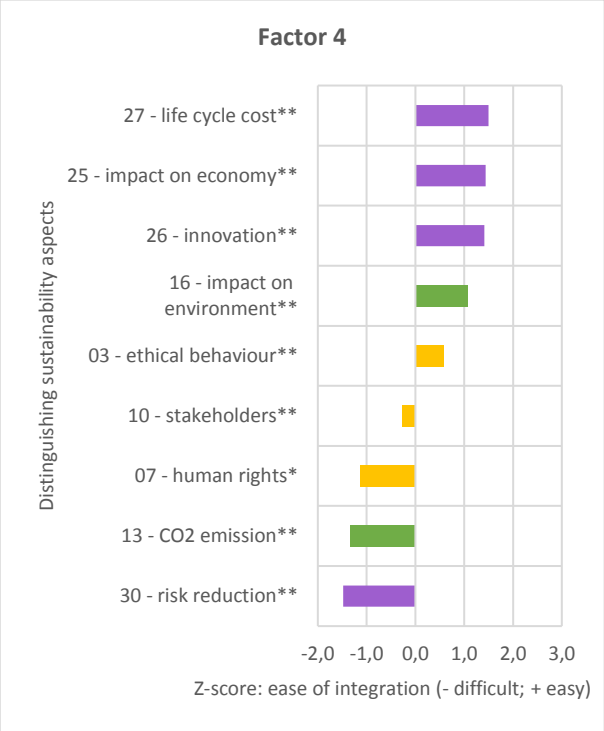
Factor 3 – Economists
This factor is defined by three respondents (3, 6, 12) whose reference project are within the Transport & Planning sector. As this aspect is ranked by only 3 people, it is less valid than factor 1.

Comparable with factor 2, the difficult parts seem to be no part of the ambition of the client and extra time and effort is needed to invest in long-term relationships needed to change these ambitions. The ease of integrating sustainability aspects in this perspective are determined by the mind-set of the project team and the client. In general, the project manager acts pro-actively to stimulate a change in culture by the client lacks the tools or a time to actually realise the change in culture with little to no integration of sustainability aspects as a result. As one of the PMs mentioned: "*as PM you can challenge your client. However, you are limited by time, quality and money because as long you are charged for these, it remains a challenge to stick your neck out.*" Project managers holding this factor are called the **economists** as the focus is on business development and business stability.

Implications for the company

The role of the project manager changes from executor to change manager which demands various competences such as communication, stimulating trust among stakeholders and being able to understand the situation as it is known and what can reasonably be expected in the future (Carnall, 2007).

This perspective implies companies need project managers who know how to manage a project and how to change behaviour. This might require specific application requirements for new employees, focusing on change management.



Factor 4 – Pioneers
This factor is defined by five respondents (8, 10, 13, 17, 19). These respondents do not share the same characteristics.

Project managers who share this factor base the difficulty of integrating aspects on a tool which is applied in the project. For example, within BREEAM, various parts within a project are scored and based on that score the project receives a final certificate. The aspects which are scored receive extra attention within the project over aspects which are not integrated. Project managers holding this factor are called the **pioneers** they integrate innovation even though it is not standard in technical construction projects.

They act proactive to implement innovation and long term thinking in their projects. The easy aspects are often supported by tools which guide the stakeholders within a team to follow steps to integrate aspects of sustainability. The difficult aspects are not part of the tool of the innovation which has a central place in the project.

Implications for the company
To overcome the difficulty of aspects which are not integrated in a tool or innovation, the boundaries of the tool have to be wider, or a new tool has to be developed. The company could steer towards a more frequent use of tools within the projects. As most projects are determined by the client, the engineering company could try to join the client in early phases to recommend the use of such sustainable tools. The concept sustainability is part of organisational and technological innovations that yields both bottom-line and top-line returns (Nidumolu, Prahalad, & Rangaswami, 2009).

Project managers could be stimulated to include innovation and new concepts in their way of working if they get the resources for it. An example is the '20% time' policy in which employees are encouraged to work on what they think will benefit Google (D'Onfro, 2015). This kind of policies must suit the culture of the company and its employees. The engineering industry is more controversial compared to a company as Google and technical engineer probably have different profiles than ICT-developers at Google. But it is an option which could be used to get the difficult aspects to the easy side of the chart.

C.3 Reasons influencing the ease of integration

C.3.1 Overview reasoning from interviews

In the table below, the keywords which describe the influencing reasons are shown. Next to that column, the number of times participants mentioned the Keywords, distribution of negative and positive influencers and the solutions are counted. This is an overview based on the raw data in the previous sub-chapters.

Group	Influencing reason	Keywords quotes	Negative	Positive
Process	Falls (not) within standard working practice	(Assumption) taken care of, country of execution has (no) issues with integrating aspect, act (different) as normal, stays how it is, it goes on the same way for ages, aspect is (not) vested in way of working, basic attitude, part of working, way of dealing with each other, core task of project team	14	27
	Perceived as (not) within responsibility or influence of project manager (PM)	Responsibility PM, influence PM	8	10
	Perceived as (not) discussed within project	Difficult conversation, (not) part of vocabulary client, is not bespoken, not on table, mention aspect, explicit mention to client	3	3
	Perceived as (un)important to the project goals	Relevance, priority, importance, no issue, top-of-mind, no focus, underexposed, insignificant, plays no role in this project, not applicable within this project, we just don't do something with aspect	20	3
	Mindset/ motivation of project team	Mindset, intrinsic motivation, own potency: what does it yield for me, awareness PM and team, be more proactive, ambition of team and PM, aspect is fun, positive consortium	0	2
Product	Perceived as (not) within project scope	Scope, requirements, contract, phase, difficult/easy to integrate in design, integration inherent to execution form which is not influenceable, not part of our project, project specific circumstances, it is (not) arranged to integrate, project obligation, award criteria	18	23
	Perceived as (no) room for improvements within contract	(No or little) room for integration	13	3
	Perceived as (limited) presence within tools used in project	BREEAM, LEED, Building with Nature, DuboCalc, tools	0	10
Society	Perceived as (not) part of regulation or standard	Regulation, rules, standards, policies, legal obligation, "no go" countries or activities	6	4
	Perceived as (not) part of culture	Culture, attitude, existing patterns / hierarchy, within DNA, ethical behaviour	9	2
	Perceived as (not) important to wider society	Society awareness, society problem, society importance, "everyone wants" aspect, "people have to feel safe"	2	5
Client	Perceived as (limited) degree of awareness by client	Client mindset, awareness client	0	5
	Client act towards (un)importance of aspect	Relevance for client, attention client, priority client, client acts, power client to act, priority for client, support from client, plays a role for client, ambition client, client took responsibility, top of mind by client, part of ambition client	3	12

Supplier	(Limited) knowledge about degree of (financial) impact	(financial) impact, broader view, calculation models, yield, ways to limit uncertainties of aspect, insight in impact, financial justice, financial driver, business case	9	4
	(Limited) knowledge about integrating aspect	Knowledge, integrating does (not) work, just difficult / easy to integrate, (no) resources known to influence aspect, technical feasible	8	2
	Business support or stimulants: time, attention, and capacity to influence client or flexible hours	Time, attention, freedom, relationship management, less focus on short term profit but vision and support, training, (mention) patience, specialists	2	3
Solutions only	As a company, show examples and communicate these to intern organisation and society	Example	0	0
	Involvement in different project phases (including design and execution)	Involvement phase	0	0
	Prioritise and focus on long term (star projects)	Long term	1	0