

MASTER

In-depth analysis into the critical success factors for supplier sustainability development programs at multinationals

Sillen, W.W.J.

Award date:
2016

[Link to publication](#)

Disclaimer

This document contains a student thesis (bachelor's or master's), as authored by a student at Eindhoven University of Technology. Student theses are made available in the TU/e repository upon obtaining the required degree. The grade received is not published on the document as presented in the repository. The required complexity or quality of research of student theses may vary by program, and the required minimum study period may vary in duration.

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain

Eindhoven, December 2015

IN-DEPTH ANALYSIS INTO THE CRITICAL SUCCESS FACTORS
FOR SUPPLIER SUSTAINABILITY DEVELOPMENT
PROGRAMS AT MULTINATIONALS

BY

WOUTER SILLEN

Student nr: 0716645

In partial fulfillment of the requirements for the degree of
Master of Science
in Operations Management and Logistics

Supervisors:

dr. T. Tan,	TU/e Operations Management and Logistics
prof. dr. A.J. van Weele,	TU/e Innovation Technology Entrepreneurship & Marketing
Dhr. Slooten,	Company X
Dhr. Braaksma,	Company X

TU/e. School of Industrial Engineering.
Series Master Theses Operations Management and Logistics

Subject headings: Supplier Sustainability, Green Supply Chain Sustainability, Risk Assessment, Target Setting, Supplier Relationship Management, Corporate Social Responsibility

Abstract

This study investigates the role of supplier sustainability development programs at multinationals. The main practical problems related to effectively implementing such programs are discussed as well as suggestions on how to address these problems. Stepwise methods are proposed on how to select suppliers to include in a sustainability program, how to assess supplier performance when included in the program, and how to create internal and external engagement for the program. This study can be seen as a guideline on what issues and methods to consider when implementing supplier sustainability development programs.

Management Summary

This study presents a research into the practices of implementing supplier sustainability development programs at multinationals. In order to address the growing importance of sustainability related subjects, multinationals want to extend their own approach towards sustainability throughout their whole supply chain. This in order to not only address their own impact on sustainability related issues but to address the impact of the whole supply chain with regards to sustainability related subjects. This study discusses the practical problems related to effectively implementing supplier sustainability practices and as an example of a supplier sustainability development program the CDP Supply Chain program is used. CDP Supply Chain is a voluntary supplier sustainability development program that is used by multinationals to invite suppliers to report on their carbon emissions. The study is conducted in cooperation with 'Company X', which provided additional insights into the challenges of implementing a supplier sustainability program.

Relevance

Supplier sustainability is a practices that quickly gaining importance at multinationals. Multinationals acknowledge that there is only so much they can do to reduce their impact on sustainability related issues since the large majority of the impact on these issues occurs upstream in the supply chain. As an example, with regards to the CDP Supply Chain program, which focuses on carbon emissions, research shows that approximately 74% of total carbon emissions occur upstream in the supply chain (Matthews, Hendrickson, & Weber, 2008). This stresses the importance of managing upstream supply chain emissions. In company X, which is going through a split up of the company right now, the upstream scope 3 emissions are estimated to be approximately 40% of total emissions in the supply chain. Hence the importance for company X, and likewise multinationals, to manage upstream scope 3 emissions.

Findings

During research several practical problems came forward related to supplier sustainability development programs at multinationals. The main problems identified were the lack of internal/external engagement for the program, the issues of which supplier to include in the program, and the issues of how to assess performance of supplier in supplier sustainability development programs. Solutions for these problems have been identified by adjusting findings in literature to match and address practical solutions mentioned by multinationals.

The main issue mentioned related to voluntary supplier sustainability programs is the lack of internal engagement at the buyer company. Since supplier sustainability development programs, in the case CDP Supply Chain, tend to be voluntary for suppliers, there is a lack of urgency with regards to the importance of the program internally. The main focus on sustainability programs at multinationals is on compliance related programs since multinationals have to address these issues by law. Compliance related programs pose a direct, short-term, risk to the business of multinationals. This paper presents several suggestions and steps on how to improve internal engagement on voluntary supplier sustainability development programs starting by publicly stating a clear goal and target for the program, emphasized by executive commitment, and followed by deploying the program thought all layers of the company. Deployment of the program throughout the buyer company needs to be paired with KPIs for each of the business functions involved so that employee performance can be related to program successfulness. Furthermore employees need to be trained

and educated on the program and plenty of resources need to be made available to actively manage the suppliers included in the program. Internal engagement is a prerequisite for a supplier sustainability development program to be successful.

Besides the major problems of lack of internal engagement for supplier sustainability development programs, some other issues occur when trying to implement supplier sustainability development programs. One of the main problems mentioned by multinationals has to do with how to decide what suppliers to include in the program and how to assess them. This issue is generally the large supplier databases of multinationals and the lack of resources to manage this large amount of suppliers. Because of that decisions have to be made on which suppliers to include in the program and which suppliers to exclude. This paper proposes a stepwise approach for identifying supplier to be included in the program (Figure 7) based on three element: Supplier sustainability risk, spend at supplier, and buyer impact on supplier. This method elaborates on a method originally proposed by Kraljic (1983) who proposed differentiating between suppliers based on supply risk and financial impact of suppliers. However, when deciding on which suppliers to include in supplier sustainability development programs even more differentiating is desirable specifically on the area of which suppliers are willing to participate in such a program, since it concern voluntary programs for suppliers. To capture this element of the analysis, Kraljic's method is adjusted as supply risk is substituted by sustainability risk and the element of buyer impact on supplier is added, since higher buyer impact is related to increased willingness to participate and cooperate with buyer companies. As for assessing supplier performance once included in a supplier development program, several options are described in this paper and depending on what the goal of the analysis is, the ideal assessment method differs. For the CDP Supply Chain program in X, which is focused on decreasing GHG-emissions at suppliers, a collaborative target setting approach meets the needs for improvement the best. Collaborative target setting is related to increased motivation at suppliers to meet the goals set.

One final practical issue that is addressed in this study is the lack of external engagement multinationals experience at suppliers. This issue comes forward in the reluctance to participate and the quality of data provided by suppliers. The lack of supplier engagement is already addressed by other parts of this study such as including buyer impact in the decision of which suppliers to include in the program, and creating strong internal engagement. Both buyer impact and strong internal engagement, which leads to consistent communication towards suppliers on the importance of the program, are related to increased willingness of supplier to participate. Furthermore it is suggested to develop incentives for suppliers to participate in the program such as preferred supplier status, awards, increased future business and others.

This research showed that several key issues need to be addressed to strongly increase the probability of a supplier sustainability development program to be successful and add value for the buyer company. The main issue is that internal engagement needs to be established before implementing and inviting suppliers. Furthermore the problems of which suppliers to include, how to assess, and how to create external engagement need to be discussed. When all these steps are completed, chances of supplier sustainability development programs leading to actual supply chain sustainability improvement significantly increase.

Preface

This study presents the final step to the degree Master in Operations Management and Logistics at Eindhoven University of Technology. This master project has been designed in cooperation with Company X and has been executed over the past 7 months. At this moment I would like to take the opportunity to briefly thank a few people for their contribution to either this thesis or my time at Eindhoven University of Technology in general.

Firstly I want to thank a few people who contributed and supported me in the process of doing this thesis. I would like to start of by thanking everyone at the sustainability department of company X for the pleasant working environment in which I was able to carry out my research for the past 7 months. I would specifically like to thank Dhr. Braaksma for giving me the opportunity to work on this project and Dhr. Slooten for the guidance during the project. Secondly I would like to thank dr. Tan and prof. dr. van Weele for their guidance on the academic part of the thesis.

Most importantly however, I would like to thank my parents, not only for their support during this thesis, but also for their support during my entire 6 years at Eindhoven University of Technology. They made sure I've always had all the resources and support I needed to be successful in the field of academics, and life in general. I couldn't have wished for anything more or different. Thanks mom and dad.

Finally, I would like to finish off with thanking everyone else who has contributed to my time of being a student in any way whatsoever.

Wouter Sillen

Abbreviations

3TG	Abbreviation used to reference to four types of conflict minerals (Tin, Tantalum, Tungsten, Gold)
AHP	Analytic Hierarchy Process
CDP	Carbon Disclosure Project
CSR	Corporate Social Responsibility
DEA	Data Envelopment Analysis
FTE	Full Time Equivalent
GHG	GreenHouse Gas
GrSCM	Green Supply Chain Management
RQ	Research Question
SCM	Supply Chain Management
SME	Small or Medium-sized Enterprise
SRM	Supplier Relationship Management

Contents

Abstract.....	ii
Management Summary	iii
Relevance	iii
Findings	iii
Preface	v
Abbreviations.....	vi
Contents.....	vii
List of Figures and Tables.....	x
1. Introduction	1
1.1. Research background.....	1
1.2. Company background	2
1.3. Research outline	4
1.3.1. Research problem	4
1.3.2. Research objective	5
1.3.3. Research questions	5
1.3.4. Report outline	6
2. Theoretical background and analysis.....	8
2.1. Literature review.....	8
2.1.1. Corporate Social Responsibility	8
2.1.2. Sustainability risk management	9
2.1.3. Supplier sustainability improvement evaluation	11
2.1.4. Supplier Relationship Management.....	12
2.2. Business problems	14
2.2.1. Risk suppliers identification in practice	14
2.2.2. Supplier sustainability evaluation in practice	15
2.2.3. Internal and external engagement in practice.....	15
2.3. Gap in the literature.....	16
3. Research methodology	17
3.1. Research methodology	17
3.2. Research context.....	17
4. Risk supplier identification process	19
4.1. Identify and define risk criteria.....	20
4.1.1. Determine relevant supplier risk criteria	20

4.1.2.	Define levels of risk in criteria.....	26
4.1.3.	Define weights per risk criteria	27
4.2.	Decide on suppliers to be included in analysis	27
4.2.1.	Set minimal requirements	28
4.2.2.	Determine suppliers that meet minimal requirements.....	30
4.3.	Gather data and perform analysis	30
4.3.1.	Gather supplier data and compute risk scores	30
4.3.2.	Compute risk chart.....	31
4.4.	Decide on which suppliers to include	32
4.5.	Wrap up	32
5.	Analyze supplier sustainability improvement.....	33
5.1.	Decide on method to evaluate improvement	33
5.2.	Execute evaluation method	35
5.2.1.	Evaluate sustainability assessment.....	35
5.2.2.	Target setting with supplier	36
5.2.3.	Evaluate targets	36
5.3.	Contribution to buyer company strategy	36
6.	Internal and external engagement	38
6.1.	Internal engagement.....	38
6.1.1.	Executive commitment	38
6.1.2.	Education & Communication	39
6.1.3.	Strategy and Goals	39
6.2.	External engagement.....	40
6.2.1.	Supplier concerns.....	40
6.2.2.	What to do when implementing supplier sustainability development programs.....	41
6.3.	Targeting SMEs.....	43
6.4.	General remarks on implementation.....	44
7.	Conclusion.....	45
7.1.	Implications for company X	46
7.2.	Implementation phase.....	46
7.3.	General managerial insights	47
7.4.	Limitations and future research.....	47
7.5.	Contributions to literature.....	48
8.	References	50
9.	Appendices.....	53
	Appendix A.....	53

Appendix B	60
Additional example	65
Appendix C	67
CDP Supply Chain and X	67
Problems with the CDP Supply Chain program in X.....	67
How to increase the value of the CDP Supply Chain program for X.....	69
Appendix D.....	71

List of Figures and Tables

Figure 1: Breakdown X emissions	3
Figure 2: Breakdown X emissions without A	3
Figure 3: Triple bottom line sustainable supply chain management approach (Carter & Rogers, 2008)	9
Figure 4: Supplier risk management framework	10
Figure 5: Supplier sustainability risk management framework	11
Figure 6: Process of implementing a supplier sustainability development program	18
Figure 7: Process of developing risk supplier identification method.....	20
Figure 8: Identify and define risk criteria process.....	20
Figure 9: Sustainability triple bottom line linked with sustainability risks	22
Figure 10: Select suppliers to be included in analysis process	28
Figure 11: Determine which suppliers to include in assessment process	29
Figure 12: Process of gathering supplier data and performing analysis.....	30
Figure 13: Process how to assess supplier sustainability improvement.....	33
Figure 14: Three steps in executing the evaluation method	35
Figure 15: Critical raw materials analysis (European Commission, 2010)	56
Figure 16: Identifying potential improvement suppliers example 1	64
Figure 17: Zoomed in version of figure 17	65
Figure 18: identifying potential improvement suppliers example 2.....	66
Figure 19: Number of CDP requests and responders of X	71
Figure 20: Split up of company X visualized.....	71
Figure 21: Purchasing portfolio concept (Kraljic, 1983).....	72
Figure 22: Overview Supplier Selection Methods (Mukherjee, 2012).....	73
Figure 23: Overview Supplier Selection Methods (Pal, Gupta, & Garg, 2013)	73
Figure 24: Top 10 criteria for supplier sustainability performance (Robert Handfield et al., 2002)	74
Figure 25: Different "Types of loss" and examples (P.D. Cousins et al., 2004; Mitchell, 1995).....	74
Figure 26: Top 3 Critical Factors for successful internal engagement (GreenBiz, 2014)	74
Figure 27: Biggest hurdles to sustainability education in the company (GreenBiz, 2014)	75
Figure 28: Several popular form of education (GreenBiz, 2014)	75
Figure 29: Barriers in Advancing Corporate Sustainability Performance (UN Global Compact, 2013)	76
Figure 30: Types of suppliers and characteristics in supplier database (UNGC and BSR, 2010)	76
Table 1: Sustainability risks, causes, and consequences	25
Table 2: Sustainability risks and possible assessment methods	26
Table 3: Scenarios of analysis with pros and cons	27
Table 4: Supplier sustainability improvement measurement methods	34
Table 5: Dos and Don'ts in creating supplier engagement (Baden et al., 2009; EPA, 2010; Jira & Toffel, 2013; UNGC and BSR, 2010)	43
Table 6: Industry specific quality standards.....	54
Table 7: Examples of raw materials that pose compliance risk to a commodity	57
Table 8: Assessment methods included in analysis + Risk levels.....	61
Table 9: Assessment weights used in example	62
Table 10: Supplier data used to create risk chart for example 1	63
Table 11: Supplier data used to compute risk chart example 2	65
Table 12: Main problems related to CDP Supply Chain program	68

1. Introduction

This report contains a study into supplier sustainability development that is conducted cooperation with 'Company X' and in partial fulfillment of the master's degree Operations Management and Logistics at Eindhoven University of Technology. The report discusses literature, practical problems, and a roadmap related to effectively implementing voluntary supplier development programs in a company. This chapter presents an introduction into the developments in supplier sustainability, an introduction of the company, description of the problem, and the research questions to be addressed in this study.

1.1. Research background

For years Supply Chain Management (SCM) has been a key strategic practice in most major companies. The aim of SCM is to align different parties in the supply chain in such a way that competitive advantage can be reached. The main focus in SCM is on the dimensions of quality, cost, delivery and technology (R. Handfield, Sroufe, & Walton, 2005). In light of the increased focus on sustainability in recent years, multinationals felt the need to switch from traditional supply chain management to Green Supply Chain Management (GrSCM). The switch to GrSCM originated from developments in the global environment in which companies operate and can be described as a switch from a re-active to a pro-active approach towards sustainability. Some examples of these developments are increased focus and knowledge about climate change, increased transparency regarding the operations of companies, increased stakeholder demands, regulatory requirements, diminishing resources, and supply and demand characteristics of energy consumption (Carter & Easton, 2011) (Srivastava, 2007). GrSCM can be defined as "integrating environmental thinking into Supply Chain Management" (Srivastava, 2007). The idea of GrSCM is that companies explore activities that increase economic performance while at the same time, stay away from activities that have either low environmental or social performance (Carter & Rogers, 2008). Engaging in GrSCM has been identified to lead to competitive advantage while not negatively influencing the traditional dimensions of SCM (Srivastava, 2007).

GrSCM encompasses a number of business activities that can vary from improving employee welfare to green purchasing. Some examples of GrSCM practices are community programs, green product design, green packaging, transportation efficiency, recycling, circular economy, supplier sustainability development and others (Carter, Kale, & Grimm, 2000). Multiple GrSCM practices combined can lead to companies acting in a sustainable way. This study focuses on the practice supplier sustainability development. If companies want move past the phase of supply chain sustainability compliance and into the phase of supply chain sustainability improvement they need to take control of their supply chains and consider the sustainability practices of their suppliers. Suppliers that infringe regulations or do not operate in a sustainable way can negatively influence the performance and brand image of the buyer company. Furthermore, research has shown that the majority of environmental impacts originate higher up in the supply chain or in the use phase of products. Emissions that occur upstream in the supply chain or in the use phase of products are defined as scope 3 emissions. Buyer companies that want to improve their environmental footprint thus need to work with suppliers to improve their environmental performance, and consequently reduce upstream scope 3 emissions.

1.2. Company background

The study is conducted in cooperation with 'Company X'. Collaborating with X creates more insight into the practical problems businesses come across when trying to implement GrSCM practices and, in this case more specifically, supplier sustainability practices. X is a Dutch multinational that was founded in 19th century and is headquartered in Amsterdam. X has 100.000+ employees spread over more than 100 countries. The X group posted a sales figure of EUR20.000+ million in 2014 and the Company X group is currently active in three main businesses namely: Business 'A', Business 'B' and Business 'C'.

X has a two-way approach towards sustainability in which it considers both the social needs of people and the ecological capacity of the planet. X creates value by producing products that have a positive impact on the health and wellbeing of people, as well as by investing in operational improvements. X wants to achieve sustainability goals by means of focusing on six identified cornerstones of sustainability. These cornerstones of sustainability are evenly distributed between the social dimension and the ecological dimension. One of the cornerstones of the ecologic dimension is Green Operations and Supplier Sustainability and this is the sustainability cornerstone to which this project is related.

This study focuses specifically on the field of Supplier Sustainability. Supplier Sustainability is included as one of the six cornerstones of sustainability that are used by X. To improve on Green Operations and Supplier Sustainability, X set specific targets on these fields in their sustainability program. Examples of these targets are a 40% CO₂ reduction by the year 2015 and 72% of suppliers compliant to X's sustainability requirements.

To be able to reduce the CO₂ emissions by 40%, X first had to create insight in the amount of CO₂ emissions the company emits, and where in the supply chain these emissions occur. Internal research suggests that the majority of the emissions of X can be classified as scope 3 emissions. Scope 3 emissions either occur upstream in the supply chain or in the use phase of the product. Scientific research that showed that in general, approximately 74% of a company's CO₂ emissions are scope 3 emissions (Matthews et al., 2008). X put effort in visualizing supply chain emissions in order to create insight in where in the supply chain the majority of Xs' emissions occur. As it turns out, in the current situation only 6% of Xs' CO₂ occur in upstream scope 3. This is caused by the high impact of CO₂ emissions in the use phase (downstream scope 3) of business area A's products. Xs' current emissions are visualized in Figure 1. The impact of downstream CO₂ emissions of A's products can clearly be seen in this graph. When business area A is excluded from the equation, the fraction downstream scope 3 emissions decrease sharply.

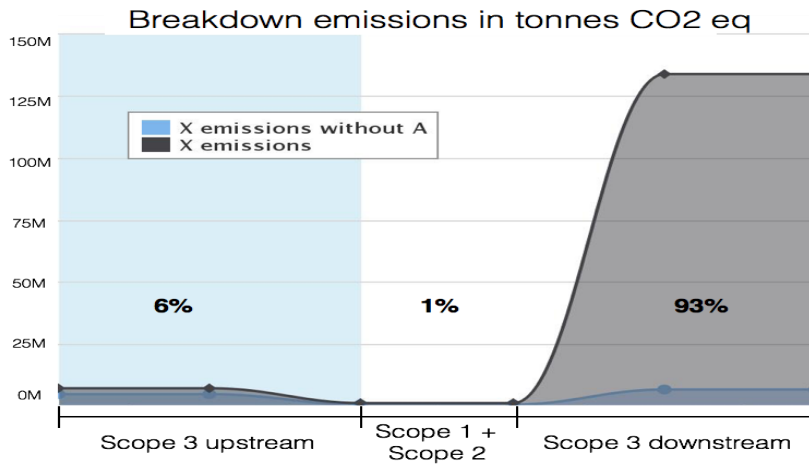


Figure 1: Breakdown X emissions

Currently X is reorganizing its operations and is going to split up the company in a separate business area A company and a remaining business areas B and C company. The remaining company without business area A will from here on be mentioned by the 'Z', whereas the new company that focuses on business area A, will use the name 'A'. The described split up of company X is visualized in Figure 20. The company will be split up in the beginning of 2016 and this has a significant impact on the fraction of scope 3 emissions in the new company. Especially Z will experience and increase in the fraction of upstream scope 3 resulting from the split up. To visualize the expected distribution of CO₂ emissions across scope in the new Z company, X's emissions are calculated again this time without any emissions occurring in the A division. This resulted in the following distribution of carbon emissions across scopes: Scope 3 upstream 40%, Scope 1+2 2%, and Scope 3 downstream 58% (as visualized in Figure 2). This sharp increase in the fraction of upstream scope 3 emissions in the new situation of the company indicates that upstream scope 3 emissions are significant and need to be actively managed in the new Z company.

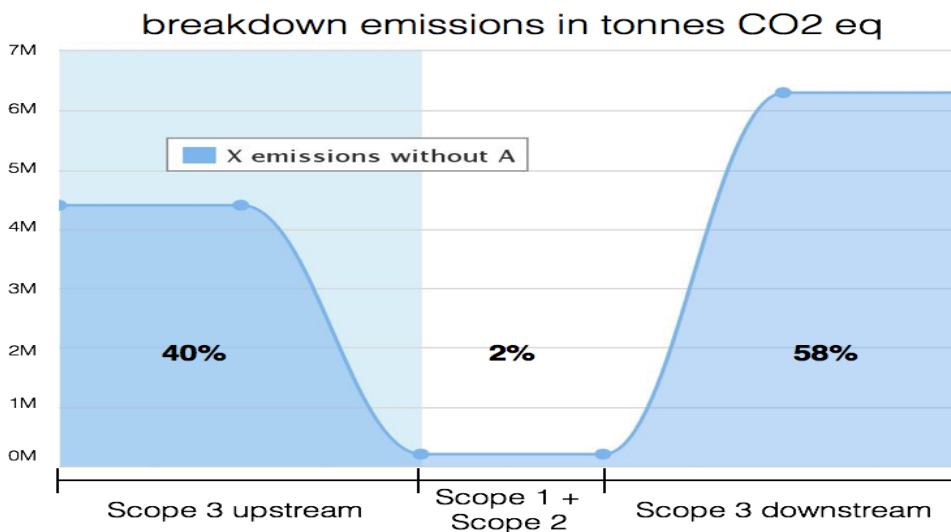


Figure 2: Breakdown X emissions without A

1.3. Research outline

1.3.1. Research problem

Cost reduction and quality improvement targets are the main drivers of the current purchasing process in businesses in general and also in X. Despite cost and quality being the main purchasing drivers, companies still want to improve their performance on social and environmental areas. When focusing on reducing up-stream supply chain sustainability impact, two main practices come to mind, namely supplier selection and supplier development. Supplier selection focuses on new suppliers whereas supplier development focuses on the existing group of suppliers. In the current form of X, management efforts of upstream scope 3 emissions has been minimal due to the relatively small impact of upstream scope 3 emissions. However Figure 2 shows that after the split up, upstream scope 3 emissions will have a significant impact on total scope 3 emissions of Z, and thus need to be managed actively in the future. X has several sustainability programs in place for managing upstream CO₂ emissions. New suppliers are required to sign a declaration in which suppliers state their commitment to sustainability on several key impact areas, and, if applicable to the specific supplier, and agreement on the regulation and use of hazardous substances such as conflict minerals. Both these programs set requirements that suppliers have to meet if they want to be a supplier for X. The requirements set in the signed declarations are based on regulations and are used to create a compliant supplier base. These methods can be seen as managing new suppliers and thus as supplier selection requirements. On the other hand existing suppliers need to be actively managed and the program that X uses to manage existing suppliers on their CO₂ emissions is the Supply Chain program of the Carbon Disclosure Project (CDP). X requests suppliers to report on their performance and strategy on managing carbon emissions. The number of suppliers that have been requested to provide information increased sharply in recent years, reaching 560 requests in 2015 (See Figure 19). The CDP supply chain program is not based on compliance and participating in the program is voluntary for all suppliers that are requested to report. The aim of the CDP Supply Chain program is to create insight in upstream scope 3 emissions, and train and develop suppliers with as a result improve sustainability performance of suppliers.

However when implementing the CDP Supply Chain program, X constantly runs into practical problems that prevent X from successfully managing upstream scope 3 emissions. Examples of the problems that occur are the lack of data, the quality of the data submitted, suppliers measure emissions differently which leads to them being incomparable, incomplete or no responses from suppliers, lack of internal and external engagement for the voluntary CDP Supply Chain program, limited resources in managing suppliers. All these problems prevent X from effectively implementing the CDP Supply Chain program and improving upstream sustainability performance. Instead the program in its current form is only used as a collector of supplier sustainability data, which eventually is not used.

This research focuses on how move past the level of compliance and how to develop and improve sustainability performance of existing suppliers. Literature describes several methods on how to select suppliers to develop, how to develop, and how to score sustainable performance. These methods however, are described in a general way and do not address problems that multinationals, such as X, come across while trying to implement a program like CDP Supply Chain. This is the main problem that is addressed in this study. The gap between scientific literature on supplier sustainability development and the practical challenges companies need to address.

1.3.2. Research objective

The main goal for X in doing this research is finding out if CDP Supply Chain program in its current form has any added value, and if not, how the CDP Supply Chain program and its role within X can be improved. When translating the problem and questions of X into a general research definition, the objective of this research becomes to address practical problems regarding existing supplier sustainability development and to develop a general roadmap on the steps to take to effectively implement a voluntary supplier sustainability development program. The goal is to create a methodology on supplier sustainability development that links the findings in scientific literature to actual practical business problems and present a stepwise approach to reach supplier sustainability improvement. The proposed methodology presents an approach that adjusts or elaborates on findings in literature to make them applicable in businesses. By doing this, the gap between literature and practice is bridged and theory is one step closer to being used in practice. In the end an example is presented to show how the finding can be applied to the business case of X, and how the CDP Supply Chain program can be improved. This example should contribute to the efforts of developing an effective supplier sustainability development system within X and by doing so indirectly improve sustainability performance of X.

1.3.3. Research questions

The formulation of this study resulted from project proposal designed by X. The research questions of this study are based on the problems X experiences when implementing the CDP Supply Chain program. From Xs' point of view there are three ways in which a supplier sustainability development program can have added value. The supplier sustainability development program either has to: improve supply chain sustainability, improve supply chain compliance, or result in cost reductions due to actions taken at suppliers. After a thorough analysis of the current CDP Supply Chain program it is concluded that the program in its current form does not add value for X in any of the three ways described above. Additionally three main problems regarding the CDP Supply Chain have been identified namely: The number and types suppliers included in the CDP Supply Chain program, a lot of data is gathered but the data is not used for improving supplier sustainability, and a lack of internal and external engagement for the program. The main problems mentioned here are discussed in more detail in section 2.2.

The research questions (RQs) addressed in this study are based on the three main practical problems experienced by company X and other multinationals when implementing the CDP Supply Chain program. RQs are generalized for the purpose of keeping the study general and applicable for both X and other companies that struggle with similar problems. After discussing the RQs in this study the findings are applied to the CDP Supply Chain program of X. The main research question of study is based on the lack of value that CDP Supply Chain currently presents for X and how addressing the main problems related to such programs can increase the value of voluntary supplier sustainability programs. The main research question is formulated as follows: *What steps need to be taken to improve the value of supplier sustainability programs for buyer companies?* This study addresses the three major problems encountered in the supplier sustainability development process. First the study addresses the issue of which suppliers need to be targeted with supplier sustainability development efforts. Secondly the study discusses the methods that can be used to analyze supplier sustainability improvement, and how such a method can be developed. At last the study discusses how to create internal and external engagement for a voluntary supplier sustainability development program. These three subjects of the study have been captured in the following research questions:

- *How can supplier characteristics be best deployed to assess supplier sustainability risk and the potential for sustainability improvement, and based on these elements, how to determine which suppliers to include in supplier sustainability development programs?*
- *What is the best method to assess sustainability improvement? Demonstrate how this can be done.*
- *Develop a methodology and implementation plan to improve the use of supplier sustainability data in the strategic decision making process. What do companies need to do to optimize changes of successfully implementing a supplier sustainability development program?*

1.3.4. Report outline

The study is aimed at bridging the gap between theory and practice in the field of voluntary supplier sustainability development programs. The report is organized in such a way that the gap between theory and practice is described for each of the research questions before the questions themselves are answered by combining theory with the business problems that present themselves. Chapter 1 presented an introduction into the concepts of supply chain management and green supply chain management, an introduction of the company at which the research is performed, some background on the problems related to supplier sustainability, and finally the research questions were formulated.

The second chapter presents a theoretical overview and analysis of the subjects at hand. A brief literature review is presented in which each of the three research questions and their related business problems are discussed from a theoretical point of view. The second part of the chapter is presented in the same layout but instead of describing the research questions and their related problems from a theoretical point of view, a practical point of view is chosen. This in order to clearly describe the gaps that exist between theory and practice.

Chapter 3 briefly discusses the research methodology and research context of this report. Additionally the steps that need to be taken when implementing a supplier sustainability development program are presented. This creates an idea of how supplier sustainability development needs to be organized and what steps need to be considered.

Chapter 4 discusses the first RQ on how to decide on which suppliers to include in a supplier sustainability program based on supplier characteristics such as sustainability risk and potential for improvement. A method is presented with which a pool of suppliers can be visualized and mapped with the goal of differentiating between them and choosing which suppliers to include in the program.

Chapter 5 elaborates on chapter 4 in the sense that, after it is decided which supplier to include in the program, how to measure performance of these suppliers on improvement over the years. This issue is discussed in chapter 5.

Chapter 6 describes the steps to take and the conditions that need to be in place for successfully implementing supplier sustainability development programs. The two main subjects discussed in this section are internal and external engagement and what companies can do to improve or create this engagement across functions and companies.

Lastly, chapter 7 discusses the conclusions, limitations, contribution to literature, and implementation plan of the research. It is a short summary of the findings of the research and links these findings to the current situation of company X to come to an advise on how to proceed with the CDP Supply Chain program. Additionally, in the appendix a small application of the study to company X is presented.

2. Theoretical background and analysis

This chapter presents a theoretical and practical background on the main subjects of this study. The current states of scientific research on the main theoretical fields of study are described followed by practical problems related to each of the research questions.

2.1. Literature review

This section presents a brief literature review regarding sustainability and the subject of each of the research questions. This overview creates understanding in the current state of scientific literature in the respective fields of study. The theoretical part of the thesis can be described by identifying the main bodies of knowledge related to the research. The main bodies of knowledge identified are: Corporate Social Responsibility (CSR), Risk management, Supplier Assessment and Supplier Relationship Management (SRM). Each of the bodies of knowledge relates to one or more research questions and provides theoretical knowledge that supports the development of the methodology.

2.1.1. Corporate Social Responsibility

The overall goal of this project is to describe how to improve buyer company sustainability by using supplier sustainability development programs. In order to create understanding regarding the subject of this research, the term sustainability has to be defined and explained. Organizational sustainability can be best explained by using the triple bottom line theory that suggests that sustainability consists of three main components: environmental performance, social performance, and economic performance (Elkington, 1998). The triple bottom line theory was extended by Carter & Rogers (2002) to fit the sustainable supply chain management approach. Carter & Rogers (2008) argued that an enterprise operates sustainable when it explores activities that increase economic performance while at the same time, stays away from activities that score low on either environmental or social performance. The framework of Carter & Rogers is presented in Figure 3 and suggests that enterprises that operate sustainable, operate on the crossroads of the triple bottom line.

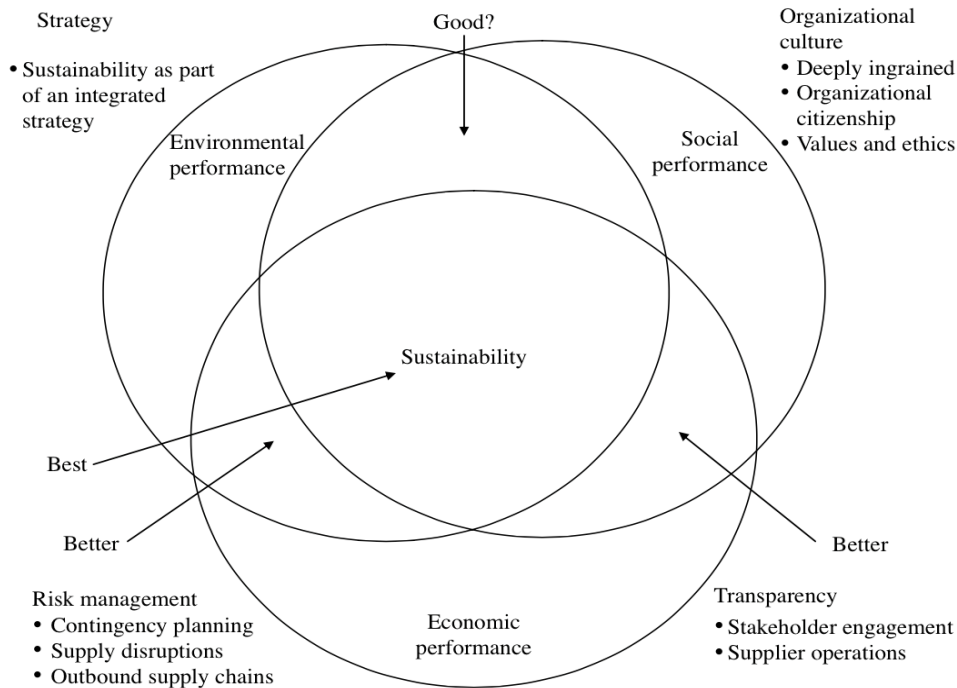


Figure 3: Triple bottom line sustainable supply chain management approach (Carter & Rogers, 2008)

2.1.2. Sustainability risk management

The subject of the first RQ is how to identify potential improvement suppliers and sustainability risk supplier, and how to select suppliers that are going to be included in a supply chain sustainability improvement program. The goal is to identify suppliers that present significant financial impact on the buyer company, as well as significant room for improvement on sustainability practices. One widely used method for mapping and analyzing the supplier base, is based on the portfolio approach developed by Kraljic (1983). This portfolio approach analyzes suppliers based on two variables namely: supplier financial impact and supplier risk. The financial impact of suppliers is generally assessed by looking at the total spend of the buyer company at a certain supplier. Supply risk, for reasons of simplicity, is generally assessed the number of potential suppliers (Van Weele, 2009). However, in order to correctly assess supply risk, additional relevant risk factors need to be included in the assessment. Based on the ideas of Kraljic (1983), supplier financial impact and supplier risk are also at the base of this study. However since this study is about supplier sustainability development, instead of using supply risk as representing supplier risk, supplier sustainability risk is used.

The subject of the first research question is how to identify potential improvement and sustainability risk suppliers, and based on this, how to select suppliers that are going to be included in a supply chain sustainability improvement program. Suppliers pose different sorts of risks to a buyer company. This can vary from cost and quality risks to working conditions risks. This section focuses specifically on sustainability risk and before elaborating on this subject, a definition of risk is presented. Risk of a supplier is based on two elements: The probability that a harmful event occurs and the consequences of such an event occurring (Foerstl, Reuter, Hartmann, & Blome, 2010). The consequences of an event are expressed in potential losses.

Supplier sustainability is an important element in the overall sustainability of the buyer companies' supply chain. Because of this, suppliers need to be managed in order to increase their sustainability

performance. Research shows that sustainable supplier management capabilities are a source of competitive advantage. The advantage occurs in terms of enhanced operational performance and lower exposure to reputational risk (Foerstl et al., 2010). The goals of a sustainable supplier management program are to create and maintain a network of capable suppliers and improve the sustainability performance of suppliers over time (Chan, Charles, & Young, 1990). Due to the large number of suppliers for multinationals, research suggests to restrict the focus of sustainable supplier management practices to so called risk suppliers. Risk suppliers can be identified based on several factors for instance, the top 80% spend for the buyer company since these suppliers pose the greatest risk to financial performance (EPA, 2010). Furthermore suppliers can be labeled risk suppliers when they provide critical components or produce energy intensive products (EPA, 2010). Some other indicators for determining the risk of a supplier are the properties of the product delivered, the related production process, the supplier’s geographic location, and the suppliers past performance (Foerstl et al., 2010). Targeting risk suppliers with sustainable supplier management practices develops the sustainable practices of such suppliers and decreases the chance of significant damage when a risk occurs. Non risk suppliers should be provided with a self-declaration and a self-audit to assess their own sustainable performance (Foerstl et al., 2010).

To manage supplier risk, in this case more specifically supplier sustainability risk, a supplier risk management framework was developed by Ritchie and Brindley (2007). The framework is presented in Figure 4 and manages supplier risk in five steps starting with the identification of supplier risk followed by the assessment of supplier risk, decision of supplier risk consequences, supplier risk management response, and supplier risk performance outcomes (Ritchie & Brindley, 2007).

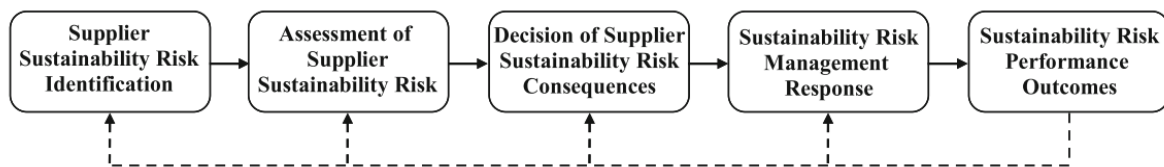


Figure 4: Supplier risk management framework

This framework aims to improve the risk management process and developing the supplier base. Foerstl et al. (2010) adjusted the model to specifically address sustainability risk and the sustainability risk management process, see Figure 5.

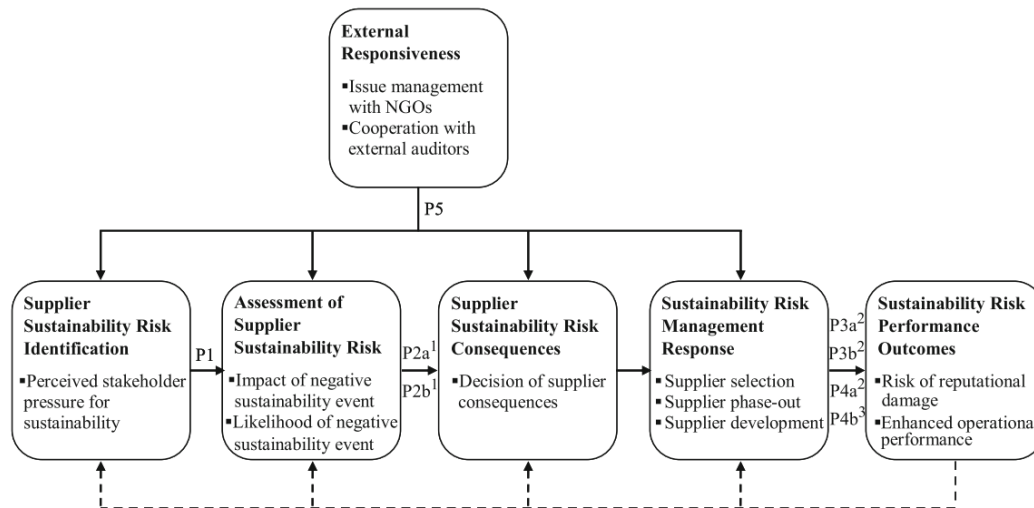


Figure 5: Supplier sustainability risk management framework

It is important that buyer companies work on improving their supply chain sustainability to prevent potential damage to the company in the form of liability for damage, non-compliance fines, negative media exposure, pressure group threats, and the loss of corporate reputation (P.D. Cousins, Lamming, & Bowen, 2004; Foerstl et al., 2010).

In general the classification of a supplier as a risk or non-risk supplier is based on a combination of the probability that a risk occurs and the financial impact of the risk. Most articles categorize suppliers by using an adjusted form of a Kraljic matrix. Suppliers with both high risk and high spend are categorized as risk suppliers and are primarily targeted with supplier sustainability development practices.

2.1.3. Supplier sustainability improvement evaluation

The second research question addresses methods to evaluate supplier sustainability performance. The majority of supplier sustainability assessment methods originate from classic supplier assessment methods used for supplier selection. These classic methods of supplier assessment can be adjusted to include sustainability in the analysis. Methods to assess supplier performance vary from Analytic Hierarchy Process (AHP) to Data Envelopment Analysis (DEA) and from regression analysis to fuzzy set theory. An overview of supplier assessment methods can be found in Figure 22 and Figure 23 in Appendix D. When implementing environmental criteria into the supplier assessment, models need to have the ability to include qualitative data in the evaluation. This presents a huge challenge for most of the traditional supplier assessment models, which work best with qualitative data as input. One of the supplier assessment methods that has the ability to include quantitative data is AHP (Noci, 1997). AHP is the most used and most cited supplier assessment method among researchers (Mukherjee, 2012). Other advantages of the AHP approach are that it helps managers understand the relationship and the interaction between different assessment criteria, and creates insight in the relative importance of the evaluation criteria (Robert Handfield, Walton, Sroufe, & Melnyk, 2002; Noci, 1997). The AHP method however does have one major disadvantage in that it is based on subjective weights and inputs from managers (Kumar, Jain, & Kumar, 2014). This could lead to inaccurate results. The idea of the AHP method is to assign weights to each of the criteria and its sub criteria. This is done by comparing all criteria to each other and

determine for each two criteria, which one is more important, and how much more important than the other, in the view of the respondent.

In order to assess suppliers on sustainability performance, assessment criteria need to be determined that address sustainable issues. Several articles discuss appropriate criteria that can be used to assess suppliers on sustainability. Examples of these criteria are environment-related certificates, use of harmful material list, but also energy efficiency and emission rates (Lee, Kang, Hsu, & Hung, 2009; van Hoek, 1999). It is important for evaluation criteria to be both clear and easy assessable. Robbert Handfield et al. (2002) and Walton, Handfield, & Melnyk (1998) recognized this and they produced a top 10 for both the popularity and the assessability of sustainable criteria. The top 3 sustainability performance indicators are Public disclosure of environmental records, second tier supplier environment evaluation, and hazardous waste management. Whereas the top 3 easily assessed are ISO 14000 certification, Ozone depleting substances, and Recyclable content. The full top 10s can be found in Appendix D Figure 24.

In general, supplier assessment methods are designed such that suppliers are either ranked or receive a score for their performance. Scores of suppliers can then be compared and it can be determined which supplier performs the best. Based on the scores and rankings suppliers can be selected to take part in the supplier development initiatives that the buyer company puts in place.

2.1.4. Supplier Relationship Management

The third research question addresses the supplier development process itself and what elements need to be considered to develop suppliers effectively. An important factor in this process is internal/external engagement for supplier sustainability development. Furthermore it is important to identify the strategies that increase the chances that supplier development efforts have significant impacts.

The first issue that needs to be addressed is the engagement of suppliers in supplier development practices. Supplier development practices are needed, as research has shown that self-regulation on the part of suppliers does not result in the desired sustainability improvements (Baden, Harwood, & Woodward, 2009). The authors show that economic interest of suppliers will always prevail over sustainability improvement interests. In this light it is important that the buyer company can convince suppliers to take part in supplier development practices. In order to understand how suppliers can be convinced, buyer companies need to understand what drives suppliers to either do or do not cooperate. The first step in getting supplier engagement in sustainable practices has to do with the willingness of suppliers to share information. Sustainability performance data is needed to accurately assess the suppliers' sustainability performance. Research highlighted several issues suppliers have with sharing of sustainability data. Suppliers are for instance concerned about how provided information will be used by the buyer company (EPA, 2010). Another example is that many suppliers think of the providing sustainability data as an extra administrative burden instead of looking at sustainability as a genuine issue that needs to be addressed (Baden et al., 2009). Furthermore, Small and Medium-sized Enterprises (SME) cite their own set of problems varying from a shortage of human resources and budgets to an inability to determine the economic risks of now engaging in sustainable practices (Lu, Wu, & Kuo, 2009).

In contrast to research that has been done on the issues at suppliers with regards to reporting and engaging in sustainable practices, there has also been research into when suppliers do want to share

information and engage in sustainable practices. Researchers identified several situations in which suppliers are more likely to be willing to share sustainability information and engage in sustainability development practices. Suppliers are more willing to share sustainability information with the buyer company when the requests from buyer companies are more frequent and the buyer pressure from requesting companies is higher (Jira & Toffel, 2013). Buyer pressure in this context refers to the impact, in terms of sales, that the buyer company has on the overall sales of the respective supplier. Some other situations in which suppliers are identified to be more willing to engage in sustainability are when buyer companies show willingness to use sustainability information, when suppliers operate in more profitable industries, when suppliers are located in countries with strict GreenHouse-Gas (GHG) regulations, and when multiple buyers place requests for sustainability information and practices (Jira & Toffel, 2013). At last it is identified that supplier need to believe that the buyer company genuinely wants to improve supply chain sustainability instead of just using supply chain sustainability as a marketing tool (Baden et al., 2009). Convincing suppliers of genuine intentions regarding supply chain sustainability requires buyer companies that act as one, meaning that all functions in the buyer company are on the same level regarding sustainability, and communicate so consistently (Walton et al., 1998). The need for consistency of communication on all levels of the buyer company demonstrates the need for internal engagement for sustainability practices.

Internal engagement at the buyer company regarding sustainability issues is needed to ensure consistent communication towards suppliers. Creating internal engagement will lead to recognition of the importance of sustainability issues on all levels in the organization (Lu et al., 2009). Literature suggests different ways of increasing internal engagement. The most important condition for internal engagement is the support of top management (EPA, 2010). Top management is responsible for defining company strategy and the main challenge regarding internal engagement is the translation of these strategic objectives into operational objectives. Two of the most important divisions to target when creating engagement are procurement and supplier account managers. Procurement is responsible for sourcing decisions and supplier account managers are the first line of communication with suppliers. Engagement in these divisions can be improved by creating allies in the divisions and working together to improve sustainability (EPA, 2010). The results of this collaboration can be used convince more reluctant managers in the respective divisions. Another way of increasing internal engagement is to explain how engaging in sustainability can help reaching business goals (EPA, 2010). Training and educating key personnel on the benefits of engaging in sustainability can do this. Furthermore training can be used to educate personnel on how they can influence suppliers to improve their sustainable performance.

When internal and external engagement for supplier sustainability practices is established, the question arises how to actually improve supplier sustainability. Literature suggests several practices to increase sustainability performance of suppliers. For instance, buyer companies can demonstrate, through training, how implementation of sustainability practices can yield in significant cost savings (EPA, 2010). Another example is the seven principles of supplier resource management that can be used a guideline for effective interaction and development between buyer and supplier. These principles can also be applied to supplier sustainability development. The seven principles of supplier resource management suggest that one should focus supplier development efforts on supplier with the highest value and risk reduction potential, treat all suppliers professionally, invest in understanding suppliers better, help suppliers understand the buyer company better, build trust

between buyer and supplier, ask supplier for feedback on the buyer companies' performance, and be open to ideas and suggestions (Hughes & Wadd, 2012). These principles can be used as basic rules for communication with suppliers.

2.2. Business problems

This section discusses the business problems related to each of the bodies of knowledge that occur in practice. Because of the existence of these problems it can be hard to implement methods from literature in practice. Several assumptions of the theoretic models suggested in scientific literature cannot be applied in practice. This section presents several business problems per research question that occurred within company X and at other multinationals in relation to the CDP Supply Chain program. Insights about problems related to the CDP Supply Chain program at other multinationals were obtained by participating in webinars, in which the CDP Supply Chain program was discussed between representatives of several multinationals. The business problems related to the CDP Supply Chain program at multinationals are used as an example of how there can be a gap between theory and practice.

2.2.1. Risk suppliers identification in practice

Multinationals typically have a large number of suppliers and it is impossible to actively manage and audit all these suppliers. How difficult it is to manage a large number of suppliers actively also comes forward when looking at the current state of the CDP Supply Chain program in company X. The number of suppliers invited to participate in the program increased sharply over the years, resulting in a large amount of data and very limited resources to analyze and do something with the data. Because of that, multinationals tend to define and identify risk suppliers in order to focus audit and development efforts where they are needed the most. In general, risk suppliers are defined based on a combination of buyer spend and supplier specific characteristics. In company X's case a supplier is labeled as a risk supplier when it meets the following criteria: Spend over a set amount of minimal annual purchasing value, located in a risk country, and delivers the high-risk commodity. Similar definitions of risk suppliers are used at other multinationals such as, among others, Dell, Intel, and IBM. Definitions of risk suppliers at these multinationals are discussed in EPA(2010). Such definitions of risk suppliers are easily applied in practice but also present some problems. First of all the number of risk factors included in the definition is very limited. The sustainability risk of a supplier is basically only based on location and spend. Besides the limited number of risk factors included in the definition, it also does not create differentiation between risk suppliers. Because of the large number of suppliers of multinationals, the number of suppliers that meet all criteria for being labeled risk suppliers is still very large. This results in more risk suppliers than adequately can be managed. Resources for supplier audits and development practices are typically limited and as such, the current risk supplier definition still does not clearly provide an answer to which suppliers should be managed and audited. One last issue that occurs with the current risk supplier definition is that the buyer company's influence on the supplier is not included. When buyer influence on suppliers is discussed in this thesis, this relates to the fraction of total sales of a supplier that is attributable to the buyer company. Even though spend at a supplier might be above the minimum amount required to be labeled a risk supplier, this amount might be negligible compared to the total sales of this supplier. Buyer companies' supplier development and audit efforts at such suppliers might have either no effect or a minimal effect since the buyer company only represents a small portion of their total business. For the buyer company it is useful to know at which suppliers they can apply buyer pressure when needed.

2.2.2. Supplier sustainability evaluation in practice

Literature presents several supplier evaluation models that include sustainability in the scoring method. Furthermore literature suggests several sustainability criteria on which suppliers can be scored. In practice however, a number of problems occur regarding the applicability of these evaluation methods. Never mind which ranking or scoring method is used, all of them assume the availability of data on all sub criteria and for all suppliers. Practice shows that complete availability of data is just not feasible. Different suppliers submit data on different criteria and that results in data being incomplete and supplier specific datasets, which are not comparable. Suppliers also tend to provide data in different measurement units, so if two comparable suppliers provide data on the same question the answers might still be incomparable. Another problem that occurs when trying to implement the supplier evaluation methods presented in literature is the supplier specific characteristics. Due to the large number of suppliers for multinationals, there also is a lot of differentiation between suppliers. In the supplier evaluation process this might result in some criteria not being applicable for several suppliers, whereas those criteria are applicable for a different set of suppliers. Because of this differentiation it is not feasible to draw up one supplier assessment method that is applicable to all suppliers. One last element that separates theory from practice is the difference between compliance criteria and improvement criteria in the assessment of suppliers. Compliance criteria are the criteria in which the supplier has to score a sufficient score to be able to keep delivering good to the buyer company. Improvement criteria of supplier evaluation relate to supplier sustainability performance on subjects, which are not required by regulations or by contract. These criteria indicate if a supplier is actively working on improving sustainability performance. In multinationals the compliance criteria are considered most important since these criteria pose direct risk to the buyer company, whereas improvement criteria are mainly an indicator of the suppliers' willingness to work on sustainability and good performance is considered as a bonus. It is hard to include the difference between these two types of sustainability criteria in the supplier evaluation methods presented in literature. Almost all problems mentioned in this section also occur in relation to the CDP Supply Chain program. The CDP Supply Chain program gathers a large amount of data but the quality of data provided differs between suppliers. Furthermore a very small amount of the invited suppliers answers all questions on the questionnaire, which results in non-complete data. At last the data that is gathered, is not used to manage suppliers or track improvement of suppliers over time. None of the multinational representatives mentioned to actively use the data obtained by CDP Supply Chain to manage suppliers on sustainability improvement, since most multinationals are still struggling in figuring out how to. This causes suppliers that have been participating in the program for years to drop out, because these suppliers do not see the goals and benefits of answering the questionnaire every year.

2.2.3. Internal and external engagement in practice

The practical problems regarding supplier development efforts are mainly related to the previous two research questions. Once it is clear which suppliers to approach and in what areas the performance of these suppliers is lacking, supplier development efforts have an increased probability of being effective. One problem that does occur during supplier development practices is to convince suppliers to take part in the development programs and what to do with suppliers that do not perform and improve as expected. Approaches adopted from literature can be used to address these issues and improve the effectiveness of supplier development programs. One other

problem is the lack of internal engagement for supplier sustainability development program. This specifically is the case for voluntary non-compliance related programs such as CDP Supply Chain. Within company X a lack of internal engagement is experienced with respect to the CDP Supply Chain program. This lack of internal engagement prevents company X of effectively communicating the program to suppliers and convincing them to participate. Internal engagement is a requirement for creating external engagement and one of the key factors in implementing any kind of improvement program.

2.3. Gap in the literature

The previous two sections presented a clear gap between scientific literature and business practice. The gap was most notable in the subjects of the first two research questions. This paper addresses the gaps described and tries to combine theory and practice to present adjusted methods or a new approach towards the subjects of the research questions. The solutions will still be based on scientific literature but methods will be adjusted such that some key assumptions can be relaxed to meet the needs of practice.

3. Research methodology

3.1. Research methodology

The outcomes of this research present a stepwise approach towards successfully implementing supplier sustainability development programs and as a consequence improve supply chain sustainability. The research is partly descriptive and partly design oriented. The descriptive part discusses the current state of theory and practice with regards to supplier sustainability programs. Whereas the thesis is design oriented in the latter phases in which recommendations, guidelines, and processes to follow are stated for multinationals that want to start new- or improve existing supplier sustainability programs. The methodology developed is based on a combination of theoretical knowledge and practical obstacles experienced within company X and other multinationals. Methodology wise this thesis could be characterized as a theoretical dissertation with several elements of primary or secondary qualitative research. The main bodies of knowledge discussed in Chapter 2 represent the theoretical part of this thesis. The identified bodies of knowledge are: Corporate Social Responsibility (CSR), Risk management, Supplier Assessment and Supplier Relationship Management (SRM). Each of the bodies of knowledge relates to one or more research questions and provides theoretical knowledge that supports the development of the methodology.

Adding to the theoretical knowledge are insights that are gathered by conducting unstructured interviews and attending meetings with professionals in company X, as well as participating in webinars in which the current state of supplier sustainability programs was discussed. Multiple meetings took place with several experts from Group Sustainability and Supplier Sustainability of Company X. Findings in these interviews are used as input for the developed methodology from a business point of view. The input of these professionals is very important since one of the goals of the research is to bridge the gap between literature and practice in the field of supplier development. Practical input from the business side creates insights in the practical problems multinationals come across when implementing suppliers sustainability development programs and, in this case more specific, voluntary supplier sustainability development programs. Combining both theoretical and practical knowledge will results in outcomes that meet business requirements better.

The unstructured interviews and meetings that are conducted are a form of data gathering but cannot be labeled as a primary research data gathering method since the interviews are not fully documented, and are used more as a method of exploring the interviewee's opinion about issues related to the research.

3.2. Research context

The goal of this research is to generally describe the process of working towards supplier sustainability development. Research has shown that a significant amount of environmental impact occurs upstream in the supply chain and this stresses the need of actively managing suppliers on sustainability. The process of working towards supplier sustainability development is illustrated in Figure 6. The steps in the process are based on the three main problems that multinationals like company X experienced when implementing the CDP Supply Chain program namely: How to come to an adequate selection of suppliers to include in the analysis, how to work with these suppliers to reach sustainability improvement, and how to create internal and external engagement for the supplier sustainability development program. The process described in Figure 6 starts when the

buyer company has made the decision to commit and implement a certain supplier sustainability development program. Once this decision has been made the buyer company needs to make a decision on what group of suppliers to target with the program, and what suppliers from that subgroup need to be included in the program. This process is captured in the first two steps in Figure 6. When the decision on which suppliers to include in the program has been made, the buyer company needs to determine how to work with suppliers towards sustainability improvement. This study identifies collaborative target setting as an effective approach for reaching improvement at suppliers. Collaborative target setting and other methods for measuring supplier improvement are discussed in more detail in chapter 5. The third, fourth, and fifth step of the process presented in Figure 6 represent the actions that need to be performed when working towards sustainability improvement at suppliers, starting with an overall sustainability assessment followed by target setting and evaluation of targets. The last step of the process relates to the third main practical problem experienced when implementing the CDP Supply Chain program at multinationals, which relates to how to create internal and external engagement for a supplier sustainability development program.

The six-step process presented in Figure 6 is based on the problems that occurred when implementing supplier development programs at buyer companies. This study focuses on the three steps that are indicated with the black arrows in Figure 6. These steps represent the subjects of each of the research questions. This study presents general guidelines on how to perform each of the steps from a buyer company point of view. The guidelines are discussed such that any buyer company that wants to implement some sort of sustainability program can use them. In the appendix the findings in this study are applied to the case of company X and the CDP Supply Chain program and recommendations are presented to improve the CDP Supply Chain program.

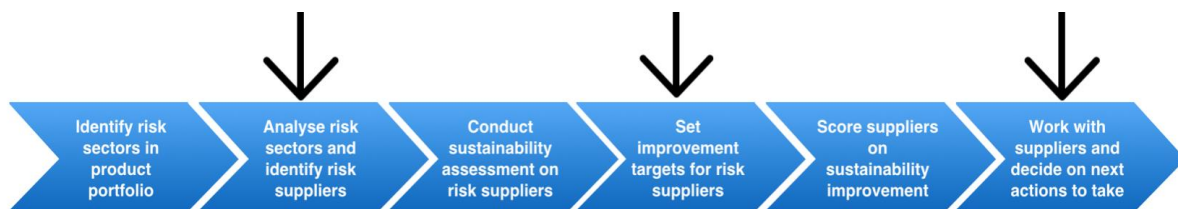


Figure 6: Process of implementing a supplier sustainability development program

4. Risk supplier identification process

This chapter discusses the proposed solution to the first research question. RQ1 focuses on the identification of risk suppliers and is formulated as follows: *How can supplier characteristics be best deployed to assess supplier sustainability risk and the potential for sustainability improvement, and based on these elements, how to determine which suppliers to include in supplier sustainability development programs?* The aim of this RQ is to give multinationals the tools to identify risk and potential improvement suppliers and create overview in the pool of potential improvement suppliers. This way multinationals can choose a subgroup of suppliers that they can approach with supplier sustainability improvement programs.

As described in the section 2.2, based on current situations at multinationals, it is argued that current risk supplier selection and identification methods used, are limited with respect to the insights they create in the pool of risk suppliers. All suppliers that meet the requirements of risk suppliers, are ranked as such and no differentiation is made within the group of risk suppliers. One other problem related to risk supplier identification at multinationals is that the number of risk criteria used to quantify supplier risk, is limited. For example, supplier risk for company X suppliers is merely based on the geographic location of the supplier, spend, and risk of the commodity. This presents another problems regarding the identification of risk suppliers. For different types of suppliers different definitions for risk suppliers are being used. This results from the different characteristics of suppliers in different sectors, and thus different supplier sustainability programs that are being used in different sectors. The problems described in this section have all been identified at company X and other multinationals, but it can be argued that the majority of these problems occur in all companies that operate in multiple countries and have to deal with an extremely large number of suppliers. From these examples it can be concluded that there is significant improvement to be made in the identification of risk suppliers in multinational companies.

The goal of this RQ is to identify the process of developing a general potential improvement supplier identification method that deals with the problems presented in the previous sections, and can be applied at multinationals in every sector. Furthermore the method has to present differentiation between risk suppliers so the buyer company can make an informed decision on which risk suppliers it wants to focus. The process of determining a suitable potential improvement supplier identification method for a buyer company has three main steps and is presented in Figure 7. These three steps are used to determine the three main elements of the analysis, namely: supplier sustainability risk, supplier financial risk (spend), and buyer impact on supplier. The three main elements of the analysis are based on the ideas of Kraljic (1993) who proposed to categorize suppliers based on supply risk and financial impact (Figure 21). In this study however supply risk is substituted by supplier sustainability risk, since the goal is to analyze suppliers on sustainability performance. Furthermore one more element is added to the analysis, namely buyer impact. Buyer impact represents the fraction of total sales of a supplier at the buyer company. Higher buyer impact is associated with greater willingness of suppliers to participate in development programs. The first step of the proposed method identifies risk criteria to be included and the levels of risk within these criteria. The second step focuses on what method to use and defining minimal requirements that suppliers have to meet to be included in the model. The third and last step of determining a suitable

risk supplier identification method is to gather supplier data that relates to the identified risk criteria and the chosen method.



Figure 7: Process of developing risk supplier identification method

4.1. Identify and define risk criteria

The first part of developing a potential improvement supplier identification method focuses on how to determine supplier sustainability risk. Determining supplier sustainability risk is done in the following steps: determine which risk criteria need to be included, how these criteria should be assessed, and what the weight for each of the criteria should be. The process of identifying and defining risk criteria is presented in Figure 8. The process is discussed step by step.

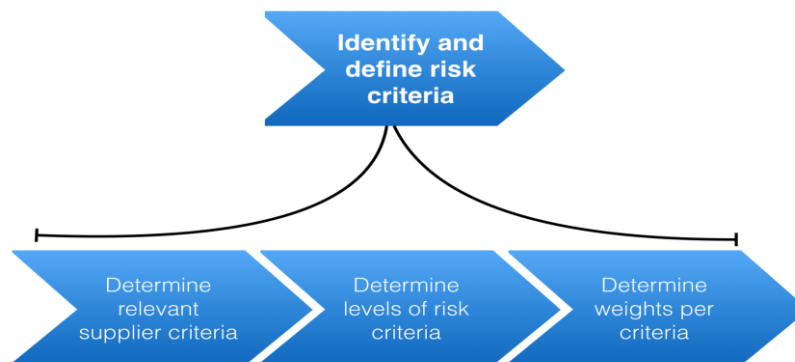


Figure 8: Identify and define risk criteria process

4.1.1. Determine relevant supplier risk criteria

The first step is to determine which risk criteria to include in the supplier risk evaluation method. The criteria to be included in the model should focus specifically on supplier sustainability risk, since the goal of the model is to give an overview of, and insight in sustainability risk of each of the suppliers. Furthermore the criteria included should be easily accessible in the sense that no in-depth inquiry should be needed to find out supplier characteristics which are important for the suppliers' risk score. The potential improvement supplier identification model is developed with the idea that based on general characteristics of suppliers; buyer companies are able to get a rough estimation of supplier sustainability risk. The group of risk suppliers that emerge from the model can then be developed more in-depth. This increases efficiency of sustainability improvement efforts since these are focused at a group of suppliers of whom it is more likely to engage in non-sustainable practices. On the contrary, these sustainability risk suppliers also have a higher potential for improvement since sustainability practices at these suppliers have not matured yet.

Literature suggests several criteria that could be included in a supplier sustainability assessment. Several articles regarding supplier sustainability risks have been reviewed and a number of key supplier sustainability risks are identified. Eight main sustainability risks are defined which cover the majority of the sustainability risks discussed in literature. To show how each of these risks relates to

the triple bottom line approach towards sustainability, an overview is presented in Figure 9. The main risks identified are business risk, supplier disruption risk, quality risk, strategic exposure risk, technological exposure risk, strategic risk, social compliance risk, and climate change compliance risk. **Business risk** refers to the financial risk of working with suppliers that are not profitable or might not stay in business for long. **Supplier disruption risk** refers to the risk of supply disruptions due to external factors such as natural disasters or labor disputes. Such events can lead to decreased production activity at a supplier and thus to supply disruptions towards the buyer company. **Quality risk** refers to the quality that is delivered by suppliers. Quality downstream in the supply chain largely depends on the quality of components delivered; this can refer to either product quality or sustainability quality of a supplier. **Strategic exposure risk** refers to a situation in which the buyer company is over-reliant on a single or a limited number of suppliers and when little substitute suppliers are available. In this case buyer companies have little negotiation leverage and increased risk of losses when undesirable events occur at the supplier. **Technological exposure risk** occurs when a buyer company is over-reliant on a single or limited source of a product, process, or technology. Technological exposure can result in problems with future legislation but also on an increased impact on the environment. **Strategic risk** refers to the situation in which suppliers are not transparent about their sustainability performance and their efforts to improve their sustainability. Transparency is desirable for stakeholders and prevents against brand image damage. Spreading clear information help suppliers and buyer companies in managing expectation regarding sustainability. **Social compliance risk** refers to the risk of a supplier being non-compliant on social issues. Increased risk of non-compliance risk can influence business continuity and this directly affects the buyer company. The same issues occur with the final form of risk, which is **climate change compliance risk**. Climate change compliance risk also refers to compliance but in this case on issues regarding climate change. The consequences for the buyer company however are basically the same. These eight main sustainability risks encompass the majority of sustainability risks mentioned in literature. The eight identified sustainability risks have a lot in common with general risks used to assess overall supplier risk. The sustainability element of these risks will however be extra emphasized in the assessment methods that are identified to assess each of the sustainability risks (Table 2). By relating the assessment methods to sustainability specific topics, the sustainability element of the identified risk criteria is brought forward and emphasized.

Naturally not all sustainability risks mentioned in literature are captured by the eight main sustainability risks defined. Some examples of sustainability risks not included in the summary are risks regarding food and plant diseases, water scarcity, and business reputation. The business reputation risk is excluded since it is already encompassed as a consequence of several other risks defined. Food and plant diseases are excluded since they do not directly affect the suppliers unless they operate in certain industries. Food and plant diseases can be classified as raw material scarcity and thus as technological exposure risk, raw materials price fluctuations/business risk or natural disasters/supplier capacity risk. The point here is that the main sustainability risks are defined in such a way that they capture as many detailed risks as possible.



Figure 9: Sustainability triple bottom line linked with sustainability risks

Each of the risks presented in Figure 9 is a generic term that encompasses several examples of sustainability risks presented in literature. The generic terms are used to keep a clear overview of the risks involved in supplier sustainability. Table 1 elaborates on each of the risk criteria, the causes, consequences, and the references applying to each type of risk. The consequences for each of the criteria occurring are classified using the ‘TYPES OF LOSS’ presented by Mitchell (1995). Mitchell (1995) discusses six different types of losses that can occur when a risk event occurs. The types of losses defined by Mitchell are: Financial loss, Performance loss, Physical loss, Social loss, Psychological loss, and Time loss. Figure 25 elaborates on the types of losses and presents an example for each of the losses to increase understanding.

From a business point of view, it is preferable to cover as many of the risks identified as possible, when selecting the risk criteria to be used. There are several ways in which each of the criteria can be assessed and every situation might need a different set of risk criteria that will be included in the risk analysis. In order to make sure supplier sustainability risk is assessed, the assessment criteria for each of the types of risk are based on sustainability related topics. In Table 2 examples are presented of how each of the types of risk can be assessed. Which criteria are best applicable depends on the company specific situation, product type, and the availability of data. However, the assessments of some of the criteria are basically the same for almost all situations for instance, the assessment of social/ climate change compliance risk and quality risks. Since these are all best assessable based on contracts and certifications.

As mentioned before, in this phase of identifying sustainability risk suppliers and suppliers with potential for sustainability improvement, it is important that the first selection of suppliers can be done fairly quickly. That is why ideally the assessment methods used in this phase of the process are easily assessable. To give an indication of the assessment difficulty of each of the assessment methods, the methods are color coded in Table 2 with green being the easiest to assess, yellow

being moderately difficult to assess, and red being very difficult to assess. The level of difficulty of each of the assessment methods in Table 2 is based on data availability at company X. However depending on the data storage at other buyer companies, the difficulty levels of assessment methods can differentiate. The difficulty level of assessment is based on how accessible the data needed for the assessment is.

There are several ways in which each of the main risks described can be assessed. In Table 2 several possible assessment methods are discussed for each of the criteria. As can be seen, some assessment methods are applicable to multiple risks since they cover several aspects of the supplier. Examples of such assessment methods are the ISO certifications, which refer to the quality of practices and processes in place at suppliers and thus cover multiple risk areas. Besides these general assessment methods, some risk criteria specific methods are identified which relate to one sustainability risk criteria. An example of such a specific method is the Maplecroft Human Rights index. This index scores countries on social compliance and indicates in which countries it is most likely that social rights and regulations are violated. All assessment methods are categorized as easy, moderate or hard to assess. When identifying risk suppliers its preferable to use easy assessable criteria to limit the effort that has to be put in computing the first phase of analysis for identifying risk suppliers. Further explanation about the assessment methods and the difficulty of assessment of the methods can be found in Appendix A.

Type of risk	Causes	Consequences	Sources
Business risk	<ul style="list-style-type: none"> - Fluctuating prices of raw materials - Significant increase in insurance cost due to climate change - Increased natural resource costs due to scarcity of natural resources - Increased transportation costs due to higher crude oil prices - Cost inflation and increasing interest rate - Increased competition due to early adopters of environmental innovation technologies 	<ul style="list-style-type: none"> - Increase in total costs for the same amount of raw materials, natural resources, and services (financial loss) - Possibility of suppliers going out of business (time loss) - Increased competition resulting from innovative early adopted (Performance loss) 	(Carter & Rogers, 2008; Chopra & Sodhi, 2004; Paul D. Cousins, Lamming, & Bowen, 2004; Jira & Toffel, 2013; Krause, Handfield, & Scannell, 1998)
Supply Disruption risk	<ul style="list-style-type: none"> - Disasters, acts of war/terrorism, labor disputes - Violent weather, lack of disaster preparedness and recovery, droughts/flooding/desertification, glacial melt/sea level rise 	<ul style="list-style-type: none"> - Decrease in supplier production capacity (financial loss, Time loss) - Damage to supplier assets (Physical loss, financial loss) 	(Chopra & Sodhi, 2004; P.D. Cousins et al., 2004; Zsidisin, Panelli, & Upton, 2000)
Quality risk	<ul style="list-style-type: none"> - Components of suppliers do not meet environmental requirements - Inability of supplier to keep up with technical changes, environmental innovation 	<ul style="list-style-type: none"> - Quality of output depends on quality of input (performance loss) - Decrease of competitiveness of products over time (performance loss) 	(Zsidisin et al., 2000)
Strategic exposure risk	<ul style="list-style-type: none"> - No or small amount of substitute suppliers available - High profit margin contribution of certain components 	<ul style="list-style-type: none"> - Small leverage in negotiations with suppliers regarding financial and sustainable issues, financial performance and brand image at risk (financial loss, social loss) 	(P.D. Cousins et al., 2004; R. Handfield et al., 2005)
Technological exposure risk	<ul style="list-style-type: none"> - Being over-reliant on a single or limited source of a product, process, or technology - Growing world population and consumption pattern, raw material scarcity - Inefficient and limited food supply 	<ul style="list-style-type: none"> - Harmful effect on physical or biological environment, problems with future legislation (physical loss, performance loss) - Limited supplies of raw materials and other critical resources (financial loss, psychological loss) 	(Paul D. Cousins et al., 2004)
Strategic risk	<ul style="list-style-type: none"> - Stakeholder communications regarding sustainability required 	<ul style="list-style-type: none"> - Lack of communications and transparency may result in unsatisfied stakeholders 	(Faris, Gilbert, LeBlanc, Ballou, & Heitger, 2013; Holliday,

	<ul style="list-style-type: none"> - Investors require actions to mitigate sustainability risk - Lack of willingness of suppliers to address sustainability issues due to administrative burden - Stakeholders require transparency regarding sustainability 	<p>(financial loss)</p> <ul style="list-style-type: none"> - Lack of mitigating sustainability risk might scare of investors (financial loss) - Risk of green washing an false sustainability information of suppliers (social loss) 	Schmidheiny, & Watts, 2002)
Social compliance risk	<ul style="list-style-type: none"> - Regulations regarding social issues (Health and safety, human rights, labor laws, anti-bribery, working conditions. - Fraud, litigation - Transaction failures, Merged companies might have different sustainability standards - New regulations 	<ul style="list-style-type: none"> - Suppliers can go out of business and pose brand image concerns to buyers (social loss, financial loss, time loss, psychological loss) - Sustainability performance of merged company might not be as good as before the merger (performance loss) - Lack of anticipation might lead to future noncompliance (financial, loss, time loss, social loss) 	(Paul D. Cousins et al., 2004; Faris et al., 2013)
Climate change compliance risk	<ul style="list-style-type: none"> - Regulations regarding climate change issues (waste & recycling, energy use, emissions, water use, conflict minerals) - Green washing - Transaction failures, merged companies might have different sustainability standards - New regulations 	<ul style="list-style-type: none"> - Suppliers can go out of business and pose brand image concerns to buyers (social loss, financial loss, time loss, psychological loss) - Sustainability performance of merged company might not be as good as before the merger (performance loss) - Lack of anticipation might lead to future noncompliance (financial, loss, time loss, social loss) 	(Paul D. Cousins et al., 2004; Faris et al., 2013)

Table 1: Sustainability risks, causes, and consequences

Risk Type	Assessment methods	Assessability
Business risk	<ul style="list-style-type: none"> • ISO Certification • A long-term contract is place with supplier? >1 year • Solo vs. single vs. multiple sourcing • Supplier financial impact 	
Supply disruption risk	<ul style="list-style-type: none"> • Solo vs. single vs. multiple sourcing • Supplier/component impact 	
Quality risk	<ul style="list-style-type: none"> • ISO Certification/QCA Certification or other quality management certifications • Supplier-buyer quality contracts and assurances in place? 	
Strategic exposure risk	<ul style="list-style-type: none"> • Availability of substitute suppliers • Component financial impact 	
Technological exposure risk	<ul style="list-style-type: none"> • Substitute components/materials available? • Component financial impact • Commodity risk 	
Strategic risk	<ul style="list-style-type: none"> • Public disclosure of sustainability records/performance • Public sustainability strategy & targets 	
Social compliance risk	<ul style="list-style-type: none"> • Maplecroft Human Rights index • ILO-OSH 2001 guidelines • Known previous violations • Supplier-buyer contracts regarding commitment to social practices 	
Climate change compliance	<ul style="list-style-type: none"> • Maplecroft legal, regulatory and environment risk • ISO 14001 certification • Known previous violations • Supplier-buyer contracts regarding commitment to environmental practices • Commodity compliance risk 	

Table 2: Sustainability risks and possible assessment methods

4.1.2. Define levels of risk in criteria

The second step in working towards a risk supplier identification model refers to the levels of risk within the criteria. For each of the criteria the levels of risk need to be defined. A simple method of doing this is to define high risk, moderate risk, and low risk for each of the criteria. The definitions of high, moderate and low risk alternatives should include all possible outcomes for a specific risk criterion. Defining different levels of risk in such a way ensures that all suppliers qualify for at least one level of risk. Subsequently a score is added to the high risk, moderate risk, and the low risk situation. The range of the scores depends on which scale is presumed suitable for the specific situation. One example of scoring different levels of risk could be use a scale from 1 to 9 where the supplier gets a score of 9 when it qualifies for the high-risk situation, a score of 5 when it qualifies for the moderate risk situation, and a score of 1 when it qualifies for the low risk situation. The scale that is used for scoring the level of risk can be adjusted to the needs of the buyer company.

4.1.3. Define weights per risk criteria

The last step of developing the risk supplier identification model consists of deciding on what assessment criteria to include and against what weights these criteria should be included. Three main options occur when looking at what criteria to include. The obvious scenarios that occur are: assess supplier risk on one critical risk criteria, assign weights to all included risk criteria and compute average risk score for a supplier, and assess supplier on multiple critical risk criteria which clearly stand out above the others. The three scenarios mentioned with their pros and cons are described Table 3. The buyer company needs to decide what scenario is best applicable for the specific situation for which the risk supplier identification method is developed. Depending on situation specific characteristics the buyer company can decide to use different methods.

The three steps discussed in the previous sections make up the ‘identify and define risk criteria’ part of the development of a potential improvement supplier identification method. This chapter represents a guideline in the steps that need to be taken to develop a quality potential improvement supplier identification model. It has to be noted that the steps described are an example of how each of the steps could be performed by a buyer company. Requirements for risk supplier identification models are company and commodity specific so the development of the model should also be company and commodity specific.

Scenario	When to use?	+	-
1 critical risk criteria	One of the risk criteria clearly stands out for the specific commodity and is by far most likely to occur.	+ Focus on the most important risk criteria.	- Less insight in the overall sustainability risk of suppliers.
Assign weights	<p>- Multiple risk criteria are relevant but some criteria are deemed more important than others.</p> <p>- Another scenario occurs when all criteria are deemed equally important. All weight are set at one and this results in an average risk score</p>	<p>+ Adjusted focus on criteria that are deemed more important. Supplier risk score more representative to specific situation.</p> <p>+Average risk score best applicable in a situation in which the buyer company wants to create an overview of overall supplier sustainability</p>	<p>- Assignment of weights is subjective and can result in a skewed risk score.</p> <p>- Does not pay specific attention to criteria that are more important or more likely to occur. This method can conceal one or two criteria that score very risky</p>
Multiple critical risk criteria	Two or more of the risk criteria clearly stand out for the specific commodity and are by far most likely to occur.	+ Focus on the most important criteria	<p>- Less insight in the overall sustainability of a supplier.</p> <p>- Selection of critical criteria can be subjective.</p>

Table 3: Scenarios of analysis with pros and cons

4.2. Decide on suppliers to be included in analysis

The second part of the process of identifying risk suppliers has to do with deciding which suppliers to include in the analysis. The first step is to set minimal requirements that suppliers have to meet to be included in the analysis. The second step is to check which suppliers meet these minimal requirements and thus will be included in the analysis. The minimal requirements are set to both

reduce the number of suppliers that need to be assessed, as well as exclude suppliers with relatively small impact or small probability of improvement in the future. The reduced number of suppliers that can be included in the analysis is the result of a limited audit capacity. Since the model aims to identify suppliers with the potential to move past compliance and work on improvement, a select group of suppliers needs to be identified. This can be illustrated by using Figure 30. The triangle represents all suppliers of the buyer company. All these suppliers need to be compliant to buyer-supplier contracts and regulations. The top part of the triangle can be seen as the select number of suppliers that present opportunities for improvement on sustainability. The goal of the two steps described in this section is to make a pre-selection out of a group of suppliers. The suppliers that meet the minimal requirements set to be included in the analysis are more likely to be in the top part of the triangle. The second step of developing the risk supplier identification method is visualized in Figure 10.

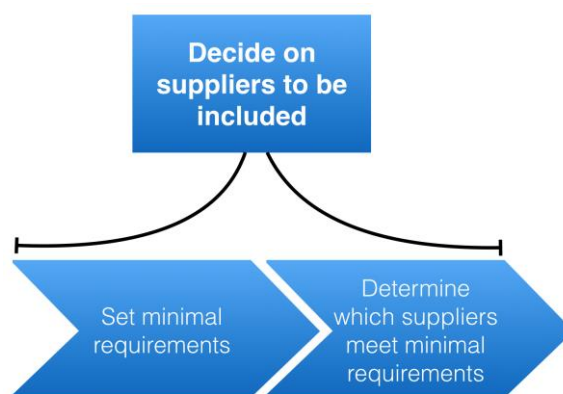


Figure 10: Select suppliers to be included in analysis process

4.2.1. Set minimal requirements

When setting minimal requirements that suppliers have to meet to be included in the assessment, two main factors have to be taken into account. The suppliers included must have a significant impact on the buyer companies' supply chain performance. This to ensure that possible supplier development efforts at this supplier will also lead to significant improvement for the buyer companies' supply chain sustainability. The second factor is that it has to be probable that improvement can be reached at a certain supplier. The idea here is that there is no point in including a supplier in the risk identification process, with the goal of selecting suppliers to participate in supplier development practices, while there is a small probability that improvement will be made at this particular supplier.

The first factor that can be used is an estimation of the probability that improvement in sustainability performance can be reached at the supplier. The idea is that it is superfluous to include suppliers in the assessment when the probability of improvement on sustainability at these suppliers is relatively low. When estimating this probability a distinction between solo, single-, and multiple sourcing is made. Solo sourcing relates to a situation in which the buyer company works with one supplier, and this supplier is the only available supplier of the specific good (Larson & Kulchitsky, 1998). Single sourcing refers to a situation in which the buyer company works with one supplier exclusively, but several other substitute suppliers are available to the buyer company when needed (Larson & Kulchitsky, 1998). Lastly multiple sourcing refers to a situation in which the buyer company works with multiple suppliers that deliver the same good (Larson & Kulchitsky, 1998). Research has

shown that solo source contracts result in total higher costs for buyer companies, less buyer/supplier cooperation, and results in high dependence on the supplier (Larson & Kulchitsky, 1998). Especially the increased dependence on suppliers is a key issues here since buyer companies apparently have less influence on the practices of their solo source suppliers. On the contrary, buyer companies do have significant influence on single source suppliers even though they also work with only one supplier. This results from the availability of substitute suppliers and thus the pressure for the supplier to keep the level of performance up. Based on the findings in Larson & Kulchitsky (1998), it is suggested to exclude solo source suppliers from the risk assessment since the probability of improvement resulting from buyer requests is negligible due to very low buyer pressure.

The second step is to set a minimum impact that suppliers are required to have on the buyer company's supply chain sustainability performance. The impact of a supplier on the buyer company is widely estimated based on spend of the buyer company at the supplier. Spend at a supplier is an indicator of financial impact of the supplier on the buyer company, as well as an indicator of the amount of business at the supplier related to the buyer company. EPA (2010) conducted a research into the managing of supply chain greenhouse gas emissions and several multinationals participated in the research. Almost all respondents reported the use of spend data as an indicator of supplier financial- and supply chain impact. Several ways of using spend data to reduce the number of suppliers in an analysis were reported, with the most common being the top 100 suppliers according to spend data or all top suppliers that compose 80% spend of the buyer company. Furthermore spend at suppliers is an indicator of the financial risk of buyer company at the particular supplier. Financial loss is a possible consequence of multiple previously identified sustainability risks. Thus spend at supplier also has the function of giving an estimation of possible losses besides reducing the number of suppliers in the analysis. The process of determining the minimal requirements that suppliers have to meet is visualized in Figure 11. The diamonds represent decision notes in which a random supplier either takes one of the two possible routes.

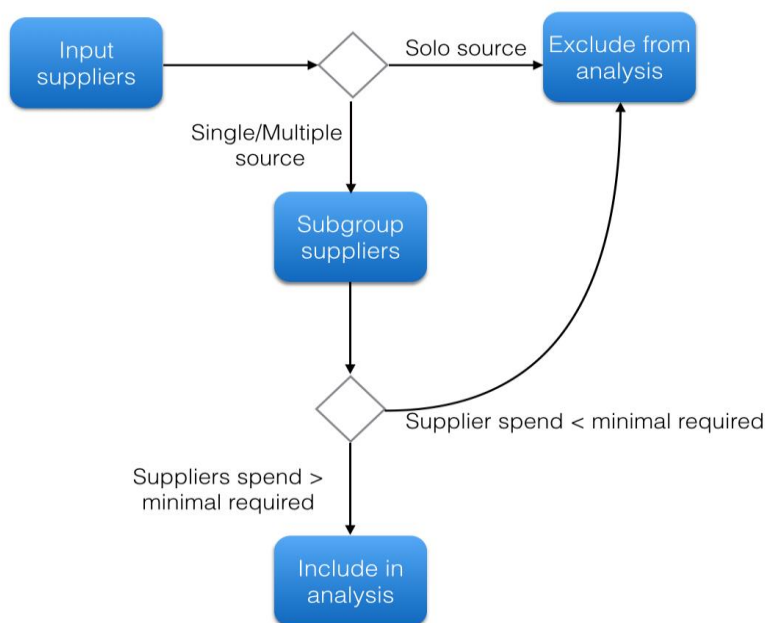


Figure 11: Determine which suppliers to include in assessment process

4.2.2. Determine suppliers that meet minimal requirements

The next step is to determine which suppliers meet the set minimal requirements. The issue here is to determine which set of suppliers to initially use as input. When starting the analysis the buyer company would preferably start with a group of comparable/similar suppliers. The possibilities are to either select a group of suppliers that operate in same sector, for example in electronic components or logistics, or to work with a group of suppliers that supply comparable components or operate in the same commodity group. The advantage of the second method is that the starting group of suppliers will be more homogenous since suppliers will be delivering similar products. This in comparison to the first method, which selects input suppliers based on the sector in which they operate. This can result in two suppliers being included in the assessment that supply completely different components and thus have completely different characteristics. Thus the second method results in an input group of more comparable suppliers. However not all companies work with commodity groups and for those companies method one would be better applicable.

4.3. Gather data and perform analysis

The third and last step in the process of developing a risk supplier identification method is to gather the actual data needed and perform the analysis. This last step can be split up in to two activities namely: gathering supplier data and computing the risk score, and determining buyer impact on supplier and computing the risk chart. The process is visualized in Figure 12 and described in sections 4.3.1 and 4.3.2

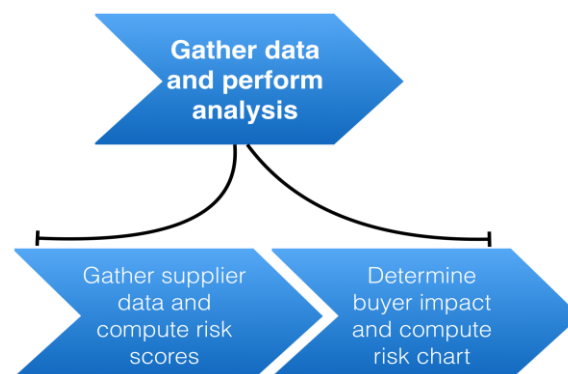


Figure 12: Process of gathering supplier data and performing analysis

4.3.1. Gather supplier data and compute risk scores

To develop a graphical representation of a group of suppliers, data regarding risk, spends, and impacts of the buyer company are needed. Several databases have to be addressed to find information regarding these subjects. One of the elements needed to compute the graphical representation of a group of suppliers is the spend data of the buyer company at the supplier. Spend data should be stored in a database within the buyer company and should be easily accessible. Spend data is one of key indicators for identifying risk suppliers. This mainly because the spend of the buyer company at a specific supplier is a good indicator of the potential business impact in case of a non-compliance of the supplier (Foerstl et al., 2010). Research has also shown that spend at a supplier is an indicator that is frequently used by companies to identify risk suppliers.

As mentioned in the previous sections, the risk supplier identification method proposed, aims at creating insight in the differences between a subgroup of suppliers, which meet the minimal requirements of a risk supplier. Data and characteristics of suppliers need to be gathered to

compute a sustainability risk score for each of the suppliers. The information that needs to be gathered depends on the relevant risk criteria and assessment methods selected during the development of the risk supplier identification model. For each supplier, data needs to be gathered to score the supplier on each of the relevant risk criteria. Most of the data needed to compute a risk score will be available in the supplier databases of the company. This results from only considering basic sustainability risk criteria when assessing supplier sustainability risk. How the risk score needs to be calculated depends on the method chosen in section 4.1.3. The supplier specific characteristics in combination with the weights assigned to each of the criteria will result in a supplier specific sustainability risk score. As mentioned earlier, supplier risk score will be plotted on the vertical axis of the graph.

The third element proposed for differentiating sustainability risk suppliers and potential improvement suppliers is the impact of the buyer company on the supplier. Engagement of suppliers in sustainable practices is one of the issues that need to be tackled to improve supply chain sustainability performance. Literature has concluded that the level of buyer pressure acts as an additional incentive for suppliers to engage in sustainable practices and to share information with the requesting party (Baden et al., 2009). The suggested approach of measuring buyer impact on the supplier is to estimate the impact of the buyer company on total sales of the supplier. The idea is that buyer pressure increases with the percentage of total supplier sales attributed to the buyer. The buyer company has to obtain some form of supplier sales data or information to produce an estimation of their impact on supplier sales. There are two obvious ways of obtaining supplier sales information as buyer company. The information can either be gathered through online public sources or through requesting the information from the supplier. Online sources are useful for obtaining a general overview of supplier sales, the disadvantage however is that public sales numbers usually present sales of the group as a whole instead of sales number of the individual enterprises. Depending on the information needed, the buyer company might need to approach the supplier for actual or estimated sales numbers to accurately estimate their impact on the specific supplier. The disadvantage of this direct approach however is that suppliers might not be willing to share this information as they can believe sharing this information will put them at a disadvantage in future negotiations. When the estimation of buyer impact on the supplier is finalized, the impact will be presented by the bubble size of the data point in the graphical representation of risk suppliers.

4.3.2. Compute risk chart

After determining the values for each of the three main dimensions that are included in the analysis, the risk chart can be computed. The three dimensions included in the risk chart are: supplier sustainability risk, supplier financial impact, and buyer impact on supplier. Values for each of the dimensions have been determined in previous steps of the process. By visualizing the impact of suppliers on each of these dimensions, the buyer company can make a distinction between suppliers that already meet the minimal requirements of being eligible to be labeled risk supplier. This method elaborates on methods that are currently used by multinationals (EPA, 2010) and adds the dimension of buyer impact on suppliers to estimate the probability of improvement and collaboration of suppliers when approached by buyer companies. As a final step the risk chart has to be computed with supplier spend on the x-axis, supplier risk score on the y-axis, and buyer impact indicated by the bubble size of the data points. For an example on how to complete each of the steps and work towards a risk chart see Appendix B.

4.4. Decide on which suppliers to include

The idea of this method is to create differentiation in the pool of risk suppliers and to provide the buyer company with additional insights in this group. This way the buyer company can make an informed decision on what suppliers it wants included in the new supplier sustainability development program. It is suggested to select suppliers at which the probabilities of improvements and participation are the highest. Two indicators of room for sustainability improvement at suppliers are: high sustainability risk and high buyer impact. High sustainability risk indicates a relatively low level of sustainability maturity at a suppliers thus room for significant sustainability improvement. High buyer impact relates to the amount of influence the buyer company has on the practices at a certain supplier. High buyer impact is related to increased willingness at suppliers to cooperate in supplier sustainability programs. Suppliers with the highest potential for improvement should be included in the sustainability program. However, the person that in the end makes the decision of which suppliers to include should beware for judgment bias. Since there are no clear guidelines on what is high potential for improvement and what is high sustainability risk, probability of judgmental bias is relatively high. Several methods are available as a form of precaution/prevention for judgmental bias. One method that could be used is a decision tree in which a number of preset conditions are defined which the decision maker has to follow. For example: for the supplier to be considered to be included the sustainability risk must score higher than 5 on a scale from 0 to 10. Putting multiple of such decisions together in a decision tree structures the way of coming to a decision on a certain supplier and decreases the probability of judgmental bias. Another method for decreasing chances of judgmental bias is leaving the final decision on which suppliers to include to a group of stakeholders, instead of one individual. When a group has to make a decision, the group process and discussion tends to decrease changes on judgmental bias of one person. One final interesting method is using linear models to analyze performance of included suppliers over time. The linear method uses the characteristics of suppliers when included in the model and relates them to the performance over time of the same suppliers in the program. The larger the sample of suppliers the stronger the relation will be and based on this linear relation, the criteria on when to include suppliers can be adjusted over time. This linear method has been identified to improve decision-making and decrease the room for judgmental bias over time (Milkman, Chugh, & Bazerman, 2009).

4.5. Wrap up

The method presented in this chapter suggests a stepwise process for identifying suitable suppliers to be included in the supplier sustainability development program. Suppliers are mapped and differentiate on three main categories namely: Sustainability risk, spend at supplier, and buyer impact. The advantage of this method is that it gives the buyer company increased insight in the characteristics of the possible suppliers to be included. Also it gives an indication of room for improvement on sustainability practices and an indication of the willingness of suppliers to participate in the program.

5. Analyze supplier sustainability improvement

This section discusses the proposed solutions to the second research question regarding the analysis of how to measure supplier sustainability improvement. The aim of this project is to identify methods to get suppliers to work on sustainability improvement on top of sustainability compliance, which is required by regulations and buyer companies. In the second step of the supplier sustainability improvement process (Figure 6), risk suppliers and suppliers with high potential of improvement are identified, this process is discussed in chapter 4. This supplier identification process is followed by a sustainability assessment that is conducted to create insight in the performance of selected suppliers on the different areas of sustainability. This assessment leads to the question of how to measure and assess sustainability improvement. The second research question is formulated as: *What is the best method to assess sustainability improvement? Demonstrate how this can be done.* This chapter presents a process that can be used to find the best suitable assessment method regarding sustainability improvement assessment. The process of working towards a suitable supplier sustainability improvement assessment tool is presented in Figure 13.



Figure 13: Process how to assess supplier sustainability improvement

The process of coming to an assessment method for supplier sustainability contains three steps and each of the steps is described extensively in this chapter.

5.1. Decide on method to evaluate improvement

The first step in the process of assessing suppliers on sustainability improvement is to determine how improvement at suppliers is going to be measured. Several assessment scenarios are possible to determine sustainability improvement at suppliers varying from assessing supplier sustainability performance compared to overall sustainability performance in the previous year, assessing supplier sustainability based on the achievement of specific targets, yearly supplier self-assessment, to assessment based on target achievement. A few possible scenarios and their pros and cons are described in Table 4.

Assessment Method	When to use?	Pros (+)	Cons (-)
Level of transparency	In the starting stages of developing supplier sustainability practices in a buyer company. One of the first steps in implementing supplier sustainability practices is to convince suppliers of sharing sustainability information with the buyer company. Improvement in the level of transparency can be an indicator of this.	Indicator of supplier commitment to sustainability practices in the early stages of adopting supplier sustainability practices	No clear indicator on sustainability performance or improvement of a supplier.
Performance/ improvement on all criteria vs. competitors	This method is suitable when the goal of measuring sustainability improvement is to compare the overall sustainability improvement of a certain supplier with the overall sustainability performance of comparable companies.	Gives insight in overall sustainability improvement of supplier compared to similar suppliers.	Does not require big improvements to be labeled with strong sustainability improvement. Industry average can skew results.
Performance/ improvement on all criteria vs. own previous performance	When the goal is to create insight in overall sustainability performance and improvement of a certain supplier compared to its overall sustainability performance in a previous period.	Gives insight in the overall sustainability improvement of the particular supplier.	Does not encourage supplier to work on certain key impact areas in sustainability
Performance/ improvement on specific criteria vs. competitors	When the goal is to assess performance/improvement of a particular supplier compared to similar suppliers on several key sustainability criteria.	Performance / improvement on key sustainability criteria is highlighted.	Industry performance average can skew results.
Performance/ improvement on specific criteria vs. own previous performance	When the goal is to assess improvement of a certain supplier on several key sustainability criteria compared to its performance in a previous period.	Gives insight in improvement of a certain supplier on highlighted sustainability criteria.	Measures sustainability improvement of supplier but does not set specific goals to reach
Achievement of targets	When the goal is to have suppliers work on one or more critical areas of sustainability.	Suppliers have specific targets to reach. This can add motivation to work on sustainability.	Target focus at specific impact areas of sustainability. Areas that are not included in target setting are kept out of scope.

Table 4: Supplier sustainability improvement measurement methods

Which supplier sustainability assessment method to use depends on the goal of the assessment from the buyer's point of view. The goal of this project is to describe the process of working towards supplier sustainability improvement while taking practical business problems experiences at multinationals into account. One of the problems mentioned in relation with supplier sustainability development is that suppliers experience a high workload related to supplier sustainability development programs of multinationals. The multiple supplier sustainability programs in place at multinationals cause this workload. Suppliers are required for some programs to, and can voluntarily for others, submit sustainability information to indicate that they are either compliant to regulations and contracts, or exceed expectations and work on sustainability improvement. Suppliers indicate

that the high workload related to providing information for the different sustainability programs results in decreased focus on actual improvement efforts on, and in some cases a box-ticking approach towards sustainability. The assessment method that reflects the need for a focus on sustainability improvement and addresses the mentioned practical problems the best is the target setting approach. However in case of implementing supplier development programs that a less focused on improvement and more focused on accomplishing other goals, different assessment methods for measuring supplier performance/improvement might be more suitable.

The target setting approach allows the buyer companies to focus on one or two key sustainability criteria to try to improve supplier performance on these criteria. Focusing on one or two key sustainability criteria also decreases the workload related to providing information to buyer companies, and thus frees up time to work on sustainability improvement. Furthermore collaborative goal-setting is related to increased motivation to reach the goal (Latham & Locke, 1979). Target setting meets all the requirements for an assessment method for measuring the specific situation of voluntary supplier sustainability improvement program. The remainder of the chapter uses target setting as the assessment method chosen. Target setting is the method that best represents the needs of working towards significant improvement on supplier sustainability related to the CDP Supply Chain program. However, in other cases of implementing supplier sustainability programs at other companies, a different assessment method presented in Table 4 might meets the needs best.

5.2. Execute evaluation method

When the suitable evaluation method is determined, it has to be executed. For the target setting method, three main steps are identified to come to relevant and significant targets that can then be evaluated. The three steps in executing the target setting method are presented in Figure 14. Each of the steps is discussed in detail in the following sections.

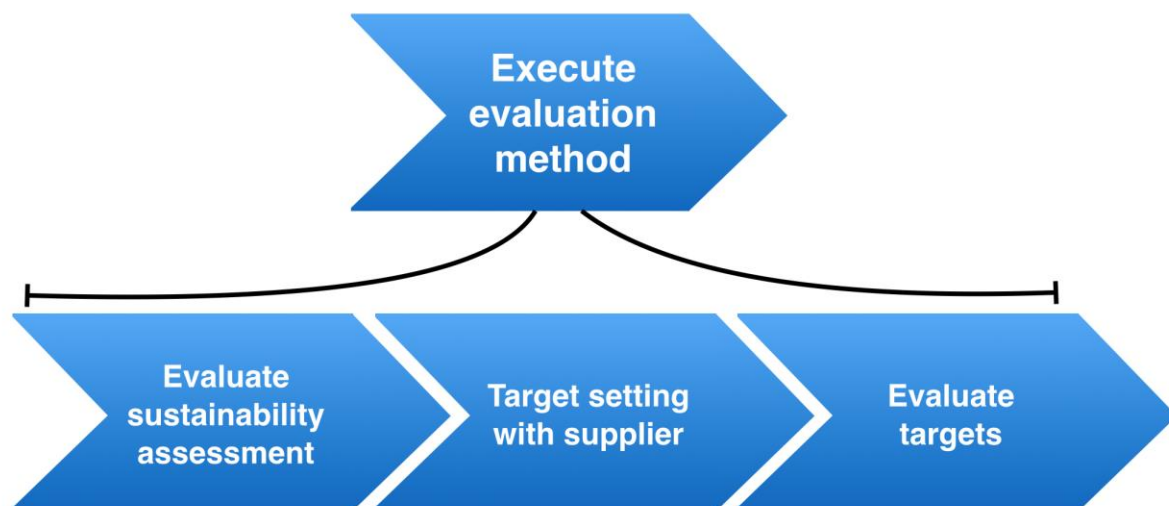


Figure 14: Three steps in executing the evaluation method

5.2.1. Evaluate sustainability assessment

As shown in the process of working towards supplier sustainability development as illustrated in Figure 6, a general sustainability assessment is conducted at the selected suppliers. This general sustainability assessment serves as input for this section. The results of the general sustainability

assessment present an overview of overall supplier sustainability performance. The results from the overall sustainability assessment need to be analyzed and, if necessary, benchmarked to identify sustainability areas with strong performance, but also identify sustainability areas in which the performance of the supplier in question is lacking. Such an analysis is the first step in getting a sense of which sustainability criteria need to be targeted with goal setting for a certain supplier.

5.2.2. Target setting with supplier

Determining the targets is the most important step in reaching supplier sustainability improvement. Setting good targets is challenging since targets need to meet certain requirements to be effective. Good targets have two main requirements, targets need to be specific instead of vague, and targets need to be challenging yet reachable (Latham & Locke, 1979). The reason that targets are required to be specific is that it allows the target setter to evaluate performance afterwards. A specific target is either reached or not reached whereas in the case of a vague target, there can be discussion about the whether the target is reached or not. In the case of the reachability of a target it is argued that challenging targets lead to better performance, if they are accepted by the executing company (supplier in this case) (Latham & Locke, 1979). This shows that setting challenging yet acceptable targets is important in triggering suppliers to work on sustainability issues. When suppliers do not accept goals, the willingness to reach these goals decreases and expected performance improvement is much lower or even insignificant. Suppliers tend to not accept goals if they feel like they are incapable of reaching the goals, or see no benefits for their own company when reaching the goals set (Latham & Locke, 1979). Situations in which suppliers do not accept the goals set have to be prevented and one way to do this is to include suppliers in the goal setting process.

Including suppliers early in the goal setting ensures that the improvement goals being set meet both the both the requirements of the buyer and supplier. Participation in goal setting increases goal acceptance and consequently increases chances for significant sustainability improvement (Latham & Locke, 1979). The input of the supplier can consist of indicating where they see opportunities for improvement in their own operations, or operations of their suppliers. This is valuable input and increases the probability that feasible and reachable targets are being set. Another element that needs consideration is the duration of the targets being set. Due to the lack of resources for yearly evaluation of targets and setting new target, it is advised to set multi-year targets with regular update reports from the supplier on target progress.

5.2.3. Evaluate targets

When clear targets are defined for suppliers, the evaluation of these targets is self-evident. Targets are either reached or not reached and consequently rewards or punishments are attributed to the supplier in question. Whether and when suppliers should receive rewards is discussed in section 6.2. Also, It is discussed what drives suppliers to engage and cooperate with programs such as CDP. The findings presented in that section also discuss the power of punishments and incentives with possible incentives being increased business, preferred supplier status, publicity due to awards and others.

5.3. Contribution to buyer company strategy

The last step in evaluating supplier sustainability improvement is linking the set targets to the overall business strategy of the buyer company. This way the contribution of the targets to the overall business goals of the buyer company can be determined. For this to be possible, the buyer company must have specific targets and goals in place for improving supplier sustainability. Including supplier

sustainability targets in the overall business strategy starts at the executive level of the buyer company. The company's vision and approach towards supplier sustainability has to be clearly communicated at the executive level. Additionally clear targets, metric, and milestones need to be set and regularly reviewed at the executive level. (UNGC and BSR, 2010). Subsequently senior management can translate these targets into specific targets for their own business groups. The role of each business group in reaching company targets has to be defined to ensure that each business group contributes to targets that it is supposed to contribute to. Only when senior management manages to successfully translate company targets to feasible business group targets, supplier sustainability improvement efforts have a chance of being successful. Linking supplier sustainability development program performance to overall company performance and strategy accomplishment is related to internal engagement at the company. The company strategy has to actively support the program by linking KPIs to the program and deploying the program from top management to bottom through the organization. More on internal engagement is discussed in section 6.1. Lack of internal engagement has also been identified as one of the main issues regarding the success of the CDP Supply Chain program and thus is very relevant to this study. Furthermore it is important to identify a way of analyzing supplier performance when implementing a supplier sustainability development program. This is one of the issues suppliers currently have with the CDP Supply Chain program. Suppliers know that the data is not used and thus do not feel a strong need for participating or putting extra effort in the program. This illustrates the need for an appropriate method of analyzing supplier performance that meets the needs of the program, which in the case of CDP Supply Chain in combination with a supplier sustainability improvement program at the buyer company, is collaborative target setting and analysis.

6. Internal and external engagement

This section discusses the proposed answers to the third research question. The third research question relates to describing and discussing elements that influence the chance of success of a supplier sustainability improvement program. The third research question is formulated as: *Develop a methodology and implementation plan to improve the use of supplier sustainability data in the strategic decision making process. What do companies need to do to optimize changes of successfully implementing a supplier sustainability development program?* The main elements in this research question are the prerequisites, which are needed to successfully implement a supplier sustainability improvement program. It can be said that responsible chain management can only exist when there is continuous alignment between internal and external expectations (De Bakker & Nijhof, 2002). This statement mentions the two main elements that influence the success of a supplier sustainability improvement program namely: internal and external engagement. This section discusses why internal and external engagement is important for the success of a supplier sustainability improvement program, and how internal and external engagement can be improved such that the chance of success of a program increases. First, internal engagement is discussed, followed by external engagement, supporting of suppliers, and how to deal with SMEs.

6.1. Internal engagement

Engagement refers to the degree of involvement and participation a person feels with a certain program. In the case of internal engagement it relates to the degree of involvement and participation employees in all levels of the organizations feel in relationship to a certain program, in this case a supplier sustainability improvement program. When implementing a new sustainability program, or any new program in general, it is important that widespread support and acceptance of the program is created. This broad base of support is needed to effectively and convincingly communicate the program with external stakeholders. This project focuses on supplier sustainability improvement programs and thus the main external stakeholders involved in such a program are suppliers. Before approaching suppliers with a proposal and a request to take part in sustainability improvement programs, the buyer company has to make sure internal alignment exists. In other words, ‘internal alignment always precedes external alignment with suppliers’ (PWC, 2013). So the question is, how can internal alignment/engagement be achieved? GreenBiz conducted research into employee engagement on sustainability in companies of different sizes. Three key success factors for sustainability engagement were identified (see Figure 26), namely: Executive commitment, Education & Communication, and Strategy & Goals (GreenBiz, 2014). What is concerning is that the same research identified two of the three critical success factors as also being one of the main hurdles for successful internal sustainability education (Figure 27). This shows that, although it is clear what the main success factors for internal engagement are, a significant amount companies are still not able or willing to put the necessary efforts into sustainability. Each of these critical success factors for internal engagement is discussed in the following sections.

6.1.1. Executive commitment

The success of every program starts with creating commitment at top management level. Top management has the authority to make strategic decisions and decisions on implementation of different programs. When trying to create top management commitment to supplier sustainability programs it is desired that top management has a certain level of environmental awareness and that environmental aspects are given the required priority in both company strategy and in daily

operations (Björklund, 2011). Several ways are mentioned in which top management can influence the development of sustainability programs. One of the main aspects is that top management should clearly articulate the company's vision on sustainability and approach to supply chain sustainability with concrete milestones and metrics (UNGC and BSR, 2010). These supply chain sustainability milestones and metrics are to be approved by top management and regular internal updates on accomplishment of these milestones need to be provided (UNGC and BSR, 2010). Furthermore top management needs to make sure that the buyer company's internal sustainability goals match the external sustainability goals set for the supply chain (Accenture, 2013). Matching of internal and external sustainability goals is important in showing suppliers that the buyer company is not only asking them to improve, but that it also wants to improve itself. It is important to present a supply chain sustainability focus instead of looking at companies in the supply chain as isolated entities. It can be concluded that top management has an important role in successfully deploying supplier sustainability programs and that top management can improve the internal engagement of such programs by clearly communicating support of the program, linking the program to the company's strategy and vision, defining milestones, and by providing regular internal updates on the development of the program.

6.1.2. Education & Communication

The second critical success factor for creating internal engagement is education and communication. Education and Communication are the main tools for deployment of any new program in a company. The bigger the company, the harder it is to reach and teach all employees on the new program, the benefits of the program, and the employees roll in helping the program succeed. Figure 27 shows that the bigger the company, the harder it is to have effective communication and education tools on new programs. Another problem is that, the bigger the company, the more programs will be introduced. This decreases attention to the individual programs since these are one of the many programs implemented over time. Despite the mentioned problems related to education and communication in large companies, it is important that employees gain familiarity with new programs. Familiarity allows them to effectively communicate the guidelines and goals of the program to external stakeholders. Furthermore it is important to educate employees on how the company intends to work with suppliers to reach and/ or exceed the goals of the program (UNGC and BSR, 2010). Several forms of education and communication can be used to inform employees throughout the organization, with one important form of communication being the previously mentioned communication of top management commitment and regular updates on goal achievement by top management. Popular forms of education are creating internal websites that inform the employees on the goals, value, and importance of the program, creating employee incentives to engage in and learn about the sustainability program, provide employee guidelines and handbooks on how to act on issues related to sustainability, and establish awards related to sustainability programs. Other examples of possible education methods can be found in Figure 28. This section outlines the value and needs of good education and clear communication, on the road towards successfully implementing sustainability programs.

6.1.3. Strategy and Goals

The last of the three critical factors to successful internal engagement is a clear strategy and challenging goals. Research has shown that for a program to be successful, cross-functional engagement is required (Walton et al., 1998). Here again, the role of top management is important. Top management needs to take ownership in translating high-level strategy goals into operational

objectives with appropriate metrics for middle management (UNGC and BSR, 2010). Middle management then has to do the same for employees in their respective divisions. This is the way in which a new program has to be deployed from top management down into every function in the organization. Each function in the organization needs to have their own specific sub metrics and take ownership of part of the program, for the program to be fully effective. If sustainability metrics are not developed and implemented as performance metrics in all functions, sustainability efforts might be perceived as additional workload (EPA, 2010). Practice has shown that it can be challenging to build a broad base of support across all function in the starting phases of a program (EPA, 2010). One way to address this problem is by developing close relationships with key managers and procurement in specific business units, and work with this select group of people in implementing the new program. This creates a sample of what the program can do and results can then be used to convince other business units to join the movement (EPA, 2010).

6.2. External engagement

The goal of a supplier sustainability development program ultimately is to improve overall supply chain sustainability. One requirement for the success of such a program is supplier engagement in the program. A supplier sustainability development program can only be effective when suppliers are willing to cooperate and work towards improvement. This willingness to cooperate in a supplier sustainability development program needs to be created at the suppliers during the implementation phase of the program. During the implementation phase of supplier sustainability development program the goal should be to create a shared mindset with suppliers regarding sustainability issues. Suppliers need to take ownership of their sustainability vision, strategy and performance (EPA, 2010; UNGC and BSR, 2010). This ownership of sustainability issues is critical in the success of any supplier sustainability program since it indicates that suppliers are internally motivated to improve their sustainability performance. Research has also addressed the need for supplier engagement as Baden, Harwood, Woodward (2009) showed that when suppliers are only participating in supplier sustainability development programs because of buyer insistence, suppliers can easily find ways to evade compliance/development without too much chance of detection. The need for creating external engagement is also emphasized by a UN Global Compact (2013) research, which identifies 'extending sustainability strategy through supply chain' as the main reason that multinational companies fail to advance in their overall sustainability performance (See Figure 27).

6.2.1. Supplier concerns

The three main barriers for a company to engage in sustainability practices are: executive commitment, Education & communication; and budget, resources & competing priorities (GreenBiz, 2014). In this section supplier concerns regarding each of these barriers are discussed.

Executive commitment at a supplier level depends largely on the effect of cooperating in the program on the competitiveness of the supplier. One part of supplier participation and cooperation in supplier sustainability development programs is that suppliers are requested to share information on their sustainability performance. This has proven to be an issue for a significant amount of suppliers for competitive reasons. Suppliers have indicated that the sharing of sustainability information with buyer companies is an issue because of the uncertainty of what will happen with the information once provided (EPA, 2010). Furthermore suppliers feel like providing information about their operations to buyer companies can put them at a disadvantage going in to future contract negotiations (EPA, 2010). Another significant concern of suppliers is that the information

shared with the buyer company shows bad environmental performance and jeopardizes the company's future business opportunities. Concerns about future competitiveness can result in green washing behavior that can be harmful for both the buyer and supplier. The concerns listed above all relate to the competitiveness of the suppliers and thus the commitment to the program. The second main barrier to engage in sustainability practices is Education & communication, or in other words, the lack thereof. Suppliers often perceive a lack of knowledge on their part for providing the information required by the buyer company. The fear of suppliers is that due to the lack of knowledge available, providing the information will take a significant amount of extra time and an increase in workload. This perception can lead to a box ticking approach that compromises the quality of data provided (Baden et al., 2009). Furthermore buyer companies tend to be inconsistent in their communication in relation to the program. This can result in skepticism at suppliers about the intentions of the buyer company for implementing the program. The last main barrier for engaging in sustainability practices is budget, resources & competing priorities. Suppliers mention the extra costs related to implementing extra sustainability practices. The concern of suppliers is that the extra costs related to implementing the program, and providing information to the buyer company, negatively affects their profits. The supplier concerns discussed in this section are legitimate issues that need to be addressed when implementing a supplier sustainability development program. The next section discussed what practices to adopt and what action to undertake to address the discussed supplier concerns.

6.2.2. What to do when implementing supplier sustainability development programs

During the implementation period of a supplier sustainability development program the buyer company has to address issues and concerns of suppliers to convince them to participate and to create supplier engagement for the program. Ample of research has been conducted into the practices of creating external engagement and which methods are most effective in doing so. This section discusses the Dos and Don'ts of creating supplier engagement for sustainability practices and addressing supplier concerns regarding sharing information.

One of the main barriers for companies, and thus also suppliers, to engage in sustainability is executive commitment at the company. Executive commitment, or lack thereof, towards sustainability depends on how the competitiveness of the company is influenced and if executives see value in the program. Suppliers indicate that concerns are in place regarding the use of sustainability information that they provide. In many cases it is unclear how the requested information is going to be used and this creates suspicion at suppliers. These concerns can be addressed by creating trust at the suppliers by sharing data and knowledge about the buyer company's path towards sustainability improvement (EPA, 2010). Another solution for the concern of sharing information is for the buyer company to work with a third party when gathering data from suppliers (EPA, 2010; UNGC and BSR, 2010). This third party can serve the interests of suppliers in protecting sensitive information. By creating trust between parties and using a third party to gather data, the concern of using the provided information for the wrong purposes is addressed. The third element in creating executive commitment is by explaining the value of the proposed program to the suppliers. The value of a supplier sustainability development programs can be shown by outlining how the incorporation of this program can result in identifying inefficiencies and implementing measures that yield significant cost savings (EPA, 2010). The buyer company can substantiate these statement by outlining how implementing the same sustainability program at the buyer company, has helped them to either reduce cost or operate more efficiently. In other words,

buyer companies can share their own success stories in sustainability to convince suppliers to also engage in sustainability. Furthermore setting incentives for strong performance can increase the value of engaging in the proposed program. These incentives can add to the already existing value of the program. Examples of possible incentives that can be set by a buyer company are: preferred supplier status, increased future business, less future audits, recognition and/or awards for strong performance, and increased collaboration in new product development (UNGC and BSR, 2010). When setting incentives for good performance and providing security about handling sensitive information is still not enough to create executive commitment at a supplier, buyer companies have the opportunity to work with their industry competitors and together request similar suppliers to engage in supplier sustainability development programs. By teaming up with industry competitors, buyer pressure on the supplier increases. Research has shown that increased buyer pressure is related to an increased willingness to share sustainability info (Jira & Toffel, 2013; Krause & Ellram, 1997). The buyer company however has to be wary that increasing buyer pressure does not result in a box-ticking approach instead of actual supplier engagement.

The second barrier for engaging in sustainability practices is the lack of knowledge/education at suppliers, and inconsistent communication related to the program by the buyer company. The buyer company has an opportunity to assist suppliers in expanding their knowledge regarding sustainability issues and other areas related to the proposed program. The buyer company can provide assistance in training and educating supplier employees in understanding the importance of sustainability and the program, the value of the program for the supplier, how to calculate GHG-emissions, and other important elements related to the program. The first goal of these training activities should be to raise awareness of the program and creating employee engagement. Types of training activities are, among others: face-to-face or online workshops, establishing a network of resources surrounding the program, examples of relevant calculations (EPA, 2010; UNGC and BSR, 2010). The idea is that employees receive training with basic knowledge about the program, and afterwards, have ample of resources available that they can consult for further questions. The role of the buyer company is to provide assistance in creating and developing trainings or employee resources. Another issue that is mentioned as a barrier for engaging in sustainability practices is the lack of (consistent) communication. The buyer company can address this barrier by being consistent in their communication about the program, the goal of the program, and why the program is important to the buyer company. Ideally the results of the program would have to be linked to the buyer company's sustainability strategy KPIs. The link between strategy KPIs and program performance emphasizes the importance of the program for the buyer company and can be used to indicate to suppliers why their sustainability performance matters. Linking KPIs to the sustainability program that is to be implemented shows commitment to the program and puts words into actions (Baden et al., 2009). Furthermore it is suggested to include sustainability/program expectation into the regular dialogue between buyer and supplier. Doing this helps to reinforce the sustainability message of the buyer company, and helps create shared mindsets, and opportunity for feedback in both ways (UNGC and BSR, 2010). Regular communication and mutual transparency result in a consistent and clear message both ways.

The third main barrier for engaging in supplier sustainability practices is lack of budget and resources. This is an argument that many suppliers make since they feel implementing sustainability practices and methods do not only require high investments, but also requires a lot of time and attention by employees. Buyer companies have two main things that they can do to influence

suppliers and reduce this third barrier. First of all the company has to make sure that suppliers understand the value of the program and how the program can contribute to making supplier operations more efficient, and thus can result in extra savings. When budget constraints are extremely stringent and the buyer company sees high value in implementing supplier sustainability methods at that specific supplier, it can consider sharing the costs of implementing sustainability methods with the supplier.

The Dos and Don'ts for implementing- and raising awareness for a supplier development program are summarized in Table 5.

Dos	Don'ts
+ Be consistent in communication about the program. Words should match your actions for a supplier to believe your commitment to the program and supply chain sustainability	- Send inconsistent messages either in words or actions
+ Show buyer company's commitment to sustainability by sharing their own success stories to demonstrate potential for improvement	- Expect supplier to work on sustainability issues while not undertaking any similar actions yourself
+ Approach peers in your industry to collaborate with in improving sustainability practices at matching suppliers. This way more buyer pressure can be exerted on suppliers	- Try to force suppliers into engaging in the sustainability program by yourself
+ Respect business sensitive information.	- Use business sensitive information in negotiations that are not related to the sustainability program for which the information is gathered
+ Incorporate program expectations in supplier-buyer dialogue regularly. Provides a platform for feedback and shows the importance of the program for the buyer company	- Request information related to the program one a year without providing feedback. Will create suspicion at supplier on why the information is requested and what the information is used for
+ Create incentives for supplier to engage in the program. Incentives motivate suppliers to work on their sustainability performance. Incentives are needed since research has shown that self-regulation without additional incentives, does not work. Economic interest will prevail of sustainability interests.	- Only penalize suppliers when they do not reach the sustainability goals set.

Table 5: Dos and Don'ts in creating supplier engagement (Baden et al., 2009; EPA, 2010; Jira & Toffel, 2013; UNGC and BSR, 2010)

6.3. Targeting SMEs

Targeting SMEs with supplier sustainability development programs requires special consideration from the buyer company. Drivers for SMEs differ from drivers of multinational companies and thus do SMEs require a different approach. Research indicated that the two main barriers for SMEs to engage in sustainability are lack of knowledge and lack of funds (Lu et al., 2009) (see Figure 29). Section 6.2.2. shows that one of the main drivers for suppliers, that are categorized as multinationals, to engage in supplier development methods proposed is buyer pressure. Supply chain pressure has also been indicated as one of the main drivers for SMEs to engage in supplier development practices although supply chain pressure was not the main driver identified. Research shows that the willingness of SMEs to engage in proposed supplier development methods mainly depends on SME owner/ managers' values with respect to sustainability (Baden et al., 2009). Furthermore SMEs willingness to engage depends on how the results on these supplier development efforts affect the buyer company's procurement decisions. SMEs need to genuinely believe that their

performance will affect their chances of success in future tenders for new business (Baden et al., 2009). Without this belief SMEs tend to end up in a box ticking approach towards supplier sustainability development efforts, just to not get penalized by the buyer company. With owner/manager values and beliefs and the effect on future business tenders being the main indicators for willingness of engagement of SMEs, buyer companies need to focus on addressing these two elements when approaching SME suppliers with such a proposal. Addressing these issues can be done by meeting with SMEs decision makers and explain the value and opportunities of such programs, and by setting internal standards and guidelines on how performance of suppliers will be implemented in future decision making.

6.4. General remarks on implementation

This chapter describes the challenges that need to be addressed when implementing a supplier sustainability development program. It is important to note that internal engagement needs to precede external engagement in order to bring the message across effectively. Internal guidelines need to clearly state the role of the program in the overall strategy, the value of the program for all stakeholders, the goal of the program, how success of the program will be measured, and a timeline with steps to take on how to achieve this goal. After establishing internal engagement, the program needs to be implemented with care. It is suggested to first conduct a pilot with a small amount of suppliers to check whether the program can do what you expect it to do. The success of the pilot determines the speed at which the program will be deployed in full scale (EPA, 2010). The last, but certainly not least important element is creating external engagement. How to create or boost external engagement is discussed in section 6.2. It is however important to present some guidelines on how to deal with suppliers. Hughes & Wadd (2012) provided these guidelines in their seven principles of effective Supplier Relationship Management (SRM).

The seven principles of SRM are defined as follows (Hughes & Wadd, 2012):

1. Focus SRM efforts on suppliers where there is the greatest potential to create value and reduce risk (see RQ1)
2. Treat all suppliers with a high degree of professionalism (RQ3)
3. Invest in understanding supplier better
4. Invest in helping suppliers understand you better (RQ3)
5. Actively built and sustain trust with suppliers (RQ3)
6. Invite supplier feedback on your own company's performance and track benefits to suppliers
7. Invite and be open to ideas and suggestions

These principles give an idea on how to approach working with suppliers and help understand that working with suppliers is a process of collaboration rather than a one-way demand/request. This brings us back to the ultimate goal of supplier sustainability development efforts which is to develop a share mindset about sustainability issues, create supplier ownership over their own sustainability performance, vision, and strategy and work closely with suppliers on other areas of share priorities (hence the collaboration) (EPA, 2010; UNGC and BSR, 2010).

7. Conclusion

This study discussed the practical problems related to implementing supplier sustainability development programs at multinationals. Research within company X and in published articles both identified lack of internal and external engagement as one of the major obstacles to successfully implementing such programs. Furthermore multinationals indicate problems with selecting the relevant suppliers from their broad supply bases to invite for such programs.

This study proposed a step-wise approach in implementing supplier sustainability development programs, which addresses these issues step by step. Before starting to implement a supplier sustainability development program, internal engagement needs to be created. When creating internal engagement the buyer company needs to focus on three main aspects namely: Executive commitment, Education & Communication, and Strategy & Goals. The success of every new program implemented in a company largely depends on executive commitment. Executive management can be the driving force for new programs such as sustainability development programs by emphasizing the importance of the program, incorporate program performance in KPIs, and provide regular updates on program performance. Executive commitment is the cornerstone of creating internal engagement but not the full story. Internal engagement means that engagement is created across all functions on all levels of the company. Online courses and training sessions are methods of creating understanding and engagement across functions but these education methods need to be supplemented by strategic targets and KPIs for all functions involved with the program and with suppliers. These three elements together strongly increase chances of internal engagement and are the first practical hurdle to successfully implementing a supplier sustainability development program.

The second main practical problem related to implementing supplier sustainability programs in practice is the question of which suppliers to include. Multinationals tend to quickly increase the number of suppliers included in such programs due to reporting advantages. This sharp increase in the number of suppliers included results in an overflow of data and lack of overview on where problems occur in the supply chain. This study proposes a six-step potential improvement supplier identification process (Figure 7) that compares a group of suppliers on three main areas namely sustainability risk, spend at supplier and buyer impact on supplier. The analysis based on these three elements gives the buyer company increased insights in the characteristics of the group of suppliers and at which suppliers improvement is most likely. It is suggested that suppliers that have the highest combination of sustainability risk and buyer impact are the best potential suppliers to include in the analysis since chances and potential for improvement is highest at these suppliers. Once suppliers are included in the program the collaborative target setting approach is suggested to work with suppliers towards actual sustainability improvement. Collaborative target setting is related to increased motivation to reach targets at suppliers and a larger adoption rate of targets set.

The final element in the study relates to creating external engagement, which when correctly implementing the previous steps discussed is in large part created automatically. The level of external engagement is strongly related to internal engagement at the buyer company and including suppliers in the development and target setting in the program. Consistent communication of the importance of the program by the buyer company is needed which again results from strong internal engagement.

Overall, when looking back on the main research question that was formulated as: *What steps need to be taken to improve the value of supplier sustainability methods for buyer companies?*. It can be argued that the main thing the buyer company needs to consider is how to create internal engagement for such a program. When strong internal engagement is established, external engagement will follow from the clear and consistent communication about the program between suppliers and buyer company. External engagement is also improved by selecting the right suppliers to include in the program. The main steps buyer companies need to consider when starting to implement supplier sustainability development programs are: Create a clear goal and target for the program, create strong internal engagement, select the right suppliers to be included in the program, and actively manage suppliers included with clear and consistent communications.

7.1. Implications for company X

All in all significant steps need to be taken in the approach towards implementing supplier sustainability development programs. When relating all this to the CDP Supply Chain program within X it can be concluded that when implementing this program, internal engagement was not established correctly or intensively enough. This caused the program to have a weak foundation which significantly decreased the chances of the program being successful within X. In its current form, the CDP Supply Chain does not present any added value for X. It does not improve supply chain sustainability, does not reduce costs and does not ensure compliance. X has to decide which actions it wants to take with regards to the future of the program. Three options are available for X and these are: stop with the CDP Supply Chain program as such, keep the CDP Supply Chain program in place and adjust how it is used to create value for the program, or replace the CDP Supply Chain program with another external program or an internal developed program that addresses the same issues. For the purpose of applicability of this paper, the second option on improvement of the program is chosen. In order to reach improvement for the CDP Supply Chain program within X, it needs to re-assess the goal of the program and first establish internal engagement for the program with a company- and sustainability strategy that includes KPIs related to the program. This is the base that a voluntary supplier sustainability development programs need to be efficient and of value. After establishing internal engagement, the next step is to re-evaluate suppliers to be included in the program and work with these suppliers towards improvement. An extensive analysis of the CDP Supply Chain program and its role within X is presented in Appendix C.

7.2. Implementation phase

Implementation of the proposed methods requires a significant amount of resources. The methods proposed require employees that push and promote the program internally, assess suppliers on the criteria on whether or not to be included in the program, actively manage suppliers included in the program and work with these supplier towards improvement, and collaborate in target setting with suppliers. This shows that plenty of resources are needed to manage and promote a program such that its chances for success are as high as possible. This is why executive commitment towards-, and the definition of the importance of such programs are essential. Depending on the number of suppliers that the buyer company wants to include in the program, the number of human resources needed can range from 3FTE for a small set of suppliers, towards approximately 6FTE for larger sets of suppliers. The increase in FTEs mostly related to increased workload in collaborative target setting, target evaluation and accomplishment, and the managing of larger groups of suppliers. The FTEs do not need to be single employees for whom their only task is to work towards success of supplier sustainability development programs. The proposed FTE workload is distributed among all

employees involved in the program such as account managers, sustainability department, compliance department and others. Average yearly salary in the Netherlands is approximately 25000 euro. This comes down to a yearly investment of 75000-150000 euro depending on the size of suppliers included.

Besides human resources, the proposed methods need some other investments to be user friendly. Multinationals tend to have numerous databases which all contain small pieces of data about suppliers. For this method to be user friendly, supplier data and characteristics need to be available centrally. Otherwise the method of deciding which suppliers to include in the program will be very labor intensive. Collecting and bundling all this supplier data into one database requires a significant time- and financial investment. The financial investment needed for this action depends on how scattered the data is across all databases.

Lastly, when buyer companies decide to work with a third party, such as CDP Supply Chain, in order to collect and manage supplier data, a yearly membership fee needs to be paid. This membership fee is estimated to be 10000 euros a year.

Adding all this together, the buyer company is looking at an annual investment of at least 100000 euro for effectively implementing and managing supplier sustainability development program. Costs can increase depending on the group size of suppliers included. This again emphasizes the importance of clearly defining the program, what it adds to the buyer company, and to create internal engagement.

7.3. General managerial insights

When buyer companies are contemplating whether or not to implement supplier sustainability development programs they have to acknowledge the efforts and challenges of implementing such programs. Buyer companies need to be fully committed to spend resources on supplier sustainability development program in order for the program to have a chance of being successful. The first thing that needs to be done is to establish the goals for the program and the KPIs related to the program. Furthermore the importance of the program for the buyer company needs to be acknowledged by leadership. Creating strong internal engagement is the base that increases chances of the program being successful. Furthermore buyer companies need to be very selective in which suppliers to include in the program, especially at the start of the program. It is advised to start of with a small pilot of identified improvement suppliers to see how the program works and if the program meets expectations. The proposed sustainability risk supplier/ potential improvement supplier identification method can be used to select suppliers to be included in the pilot group. Finally the buyer company needs to have a clear view of what they want from the program and how they communicate this towards suppliers. If this specific program needs to have high importance at suppliers, the buyer company needs to make sure that its actions reflect this importance. Consistency in communications and deeds is necessary here. These are the main factors buyer companies need to consider when starting to implement supplier sustainability development program, since good decisions on these factors create a strong base for the program.

7.4. Limitations and future research

Even though this study presents an alternative approach that assesses some practical problems experienced in multinationals when trying to implement supplier sustainability development programs, this method also has its limitations. First of all the analysis as currently presented is

relatively resource intensive since the analysis on identifying potential improvement suppliers needs human judgment on levels of sustainability risk and buyer impact to decide which suppliers to include in the program. Furthermore it is suggested to actively manage suppliers and work with collaborative target setting. This too requires a significant amount of human resources. The method as presented works when targeting a small amount of suppliers however when the buyer company wants to extend the number of suppliers included, databases that include all supplier characteristics need to be bundled in order to automate the analysis. Experience within X showed that different supplier characteristics are stored in different databases with ownership by different people. Combining all these is a huge task. Furthermore practice shows that in general, the main environmental impacts in the supply chain go back further than first tier suppliers. Additional research needs to be done on how to expand sustainability strategy and programs past tier-1 suppliers all the way into the supply chain. One could think of research on issues such as how to convince suppliers to implement likewise programs for their suppliers and thus creating a chain reaction, the effectiveness of approaching suppliers further back than tier-1 suppliers, motivations of suppliers past tier-1 for participating in sustainability programs, and methods for visualizing where environmental impacts occur in the supply chain to better inform end-users of the products. The problem of the effect of sustainability development efforts being limited to tier-1 suppliers is experienced by a number of multinationals and practical guidelines on how to do this are limited.

7.5. Contributions to literature

This paper looked into the issues of supplier sustainability development programs at multinationals and compared how findings in scientific literature related to the business situation in which these companies operate. On the topic of internal and external engagement, findings in literature can be well reflected on the business cases of these multinationals. However on the topic of how to decide on which suppliers to include and how to assess these suppliers a gap needed to be bridged between findings in literature and practical problems experiences at multinationals. This paper elaborates on the findings of Kraljic (1983) and presents a more in depth approach for differentiating between suppliers based on basic supplier characteristics, combined with spend data and a factor of buyer impact. These additions to the model allow buyer companies to make better-informed decisions in selecting a subgroup of suppliers to include in the program. The proposed method addresses the issues lack of resources to actively manages all suppliers, and lack of supplier willingness to participate in the program. Lack of resources to actively manage all suppliers is addressed by providing the buyer company a tool to make decisions between suppliers are reduce the number of suppliers included, whereas the willingness of suppliers to participate is addressed by the indicator of buyer impact, since high buyer impact relates to increased willingness to participate in buyer company initialized programs. On the issue of assessing supplier performance and improvement on sustainability, literature suggests several numerical methods for ranking suppliers. In practice however, it turns out that many of these methods are not applicable due to lack of data and low quality of available data. Also supplier willingness to participate in the program decreases when it is not clear to them how their performance will be rated. This is why, in cases of implementing supplier sustainability development programs, assessment methods with clear and simple assessment criteria are proposed.

Overall it can be concluded that this paper combines theoretical knowledge on the field of green supply chains with practical problems experiences at multinationals. The methods proposed in this paper expand or adjust methods presented in literature to meet the needs of multinationals when

implementing supplier sustainability development programs. The main problems experienced related to implementing such programs are addressed in these methods by adding elements from other theoretical field in order to, for instance, improve willingness of participation at suppliers.

8. References

- Accenture. (2013). *The Sustainable Organization: Lessons From leaders in Series*. Accenture.
- Baden, D. a., Harwood, I. a., & Woodward, D. G. (2009). The effect of buyer pressure on suppliers in SMEs to demonstrate CSR practices: An added incentive or counter productive? *European Management Journal*, 27(6), 429–441. doi:10.1016/j.emj.2008.10.004
- Björklund, M. (2011). Influence from the business environment on environmental purchasing - Drivers and hinders of purchasing green transportation services. *Journal of Purchasing and Supply Management*, 17, 11–22. doi:10.1016/j.pursup.2010.04.002
- Carter, C. R., & Easton, P. L. (2011). Sustainable supply chain management: evolution and future directions. *International Journal of Physical Distribution & Logistics Management*, 41, 46–62. doi:10.1108/096000311111101420
- Carter, C. R., Kale, R., & Grimm, C. M. (2000). Environmental purchasing and firm performance: An empirical investigation. *Transportation Research Part E: Logistics and Transportation Review*, 36, 219–228. doi:10.1016/S1366-5545(99)00034-4
- Carter, C. R., & Rogers, D. S. (2008). A framework of sustainable supply chain management: moving toward new theory. *International Journal of Physical Distribution & Logistics Management*, 38, 360–387. doi:10.1108/09600030810882816
- Chan, K., Charles, a, & Young, K. (1990). The Supplier Development Program : A Conceptual Model. *Journal of Purchasing and Materials Management*, 26(2), 2–7.
- Chopra, S., & Sodhi, M. S. (2004). Managing Risk To Avoid Supply-Chain Breakdown. *MITSloan Management Review*, 46(1), 53–61.
- Cousins, P. D., Lamming, R. C., & Bowen, F. (2004). The role of risk in environment-related supplier initiatives. *International Journal of Operations & Production Management*, 24(6), 554–565.
- Cousins, P. D., Lamming, R. C., & Bowen, F. E. (2004). *The Role of Risk in Environment-Related Supplier Initiatives*. doi:10.1108/01443570410538104
- De Bakker, F., & Nijhof, A. (2002). Responsible chain management: A capability assessment framework. *Business Strategy and the Environment*, 11, 63–75. doi:10.1002/bse.319
- Ecorys. (2012). *Mapping resource prices : the past and the future*.
- Elkington, J. (1998). Partnerships from Cannibals with Forks : The Triple Bottom Line of 21st-Century Business. *Environmental Quality Management*, 37–51.
- EPA. (2010). *Managing Supply Chain Greenhouse Gas Emissions - Lessons learned for the road ahead*.
- European Commission. (2010). *Critical raw materials for the EU, Report of the Ad-hoc Working Group on defining critical raw materials*. European Commission (Vol. 39). doi:10.1002/eji.200839120.IL-17-Producing
- Faris, C. (E&Y), Gilbert, B. (E&Y), LeBlanc, B. (E&Y), Ballou, B. (Miami U., & Heitger, D. L. (Miami U. (2013). *Demystifying sustainability risk: Integrating the triple bottom line into an enterprise risk management program*.
- Foerstl, K., Reuter, C., Hartmann, E., & Blome, C. (2010). Managing supplier sustainability risks in a dynamically changing environment-Sustainable supplier management in the chemical industry. *Journal of Purchasing and Supply Management*, 16(2), 118–130. doi:10.1016/j.pursup.2010.03.011
- GreenBiz. (2014). *Sustainability & Employee Engagement - The State of The Art*.

- Handfield, R., Sroufe, R., & Walton, S. (2005). Integrating environmental management and supply chain strategies. *Business Strategic Environment*, 14, 1–19.
- Handfield, R., Walton, S. V., Sroufe, R., & Melnyk, S. a. (2002). Applying environmental criteria to supplier assessment: A study in the application of the Analytical Hierarchy Process. *European Journal of Operational Research*, 141, 70–87. doi:10.1016/S0377-2217(01)00261-2
- Holliday, C. O. J., Schmidheiny, S., & Watts, P. (2002). *Walking the Talk: The Business Case for Sustainability*. San Francisco, CA: Berrett-Koehler Publishers Inc.
- Hughes, J., & Wadd, J. (2012). Getting the Most Out of SRM. *Supply Chain Management Review*, (January/February), 22–29.
- Jira, C. F., & Toffel, M. W. (2013). Engaging Supply Chains in Climate Change. *Manufacturing & Service Operations Management*, 15(January 2015), 559–577. doi:10.1287/msom.1120.0420
- Kraljic, P. (1983). Purchasing must become supply management. *Harvard Business Review*, (September - October), 109–117.
- Krause, D. R., & Ellram, L. M. (1997). Critical elements of supplier development The buying-firm perspective. *European Journal of Purchasing & Supply Management*, 3(1), 21–31. doi:10.1016/S0969-7012(96)00003-2
- Krause, D. R., Handfield, R. B., & Scannell, T. V. (1998). An empirical investigation of supplier development: reactive and strategic processes. *Journal of Operations Management*, 17(1), 39–58. doi:10.1016/S0272-6963(98)00030-8
- Kumar, A., Jain, V., & Kumar, S. (2014). A comprehensive environment friendly approach for supplier selection. *Omega (United Kingdom)*, 42(1), 109–123. doi:10.1016/j.omega.2013.04.003
- Larson, P. D., & Kulchitsky, J. D. (1998). Single Sourcing and Supplier Certification. *Industrial Marketing Management*, 27(1), 73–81. doi:10.1016/S0019-8501(97)00039-4
- Latham, G. P., & Locke, E. a. (1979). Goal setting—A motivational technique that works. *Organizational Dynamics*, 8(2), 68–80. doi:10.1016/0090-2616(79)90032-9
- Lee, A. H. I., Kang, H.-Y., Hsu, C.-F., & Hung, H.-C. (2009). A green supplier selection model for high-tech industry. *Expert Systems with Applications*, 36(4), 7917–7927. doi:10.1016/j.eswa.2008.11.052
- Lu, L. Y. Y., Wu, C. H., & Kuo, T. (2009). Environmental principles applicable to green supplier evaluation by using multi- objective decision analysis. *International Journal of Production Research*, 45(18-19), 4317–4331. doi:10.1080/00207540701472694
- Matthews, H. S., Hendrickson, C. T., & Weber, C. L. (2008). The Importance of Carbon Footprint Estimation Boundaries. *Environmental Science and Technology*, 42, 5839–5842.
- Milkman, K., Chugh, D., & Bazerman, M. (2009). How can decision making be improved? *Psychological Science*. doi:10.1111/j.1745-6924.2009.01142.x
- Mitchell, V.-W. (1995). Organisational risk perception and reduction: a literature review. *British Journal of Management*, 6, 115–133.
- Mukherjee, K. (2012). *Supplier selection criteria and methods: past, present and future*. Kolkata. Retrieved from <http://mpra.ub.uni-muenchen.de/60079/>
- Noci, G. (1997). Designing “green” vendor rating systems for the assessment of a supplier’s environmental performance. *European Journal of Purchasing & Supply Management*, 3(2), 103–114. doi:10.1016/S0969-7012(96)00021-4

- Pal, O., Gupta, A. K., & Garg, R. K. (2013). Supplier Selection Criteria and Methods in Supply Chains : A Review. *International Journal of Social, Education, Economics and Management Engineering*, 7(10), 27–33.
- PWC. (2013). *Supplier Relationship Management How key suppliers drive your company's competitive advantage*.
- Ritchie, B., & Brindley, C. (2007). Supply chain risk management and performance - a guiding framework for future development. *Journal of Operations & Production Management*, 27(3), 302–322.
- Srivastava, S. K. (2007). Green supply-chain management: A state-of-the-art literature review. *International Journal of Management Reviews*, 9(1), 53–80. doi:10.1111/j.1468-2370.2007.00202.x
- UN Global Compact. (2013). Global Corporate Sustainability Report 2013, 28.
- UNGC and BSR. (2010). *Supply Chain Sustainability: A Practical Guide for Continuous Improvement*. Retrieved from http://www.unep.fr/scp/business/dialogue/2011/pdf/UNEP_2011_BIGD_Agenda.pdf
- van Hoek, R. I. (1999). From reversed logistics to green supply chains. *Supply Chain Management: An International Journal*, 4(3), 129–135. doi:10.1108/13598549910279576
- Van Weele, A. J. (2009). *Purchasing and Supply Chain Management* (5th ed.). Eindhoven: Thomas Rennie.
- Walton, S. V., Handfield, R. B., & Melnyk, S. a. (1998). The Green Supply Chain: Integrating Suppliers into Environmental Management Processes. *International Journal of Purchasing and Materials Management*, 34, 2–11. doi:10.1111/j.1745-493X.1998.tb00042.x
- Zsidisin, G. a., Panelli, A., & Upton, R. (2000). Purchasing organization involvement in risk assessments, contingency plans, and risk management: an exploratory study. *Supply Chain Management: An International Journal*, 5(4), 187–198. doi:10.1108/13598540010347307

9. Appendices

Appendix A

Sustainability risks can be assessed by several assessment methods, which estimate the probability of a risk occurring and the consequence when a risk occurs. This section describes the assessment methods per defined sustainability risk and the level of difficulty of assessment for each of the assessment methods. Several assessment methods are indicators for multiple sustainability risks and are described in detail the first time the indicator is mentioned. After that recurring indicators will be briefly described in relation to the specific sustainability risk being discussed.

Business risk can be assessed on different areas. The assessment areas can either relate to the probability of business risk occurring or the impact when business risk occurs. Business risk is defined as the financial risk of working with suppliers that are not profitable or might not stay in business for long. One of the assessment methods that can be used to assess the probability of business risk occurring is ISO certification. ISO certification is proof of efficient and high quality practices in a company and indicates reduced chance of going out of business due to internal factors. ISO standards are the most widely used standards on issues regarding to quality of practices. This makes ISO standards a suitable assessment method for the internal practices of a supplier. Additionally ISO standards are easy to assess since suppliers are either certified or not. This is another characteristic, which makes ISO certification a suitable assessment method for assessing risk suppliers. The three other assessment methods mainly focus on the impact on the buyer company when business risk occurs. The suggested assessment methods are: contract duration, sourcing type, and supplier financial impact. Contract duration is an indication of consequence since long-term contracts indicate a long-term commitment between buyer and supplier and thus also result in higher impact if supplier goes out of business i.e. long-term contracts pose more risk to buyer than short-term contracts. Long-term contract are defined as contract between buyer and supplier with a duration of longer than one year. The majority of sourcing contracts is year-based and longer commitments can be characterized as long-term. Furthermore, contract duration is easy assessable since knowledge about contract duration is available within the buyer company, which makes it suitable as assessment method business risk. Sourcing type indicates the type of sourcing relation between buyer and supplier. Three sourcing types are solo sourcing, single sourcing, and multiple sourcing. Solo sourcing means that no substitute suppliers are available whereas single sourcing refers to the case in which the buyer company choses to work with one supplier but others are available (Larson & Kulchitsky, 1998). Solo sourcing poses the highest risk to the buyer company since no substitutes are available and the impact of going out of business is biggest, followed by single sourcing and multiple sourcing. In the situation of single and multiple sourcing the impact on the buyer company can be reduced by using alternative suppliers. Sourcing type is another assessment method that is easy to assess single knowledge is internally available. The last suggested assessment method is supplier financial impact. Supplier financial impact can be estimated by spend at a supplier and is slightly harder to assess since quality spend data is not always available. Financial impact is an indicator of consequences of several risk criteria and can thus also be used as a general indicator of consequence.

Supply disruption risk is defined as risk of supply disruptions due to external factors such as natural disasters or labor disputes and can be assessed by two methods namely: sourcing type and

component impact. Sourcing type relates to the probability of supply disruption risk at a supplier. When buyer companies work with solo or single sourcing they are dependent on one supplier for the full capacity of the products that is needed. Whereas in multiple sourcing they can increase demand at other suppliers when a specific supplier has problems with meeting demands. Solo sourcing refers to higher supplier capacity risk, followed by single sourcing and multiple sourcing. Sourcing type is easily assessable since knowledge is available in-house. Component impact relates to the consequence of supply disruption risk. If supplier capacity risk occurs and thus supply disruptions occur, the criticality of the components that is not delivered, will be an indicator of the impact on the buyer company. Critical components, without which processes need to be stopped or delayed, have much higher impact on the buyer company compared to non-critical components. Levels of criticality of components however are hard to assess since in general there is no clear overview of all the consequences that will occur when the component is not available (production delays, financial loss, goodwill losses etc.). This makes component impact difficult to assess and thus less suitable for the risk supplier identification models since the goal is to use as many basic measures and assessment methods as possible.

Quality risk refers to the quality, and the lack thereof, that is delivered by suppliers. The quality of output of the whole supply chain depends on the quality of individual components that are being delivered by suppliers. One assessment method that can be used when looking at the probability of quality risk occurring is if suppliers are ISO certified. ISO 9001:2008 (soon to be replaced by ISO 9001:2015) defines several sets of requirements, which operations and practices at companies have to meet, to be certified as having a good quality management system. ISO 9001 is the general standard that can be applied to almost all industries. Some industries have additional standards which complement the original ISO 9001 standard with industry specific requirements. Some examples of industry specific standard are presented in Table 6. ISO certification is easy to assess and thus a suitable method to include in the risk supplier identification method.

Standard	Industry
ISO / TS 16949	Automotive production and relevant service part organizations
ISO / TS 29001	Petroleum, petrochemical and natural gas industries
ISO / IEC 17025	Competence of testing and calibration laboratories
ISO / 13485	Medical devices
AS/EN 9100	Aerospace
ISO 22000	Food safety
ISO/IEC 27001	Information technology, security techniques, Information security management systems

Table 6: Industry specific quality standards

A second assessment method that can be used to assess the consequence of quality risk is, if there are supplier buyer contract assurances in place. Buyer supplier contracts can include agreements on quality of products and compensation clauses in case delivered products do not meet requirements. The presence of buyer supplier contracts and agreements on quality of products is an assessment method that is easy assessable since knowledge of such contracts is available within the buyer company. This makes the presence of buyer supplier quality contracts a suitable assessment method to be included in the risk supplier identification model.

Strategic exposure risk refers to a situation in which the buyer company is over-reliant on a single or limited number suppliers and when little substitute suppliers are available. This situation can occur when only a limited number of suppliers are able to deliver the required products with the

specifications the buyer needs. In such a case, suppliers have limited competition for their services/product and thus have a strong negotiation position in discussions with the buyer company. The probability of strategic exposure risk occurring depends on the availability of substitute suppliers. The more substitute suppliers are available the lower the dependency of the buyer company on the supplier. The availability of substitute suppliers however is not always easy to determine since there is not always an up-to-date overview available of possible suppliers and their competences. Research needs to be conducted to estimate the number of available substitute suppliers. The assessment of substitute suppliers is categorized as moderately suitable to be included in the risk supplier identification method because of the work that is needed to estimate the number of substitute suppliers. The consequence of strategic exposure risk can be assessed by the components' financial impact. When strategic exposure risk occurs and when issues occur in the production process of the specific supplier, the consequence for the buyer company can be estimated by the financial impact of the component at the buyer company. This financial impact however is hard to estimate since it depends on multiple areas such as among others, the criticality of the component, the average amount of the component purchased, and the price of the components. Since it is hard to estimate the financial impact of a component, this assessment method is categorized as not suitable to include in the risk supplier identification model, since the method requires too much in-depth research and time to be included in a general risk assessment method.

Technological exposure risk can occur when a buyer company is over-reliant on a single or limited source of a product, process, or technology. Technological exposure risk can result in problems with future legislation but also in an increased impact on the environment. The probability of technological exposure risk can be estimated by two assessment methods. Namely the availability of substitute components/materials that meet the requirements, or the component risk. The availability of substitute components and materials needs to be estimated by doing market research and keeping an eye on technological developments. Doing this is time consuming and requires significant effort, which makes the assessment method moderately suitable for being included in the risk supplier identification method. The second assessment method for technological exposure risk is the risk of the commodity delivered by the supplier. The commodity risk has two components namely the supply risk and regulatory risk related to the raw materials used. Supply risk of raw materials originates from increased demand due to growth in populations and decreased reserves of raw materials. Furthermore supply risk of raw materials can occur when production or resources of the raw materials are dominantly available in one country. This country has the ability to significantly influence the amount of resources available on the market. The European Commission (2010) presented a report that investigated the availability of resources in the coming years. The research identified 14 raw materials as critical due to relative high economic importance and high supply risk. Figure 15 presents an overview of the raw materials included in the analysis. For more elaborate of the supply risk of raw materials see the European commission (2010) report.

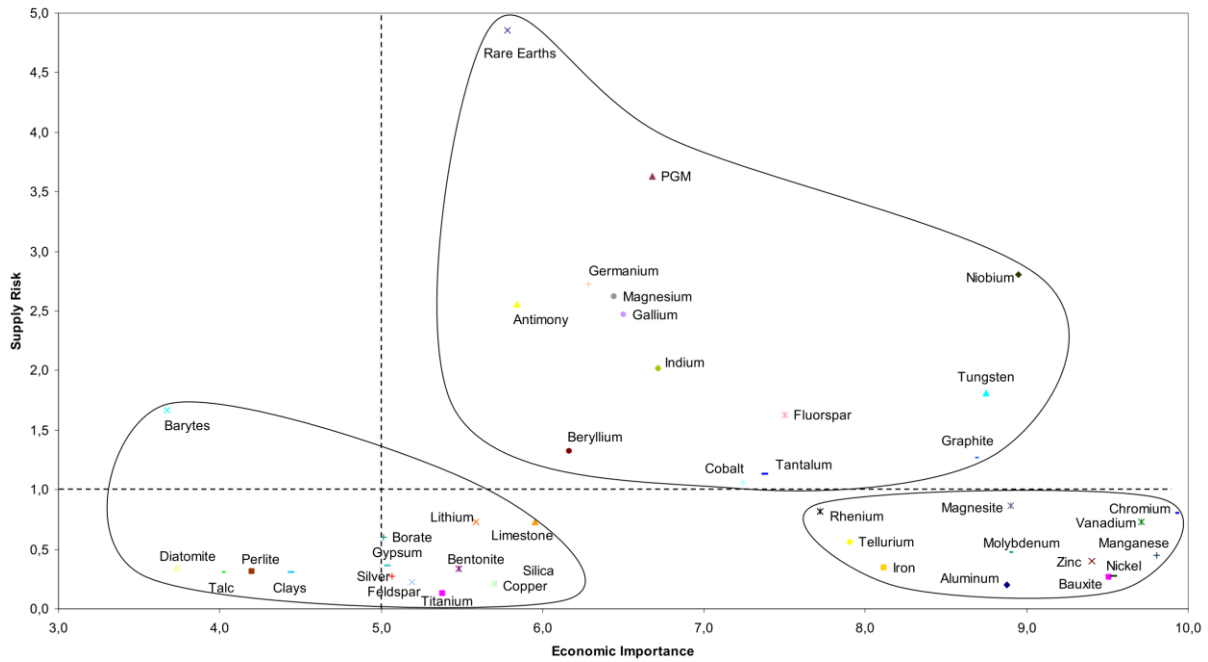


Figure 15: Critical raw materials analysis (European Commission, 2010)

The second component commodity risk refers to regulatory risk related to the raw materials used. Over the years more and more regulations have been formulated to regulate the use and production of raw materials that have a significant environmental impacts. These regulations are ever evolving and continue to become stricter over the years. When companies are over-reliant on raw materials that are impacted by these regulations, technological exposure risk can occur. Well-known examples of raw materials that are influenced by regulations are conflict minerals and metals. Some examples of raw materials with compliance risks are presented in Table 7. Besides the materials discussed in the table, the buyer company needs to take current and upcoming regulation into account. Regulation examples for buyer companies in the European union are: the regulation on Registration, Evaluation, Authorization and Restriction (REACH) of chemicals, and the regulation on Restriction of Hazardous Substances (RoHS) in Electrical and Electronic equipment. These regulations are continuously evolving and for updated versions see the following websites:

http://ec.europa.eu/environment/waste/rohs_eee/legis_en.htm

http://ec.europa.eu/enterprise/sectors/chemicals/reach/index_en.htm

Material	Industry	Sustainability impact
Rare Earths	Automotive, Electronics, Renewables	Mining for rare earths can be highly damaging environment and the health of humans living in the proximity. (Ecorys, 2012)
Conflict minerals (3TG)	Electronics, Jewelry, Lighting, Batteries	Mining for conflict minerals can be highly damaging for the environment and the health of humans living in the proximity. Furthermore, buyer companies need to check if conflict minerals are sourced from conflict free smelters. For more information check: http://www.conflictreesourcing.org/
Iron Ores	Steel production, building sectors, railways, automotive,	Mining process needs a lot of chemicals, which destroy forest ecology and pollute soil, groundwater and surface water. (Ecorys, 2012)

	ships	
Copper	Electronics, construction	Mining of copper is energy intensive process, causing significant CO ₂ emissions. (Ecorys, 2012)
Cobalt	Rechargeable batteries, super alloys, hard metals	Main impact results from water contamination and energy used during extraction, transport and refining.(Ecorys, 2012)
Graphite	Steel, Aluminum, automotive, fuel cells, semi-conductors	Main impact results from water contamination and energy used during extraction, transport and refining.(Ecorys, 2012)
Indium	Films, LCD, Flat-panel displays, touchscreen, semiconductors	Primary impacts are damage to kidneys and respiratory system. (Ecorys, 2012)
Fluorspar	Pharmaceutical, Agrochemical	Fluorspar is listed as a GHG and thus contributes to global warming. (Ecorys, 2012)
Crude oil	Transport fuel, plastics, chemicals	Combustion of oil produces CO ₂ and thus contributes to climate change. Crude oil can be a major water pollutant. (Ecorys, 2012)

Table 7: Examples of raw materials that pose compliance risk to a commodity

As can be seen it is hard to estimate commodity risk and this makes technological exposure risk hard to include in the risk supplier identification model.

The consequence of Technological exposure risk can be assessed by the components' financial impact. This financial impact however is hard to estimate since it depends on multiple areas such as among others, the criticality of the component, the average amount of the component purchased, and the price of the components. Since it is hard to estimate the financial impact of a component, this assessment method is categorized as not suitable to include in the risk supplier identification model, since the method requires too much in-depth research and time to be included in a general risk assessment method.

Strategic risk refers to the situation in which suppliers are not transparent about their sustainability performance and their efforts to improve their sustainability. Transparency is desirable for stakeholders and prevents against brand image. Spreading clear information helps suppliers and buyer companies in managing expectation regarding sustainability. Assessing strategic risk is relatively easy since it is all about transparency. As assessment method of strategic risk, buyer companies can use the public information about sustainability performance and public sustainability improvement target. Suppliers that share this information are transparent about their performance and show that they also have knowledge about their performance and where they want to go in the future. Both public performance information and public targets and goals are easily assessable since information is either not available or publicly available. This makes that strategic risk is suitable to include in the risk supplier identification method.

Social compliance risk refers to the risk of a supplier being non-compliant on social issues. Increased risk of non-compliance can influence business continuity and this directly affects the buyer company. Also non-compliance at a supplier can result in brand image damage for the buyer company. Several assessment methods of social compliance risk are proposed with one of them being the Maplecroft Human Rights index. This index estimates the risk of social compliance violation and working

condition violations on a countrywide basis. These estimates are based on known violation, average working conditions, and other working characteristics in respective countries. The idea is that suppliers that are located and operate in a specific country have a certain probability of being non-compliant and that there should be increased focus on countries that are deemed riskier. Maplecroft indices are scored on a scale of 0 to 10 with 0 being the riskiest and 10 being the least risky score. For example, in 2014 the worst scoring countries were: Syria (0,31), Sudan (0,38), DR Congo (0,43), and the best scoring countries being: San Marino (9,69), Monaco (9,56), Liechtenstein (9,49). Examples of possible other relevant countries: Netherlands (8,52), China (1,32). An index like the Maplecroft index gives an estimation of the risks per country and thus could be a good starting point for starting a risk supplier analysis. Furthermore it is an easily assessable method and thus is suitable to include in the risk supplier identification method. For more information on the Maplecroft indices: <https://www.maplecroft.com/>. Another assessment method that can be used to assess social compliance risk is to check whether a supplier works according to ILO-OSH 2001 guidelines. The ILO-OSH 2001 guidelines have been defined by the International Labour Organization (ILO) and refer to Occupational Safety and Health Management (OSH) systems in companies. When suppliers use these guidelines in their daily activities they are less likely to pose social compliance risk to the buyer company. It is however not easy to determine if a supplier works according to these guidelines since not certificate is granted to companies that do. However if suppliers can show they do take these guidelines into account, it shows that they think of and work on social issues and working conditions. A third assessment method of social compliance risk refers to known previous violations. When suppliers have had issues with compliance on social issues in the past, they might be more likely to be non-compliant in the future too. Previous violations are relatively hard to assess since data about these violations needs to be available or violations have to be documented by the buyer company. It is hard to assess on previous violation when the information about these violations is incomplete or of low quality. This makes previous violations and useful assessment method but moderately assessable. The last assessment method relates to the existence of supplier-buyer contract on social practices. In such contract, suppliers commit to working on being compliant on all regulations included in the contract. The more extensive the contract between buyer and supplier, the lower the risk of non-compliance on social issues. In case non-compliance does occur when such a buyer-supplier contract is in place, this contract can be used to reduce brand image damage. Buyer-supplier contracts are easily assessable since knowledge of such contract is available internally at the buyer company. This makes the existence of buyer-supplier contracts on social compliance issues a suitable assessment method to include in the risk supplier identification method.

Climate change compliance risk refers to compliance but in this case on issues regarding climate change. Some of the same methods that are used for assessing social compliance risk can assess climate change compliance risk. Known previous violations and supplier-buyer contracts regarding environmental practices are assessment methods that can be applied in the same way as in social compliance risk. The Maplecroft index can also be used when assessing Climate change compliance risk, but in this case the legal, regulatory and environmental risk index should be used. This index basically works in the same way as the Maplecroft Human Rights Index described earlier. One last assessment method on Climate change compliance risk is the ISO 14001 certification. ISO 14001 is an internationally recognized standard that indicates what practices companies should implement to have a competent environmental management system. ISO 14001 related specifically to environmental issues and thus is applicable to assess climate change compliance risk. Furthermore,

ISO certifications are easy to assess since either supplier are or are not certified. This makes ISO 14001 certification a suitable method to include in the risk supplier identification method. The last assessment method is commodity compliance risk which, as described earlier, is hard to assess and hard to include in the risk supplier identification method. Commodity compliance risk with respect to climate change compliance risk mainly refers to the raw materials used in products and if those meet environmental regulations.

Appendix B

This appendix provides an example on how the risk supplier identification method can be applied to a business situation. All activities described in chapter 4 are carried out step by step. This example is executed with a group of road transportation suppliers of X. For confidentiality concerns, the names of the companies included in the analysis are not presented. Instead abbreviations are used. All scores and spend numbers are based on in-house data of X.

1. Determine relevant supplier risk criteria

The first step is to determine all relevant supplier risk criteria to be included in the application. Generally the starting point is to include all supplier sustainability risks described in section 4.1.1. However, situations can occur in which one or more defined supplier sustainability risks are not applicable to the group of suppliers that is analyzed. In this example all described supplier sustainability risk criteria are included in the analysis. As a reminder, the defined risks are:

- I. Business risk
- II. Supplier capacity risk
- III. Quality risk
- IV. Strategic exposure risk
- V. Technological exposure risk
- VI. Strategic risk
- VII. Social compliance risk
- VIII. Climate change compliance risk

The next step is to determine which assessment methods will be used to cover and assess all risk criteria. As mentioned earlier, and illustrated in Table 2 and Table 8, some assessment methods can cover multiple supplier sustainability risk criteria since they cover elements of multiple criteria. The proposed method is designed to work with 3 dimensions namely: Supplier sustainability risk, spend at supplier, and buyer impact on supplier. Spend at supplier is an indication of financial impact on the buyer company in case of non-compliance, out-of-business, supply disruption and so forth. This shows that spend-at-supplier covers several sustainability risks and thus is used as an assessment method for business risk, but also as an indication of the consequence of several other risks occurring. Furthermore the minimal requirements regarding the type of sourcing reduce the chance of strategic exposure risk. All other risk assessment methods used, and the risks they assess are presented in Table 8.

2. Determine levels of risk

The second step is to define the different levels of risk in each of the risk criteria included in the model. Define when a risk is assessed as high risk, average risk, or low risk. The definitions of each of the criteria need to cover all alternatives that can occur within the specific criteria. It can occur that a specific criterion is not applicable to a certain supplier or group of suppliers. In this case the criteria get a score of N/A and are not included in the analysis. Since in this example a group of road transportation suppliers is used, and the main environmental impact of road transportation is in carbon emissions, commodity risk is expressed as the risk of high, moderate or low amount of carbon emissions. Defining commodity risk as levels of carbon intensity also relates to the CDP Supply Chain program since this program, which is at the base of this research for X, focuses on mapping and analyzing upstream scope 3 carbon emissions. This once again illustrates how the risk

assessment methods can be adjusted according to the needs of the buyer company. When the buyer company wants perform the analysis for a different sustainability program or for a different group of suppliers, either from one industry or from different industries, the definitions of commodity risk assessment can be adjusted to meet the desired requirements of the buyer company. The defined levels of risk are presented in Table 8.

Human Rights Score	Retrieved from Maplecroft data, Score between 1 to 9 (Maplecroft Human Rights Website)	Social Compliance Risk
Legal and Regulatory Environment Score	Retrieved from Maplecroft data, Score between 1 to 9 (Maplecroft Legal and Regulatory Environment index Website)	Climate Change Compliance Risk
Commodity type Risk	9 if supplier operates in carbon intensive industry 5 if supplier operates in moderate carbon intensive industry 1 if supplier operates in low carbon intensive industry	Technological exposure risk/commodity compliance risk
ISO Cert. Score	9 if supplier has no ISO certification 5 if supplier has ISO 9001 certification 1 if supplier has ISO 14001 certification	Quality risk/ Environmental compliance risk/Business risk
Public Disclosure of Env rec. scores	9 if supplier does not publicly disclose environmental information 5 if supplier publicly discloses environmental information 1 if supplier publicly discloses environmental information and reduction targets	Strategic risk
Buyer – supplier contract related to used of restricted substances	9 if not signed 5 if supplier signed but not audited 1 if supplier signed + audited N/A	Technological exposure risk
Buyer – supplier contract related to overall sustainable practices	9 if not signed 5 if signed 1 if signed + audited	Quality risk/Environmental Compliance risk/Social compliance risk
Sourcing type	9 if solo sourcing 5 if single sourcing 1 if multiple sourcing	Business risk/Technological exposure risk/ Strategic exposure risk/Supplier capacity risk
€Spend	EUR spend per supplier	Business risk/Technological exposure risk/ Strategic exposure risk/Supplier capacity risk
X impact on supplier revenue	Percentage of supplier revenue that can be attributed to X	

Table 8: Assessment methods included in analysis + Risk levels

The example presented in Table 8 is based on several supplier assessment tools suggested in literature and used by X. Some assessment methods need explanation because of several specific terms used in the definition of the different levels of risk criteria. Buyer – supplier contract related to the used of substances captures the suppliers’ commitment to not using substances in their products that are on the restricted or regulated by law. And if they do, they agree to not using more than the legally allowed amount of these substances. Suppliers have to sign and need to commit to complying with this buyer-supplier agreement before they can start delivering goods to X. Another assessment method is the buyer – supplier contract related to the overall sustainability practices of suppliers. By signing this contract, suppliers commit to actively manage and meet minimal requirements on several sustainability areas. The contract covers multiple elements of sustainability such as social

issues and environmental issues. Suppliers are required to, if applicable, sign both these contract before they are allowed to deliver goods to X.

In this case the goal is to create a general overview of the sustainability risk of a group of suppliers. The best method to achieve this goal is to set the weights of all criteria to 1 and compute an average risk score for each supplier. The weights for this example are presented in Table 9.

	Criteria weights
Human Rights index	1
Legal and Regulatory Environment Risk score	1
Commodity type risk	1
ISO Certificate	1
Public disclosure of environmental records	1
Buyer – supplier contract, substances	1
Buyer – supplier contract, sustainability practices	1
Sourcing type	1

Table 9: Assessment weights used in example

3. Set minimal requirements

Minimal requirements are set by using the process described in Figure 11. Solo suppliers are excluded, which in this case has no influence on the number of suppliers included in the analysis. Since all suppliers operate in road transportation all these suppliers are categorized as multiple sourcing suppliers. Which leads to the decision on what the minimal spend at a supplier should be, to be included in the analysis. In this case a minimum spend of €1,000,000 is chosen. This amount significantly reduces the number of road transportation suppliers used by X and the remaining group of suppliers represents both significant financial impacts as a suitable number of suppliers to include in the analysis.

4. Determine which suppliers meet minimal requirements

Suppliers are checked on the minimal requirements. The group of suppliers to be included in the analysis significantly decreased and in the end nine suppliers met both minimal requirements. These nine suppliers are included in the analysis

5. Gather supplier data & compute risk score

The required data for the nine included companies was obtained from several databases and employees at X, and resulted in the following risk score, spend data, and buyer impact. The risk score is computed by taking an average of all the risk scores according to the risk levels defined in Table 8. The risk scores are defined with low risk as score 9 and high risk as score 1. The risk scores of the suppliers included in the analysis are presented in Table 10.

Supplier Name	Risk Score	€Spend	Impact X
DA	4,612857143	€ 16.889.233,00	0,32%
TR	5,132857143	€ 4.514.839,00	9,03%
DP	2,898571429	€ 85.801.682,00	0,15%
RA	3,994285714	€ 6.154.612,00	0,62%
TL	5,81	€ 4.088.198,00	16,35%
CE	2,851428571	€ 37.046.939,00	0,54%
vR	4,565714286	€ 1.998.419,00	2,66%
UP	3,162857143	€ 62.032.182,00	0,13%
GE	4,148571429	€ 5.357.912,00	0,13%

Table 10: Supplier data used to create risk chart for example 1

6. Compute risk chart

The risk chart based on the gathered data is presented in Figure 16. Based on the three dimensions, buyer companies can decide which suppliers to approach with sustainability improvement programs. Sustainability risk is presented on the y-axis, Spend at supplier on the x-axis, and buyer impact is presented by the bubble size. Suppliers in this chart meet the minimal requirements set to enter the risk supplier identification process. In this case the minimal requirement is: annual spend of over €1.000.000 last year. Furthermore the group suppliers all deliver the same commodity to X since all suppliers are road transportation suppliers.

Figure 16 presents the graph that results from the analysis of nine road transportation suppliers of X. From the perspective of the X it would be ideal if the buyer impact would be highest at the suppliers with the highest spend. This assumption is based on several scientific articles that suggest that higher buyer impact relates to higher supplier willingness to work on sustainability issues. The graph shows that the majority of spend is allocated to three suppliers namely suppliers 'CE', 'UP', and 'DP'. When looking at Table 9, it can be concluded that the buyer impact of X on these suppliers is extremely small, ranging from 0,13% to 0,54%. Furthermore an in-depth analysis on the sustainability programs of these three suppliers shows that their respective sustainability programs are more extensive than X's sustainability program on issues related to carbon emissions. All this suggests that approaching suppliers with big spend but low buyer impact, will result in either no or very small changes in sustainability practices at suppliers. Even if sustainability improvements at these suppliers occur, it is very unlikely that X can credibly claim these sustainability improvements as resulting from their demands. Lastly the effect of possible sustainability improvements at these suppliers that can be traced back to improvement in X operations is very small, since X is such a small customer of the respective suppliers. It can be concluded that when the goal of X is to improve supply chain sustainability and efficiency, suppliers with high spend but low buyer impact are not the most ideal suppliers to approach.

Identifying potential improvement suppliers

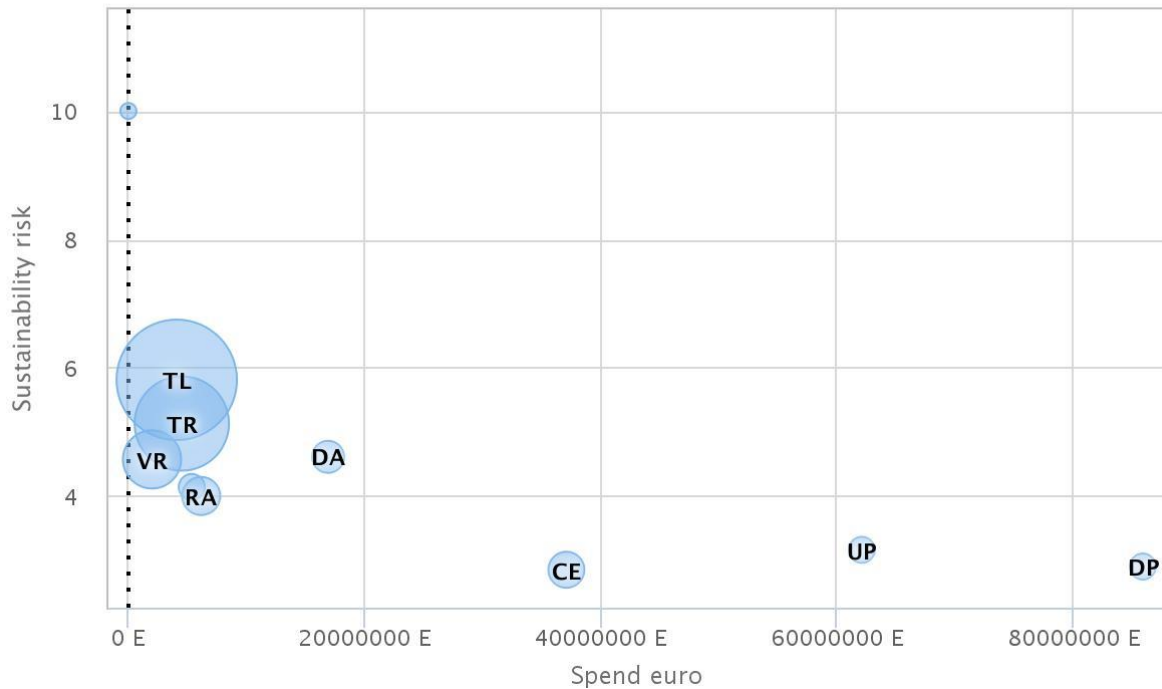


Figure 16: Identifying potential improvement suppliers example 1

The question remains however which suppliers do need to be approach for being included in supplier sustainability development programs. When looking at Table 10, suppliers TL and TR are suppliers with the highest buyer impact of X. Both these suppliers also have relatively high sustainability risk scores. For a closer look on the left part of the graph see Figure 17 which presents a zoomed in version of the Figure 16 to create more overview. According to the theory of increased buyer pressure on sustainability developments at suppliers, suppliers 'TL' and 'TR' should be invited to participate in supplier development programs of X. Another advantage of included these suppliers in supplier sustainability development programs is that X can claim ownership on a larger part of the sustainability improvements at these suppliers. Furthermore, there's more room for improvement in sustainability practices at these suppliers, which is indicated by the higher sustainability risk.

Identifying potential improvement suppliers

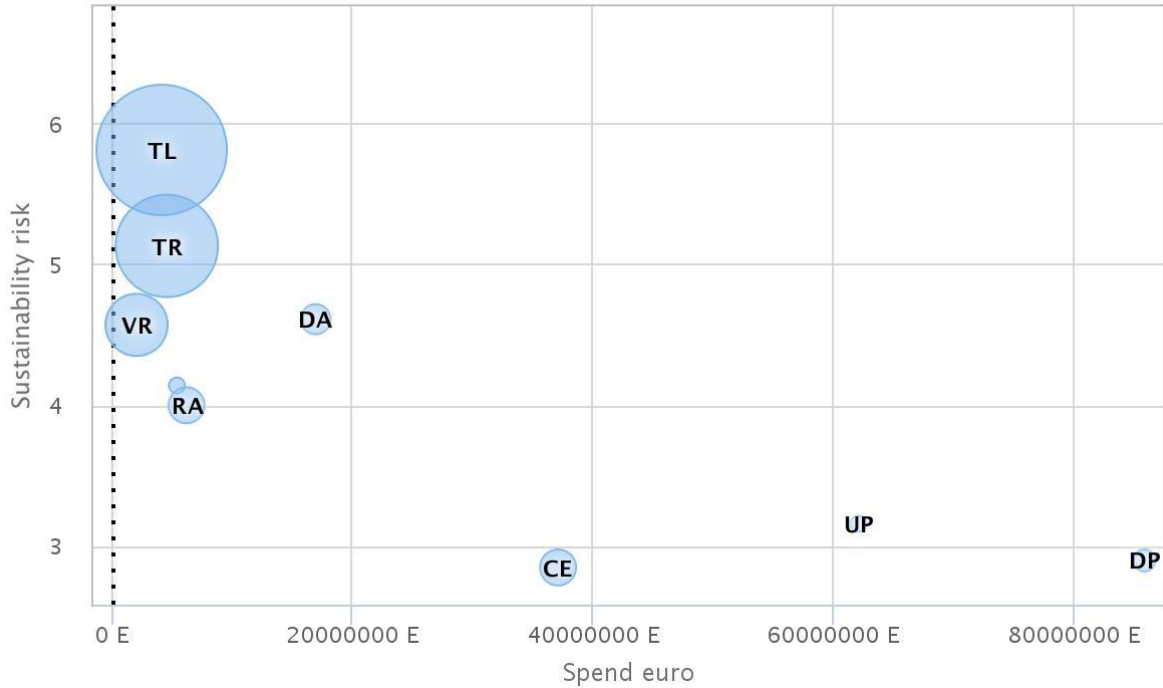


Figure 17: Zoomed in version of figure 17

Additional example

Another example of the risk supplier identification methods is created to show that the method also work with suppliers that do not supply the exact same commodity. For this second example the top 6 suppliers in terms of spend of a business unit of X are used. This is presented as the second example since not all the required data could be obtained from X's databases or employees. Because of this a few supplier characteristics had to be estimated which made the analysis of the second example less complete. That being said, the supplier data and characteristics used to estimate the risk score and buyer impact resulted in the following data presented in Table 11.

Supplier	Risk Score	€Spend	Buyer impact
SM	3,591428571	€ 50.907.963	25,96%
SA	3,02	€ 168.078.137	2,63%
KE	1,877142857	€ 89.744.925	10,96%
TR	3,434285714	€ 72.710.863	0,61%
AN	3,591428571	€ 54.298.322	10,48%
BA	3,381428571	€ 41.964.811	4,10%

Table 11: Supplier data used to compute risk chart example 2

The data presented in Table 11 results in the risk chart presented in Figure 18.

Identifying potential improvement suppliers

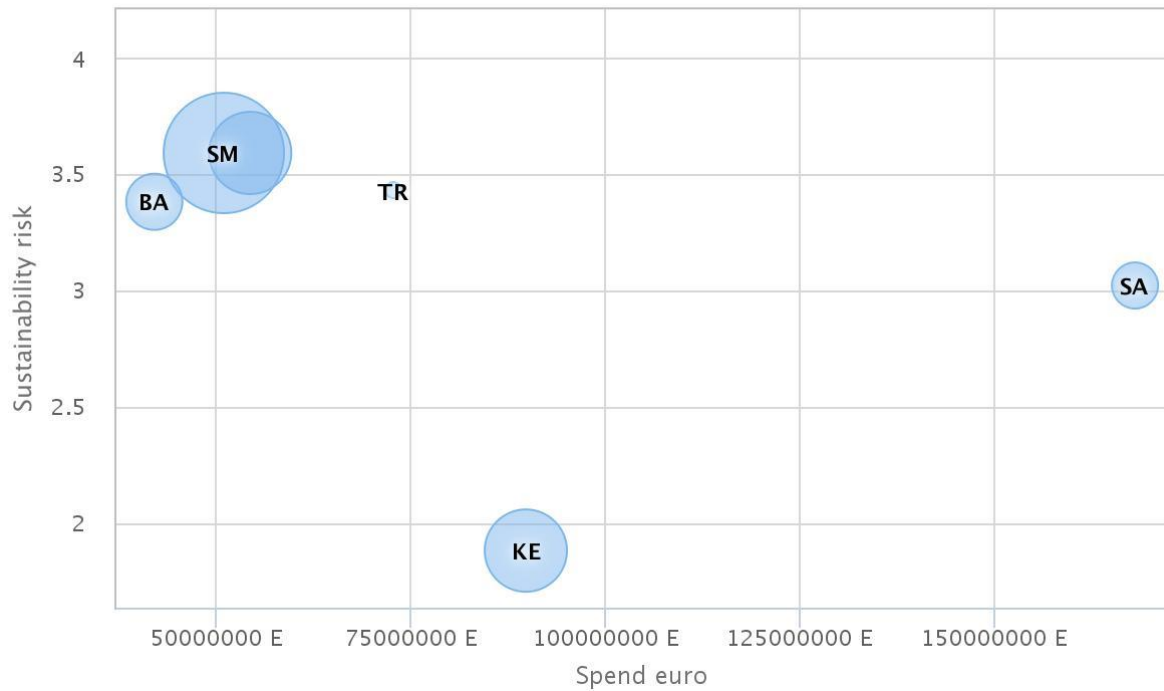


Figure 18: identifying potential improvement suppliers example 2

Analyzing the chart of the second example shows a relatively small sustainability risk for all suppliers included in the analysis. On the other hand Table 11 indicates relatively high buyer impact of X at three of the six included suppliers. Again, here it is advised to approach the suppliers at which X has a relatively high buyer impact since the chances on improvement are highest at these suppliers. Since sustainability risks at all suppliers included are relatively low, the margin for improvement is relatively small too. However, since the suppliers included in the analysis represent some of the largest suppliers of X, in terms of spend, the potential impact on overall supply chain sustainability is potentially large.

Appendix C

This appendix presents an application of the findings of the report to X's situation in relation to the CDP Supply chain program. First of all the CDP Supply Chain program is introduced, followed by the current state of the program, and recommendations on how to improve the program.

CDP Supply Chain and X

The CDP Supply Chain program is a sustainability program X uses to identify, measure, and manage carbon emissions at suppliers. The CDP Supply Chain program is a program developed by the Carbon Disclosure Project and provides a third party platform for multinationals to use when attempting to actively manage carbon emissions at suppliers. In X's case it is becoming more and more important that carbon emissions at suppliers are actively managed. One of the reasons that stresses the importance of managing carbon emissions is the goal of X to be a frontrunner on sustainability. One other reason is the added importance of upstream scope 3 emissions after the planned split-up of X. This split up (Figure 20) will result in a significant increase in the fraction of total emissions occurring in upstream scope 3 because of the dismissal of the huge impact of downstream scope 3 emissions occurring in the use phase of company A products. The importance of managing upstream scope 3 emissions is also visualized in Figure 1 and Figure 2.

In 2015, X invited 560 suppliers to participate in the CDP Supply Chain program, which is voluntary for Xs' suppliers. In the current situation the goal is to invite suppliers covering approximately 80% of total spend which comes down to 1000 – 1500 suppliers. The number of respondents increased significantly over the years and X is on its way towards inviting up to 1000 suppliers (Figure 19).

For a sustainability program to have any added value for a company, it needs to, according to X, add value on either one or more of the following points:

- **Improve supply chain sustainability** by decreasing supply chain GHG emissions
- Ensuring sustainability **compliance**
- Resulting in increased profits due to **cost reductions** resulting from more efficient operations at suppliers.

The program is analyzed and assessed on these types of added values in the following sections. It is discussed whether or not the CDP Supply Chain program has any added value, and if not, what needs to be improved to increase chances of the program having added value.

Problems with the CDP Supply Chain program in X

During this study a number of problems came forward related to the CDP Supply Chain program in its value for X. The first and foremost problem identified is related to the goal of the program within X. Several goals of the program are communicated in relationship to the CDP Supply Chain program. Some examples are: 'Invite suppliers that cover 80% of procurement spend to complete the CDP Supply Chain questionnaire', 'Use the CDP Supply Chain program to work towards a sustainable supply chain', 'Use the CDP Supply Chain program to come to a realistic but ambitious target in % of CO₂ reduction in the supply chain', and 'use the CDP Supply Chain program for creating supplier awareness on sustainability'. All these targets are non-measurable and vague in the sense that they do not indicate performance improvement and thus it cannot be decided if a target is met or not. Besides that, sustainability programs should be a means to reach targets and not a means to set targets, which is what some of the mentioned goals of the CDP Supply Chain program suggest. Several of other problems are discussed in Table 12 below.

Problem	Cause	Implication	Owner
No feedback of suppliers	Lack of strategy behind the program	X does not know what suppliers think of the CDP Supply Chain program and how it influences them and their behavior	X
CDP data not used	No clear goal and vision on how to manage suppliers	CDP Supply Chain data is not used in X's decision-making regarding suppliers and future decision-making. Suppliers do not see the need to participate if it brings no benefits.	X
No repercussions or rewards	Lack of strategy behind the program	It does not matter if, or how good suppliers fill in the questionnaire. No actions are taken based on the results	X
Provided data incomplete and non comparable	Different reporting standards used by suppliers	Analyzing data very difficult when the quality of data is very bad. Results of analysis become questionable	X
No year-on-year comparison provided	Lack of resources at CDP, large number of suppliers included	Hard to analyze suppliers improvement of a big group of suppliers when no year-on-year overview is provided by CDP	X
No environmental or cost benefits can be claimed from the program	Program is currently based on gathering data and not on using data to improve	The program lacks value for X and this makes suppliers especially questioning the value for them.	X

Table 12: Main problems related to CDP Supply Chain program

Table 12 presents some of the practical problems related to the CDP Supply Chain program in X which came forward during the time of the study. The problems related to the program can be summarized by three main issues: There is no clear strategy behind the program either on company wide level or business group level, the large number of suppliers included complicates the analysis of already bad quality data, and when the data is available, X does not know how to use it to improve supplier sustainability and decrease supplier carbon emissions.

Relating all this to the three possible types of added value for a sustainability program according to X. CDP Supply Chain does not improve supply chain sustainability since the bad quality data that is gathered is not used for managing suppliers and improving their performance. CDP Supply Chain does not ensure sustainability compliance since the program is not aimed on compliance and regulations, which is also indicated by the fact that the program is voluntary, which means that suppliers do not have to comply to issues related to CDP Supply Chain. Lastly, no cost reductions can be derived from the CDP Supply Chain program due to internal regulations related to claiming cost reductions. CDP Supply Chain does not fall into a category from which cost reductions may be claimed. Putting all this together results in:

CDP Supply Chain added value for X:

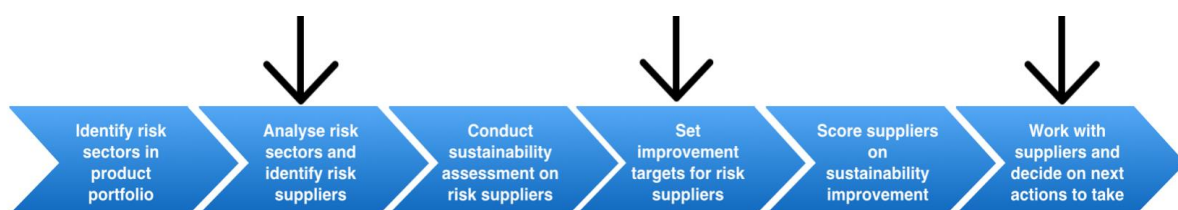
- **Improve supply chain sustainability** by decreasing supply chain GHG emissions **NO**
- Ensuring sustainability **compliance (N/A)**
- Resulting in increased profits due to **cost reductions** resulting from more efficient operations at suppliers. **(NO)**

It is concluded that CDP Supply Chain in its current form has no added value for X and since X wants to work following the lean no waste approach, the program either needs to be dismissed, improved, or replaced. Dismissal of the program is only an option when it is determined that upstream scope 3 emissions are not considered a priority any more. The second option is to look at the program in its current state and address the main issues identified such that the value of the CDP Supply Chain program for X increases. The last option is to replace the CDP Supply Chain program with another likewise program that better meets the needs of such a program for X. The next sections in this analysis of the CDP Supply Chain program discusses how to program can be improved to add value in the future. The main problems addressed are: Strategy and improving engagement in the program, reducing the suppliers included in the program to simplify analysis, set guidelines how to work with suppliers on improvement.

How to increase the value of the CDP Supply Chain program for X

For X, the first step that needs to be taken is to clearly define the goal of the CDP Supply Chain program in its organization. What is the goal to be reached with the program and what targets can be related to this goal. Without a clear goal that is acknowledged by the executive committee, it is hard to sell the program to employees and get them to engage and adopt the program.

When the goal and the function of the program is clearly defined, the next steps are related to implementing the program and deciding on which sectors and suppliers to target, how to measure performance at these suppliers, and how to create internal and external engagement. The steps to be followed when the goal of the CDP Supply Chain program is defined are visualized in the figure presented below.



See Figure 6: Process of implementing a supplier sustainability development program

How to perform each of the steps has been discussed throughout this paper and by following this stepwise approach, several major problems related to the CDP Supply Chain program are addressed. Some of the advantages of this approach are that suppliers with significant impact on supply chain carbon emissions will be invited for the program due to the sustainability risk analysis of suppliers, suppliers that are included will show more willingness to cooperate and participate in the program due to increased quality of communication related to the program, the buyer impact analysis, and the definition of a clear goal for the program, and internal engagement will be higher due to better deployment of the program throughout all relevant function in the buyer organization.

These are some examples of advantages of the use of the method presented in this paper. The main takeaway for X however is that when implementing programs such as the CDP Supply Chain program, the focus should be on first building a strong foundation for the program internally, before trying to implement and convince external parties to participate in the program. This leads to the conclusion that in order to create a situation in which the CDP Supply Chain program adds value for X, the program needs to be re-evaluated all over again starting with a clear definition of the goal of the program with targets related to this goal. This is the starting point for a new and improved role of the CDP Supply Chain program for X.

Appendix D

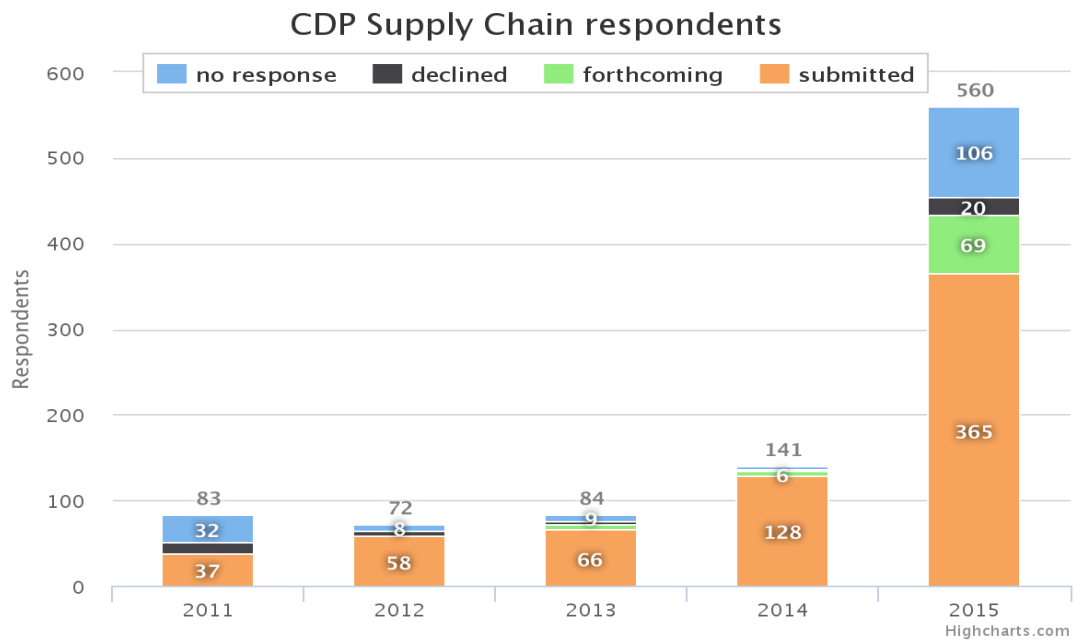


Figure 19: Number of CDP requests and responders of X

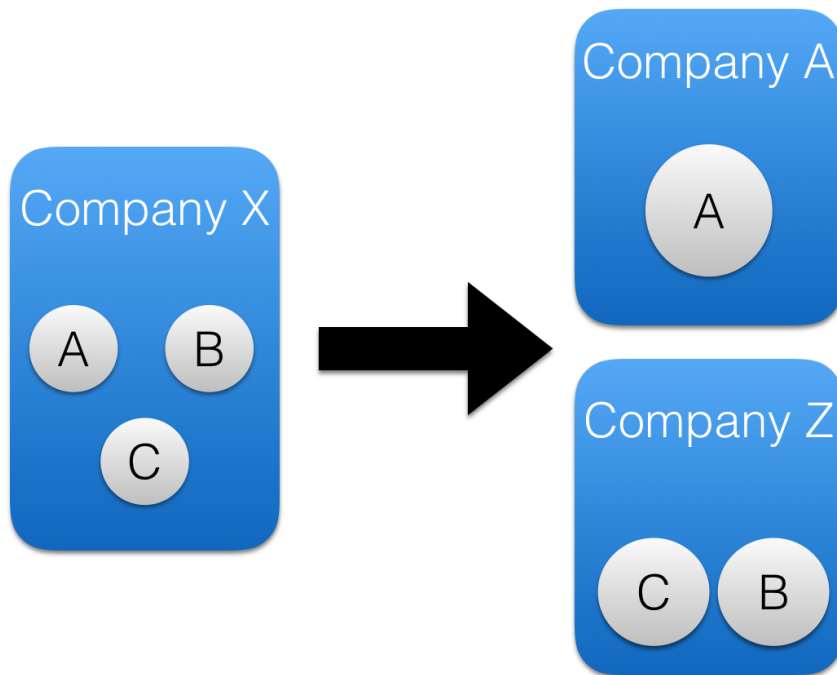


Figure 20: Split up of company X visualized

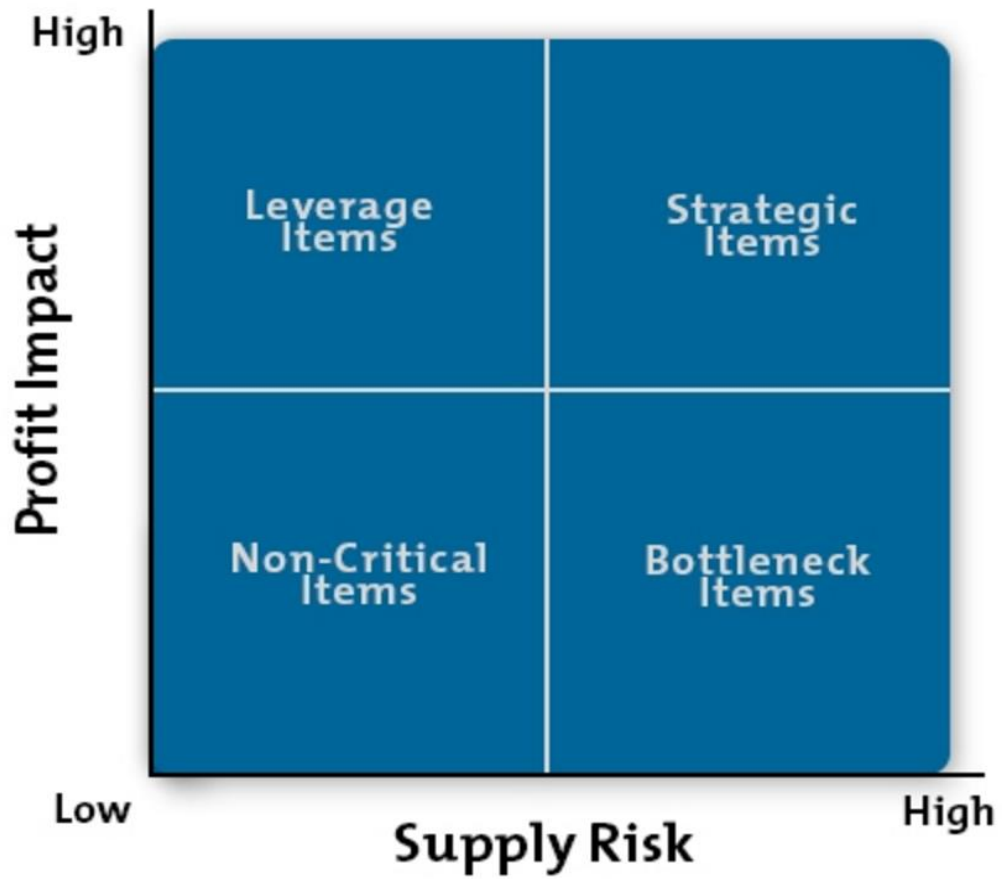


Figure 21: Purchasing portfolio concept (Kraljic, 1983)

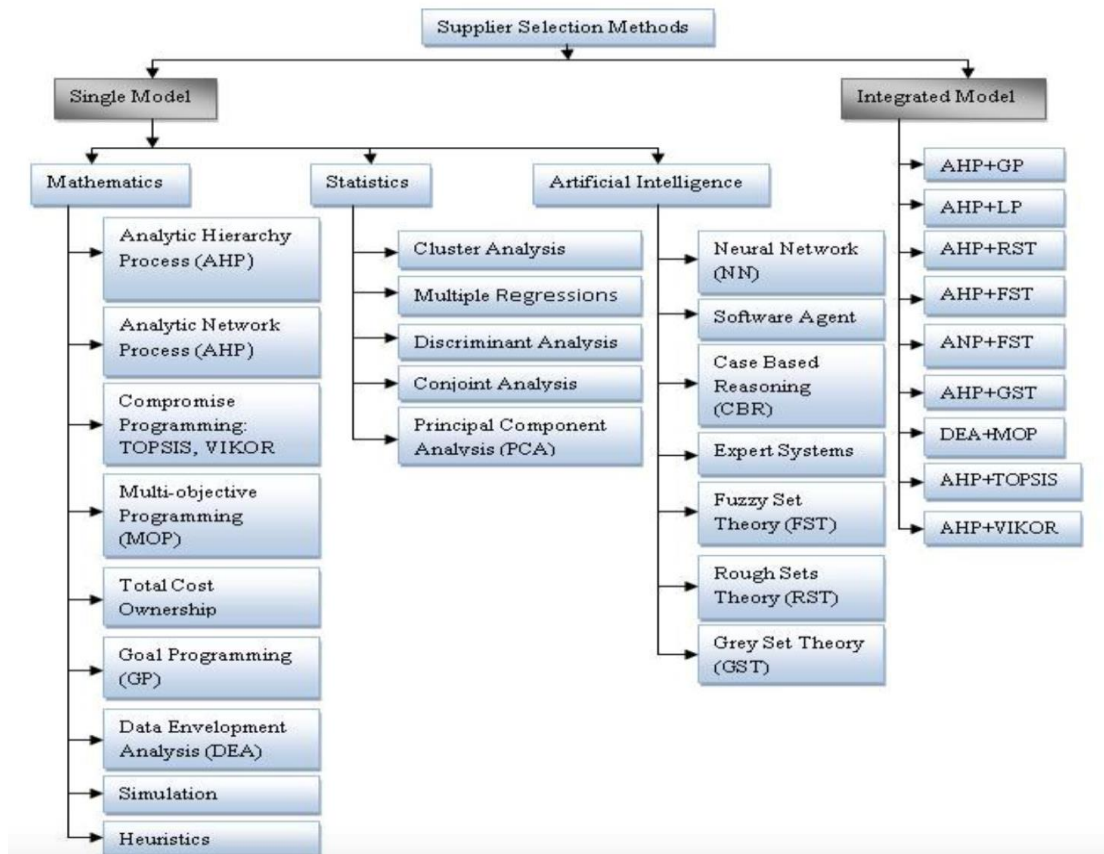


Figure 22: Overview Supplier Selection Methods (Mukherjee, 2012)

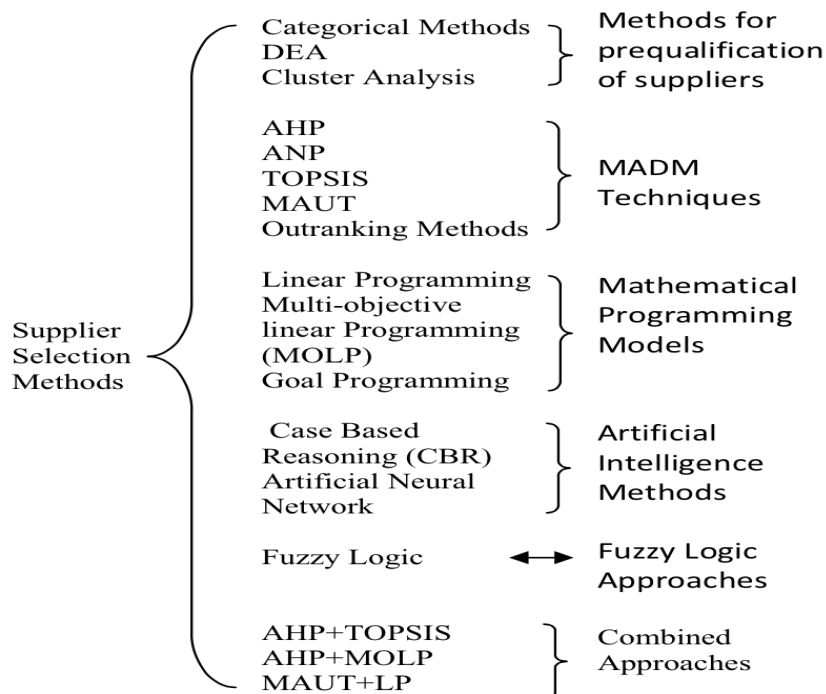


Figure 23: Overview Supplier Selection Methods (Pal, Gupta, & Garg, 2013)

Top 10 – most important	Top 10 – most easily assessed
1. Public disclosure of environmental record	1. ISO 14000 certified
2. Second tier supplier environmental evaluation	2. Ozone depleting substances
3. Hazardous waste management	3. Recyclable content
4. Toxic waste pollution management	4. VOC content
5. On EPA 17 hazardous material list	5. On EPA 17 hazardous material list
6. ISO 14000 certified	6. Remanufacturing/reuse activity
7. Reverse logistics program	7. Returnable or reduced packaging
8. Environmentally friendly product packaging	8. Take back or reverse logistics
9. Ozone depleting substances	9. Participation in voluntary EPA programs
10. Hazardous air emissions management	10. Public disclosure of environmental record

Figure 24: Top 10 criteria for supplier sustainability performance (Robert Handfield et al., 2002)

Type of loss	Example
Financial loss	Having to buy from or sell to alternative sources because a firm's product or process fails to reach environmental standards expected
Performance loss	Being forced to use environmentally inferior technology because of inability in customer/supplier to provide correct complementary inputs, processes or products to use cleaner technologies
Physical loss	Environmental accident (e.g. spill, fire) causing damage to a customer/supplier's equipment, or own equipment on customer/supplier's premises
Social loss	Loss in reputation in society at large because of association with poor environmental practices of a customer/supplier
Psychological loss	Damage to organisation's self-perception because of association with a customer/supplier which has an environmental accident
Time loss	Customer/supplier experiencing an environmental problem with its operations, and causing an order or delivery delay

Figure 25: Different "Types of loss" and examples (P.D. Cousins et al., 2004; Mitchell, 1995)

Top 3 Critical Factors to Have in Place for Success (Chart 16)

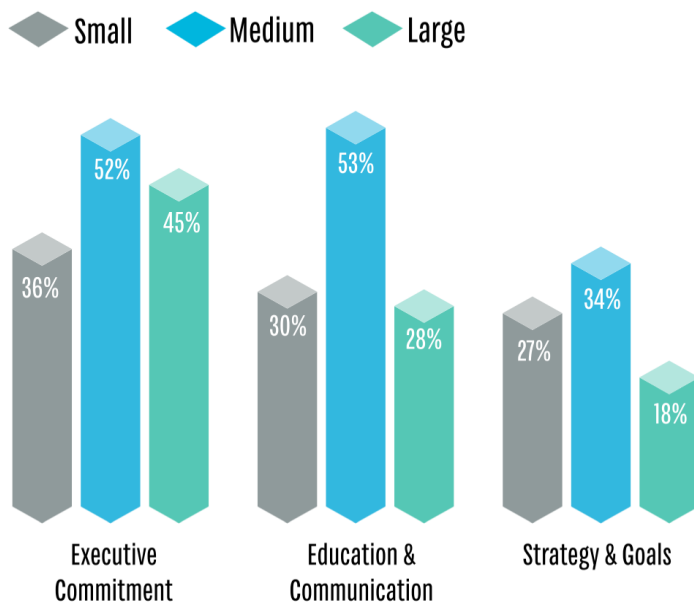


Figure 26: Top 3 Critical Factors for successful internal engagement (GreenBiz, 2014)

What Are the Biggest Internal Hurdles to Sustainability Education in the Company? (Chart 15)

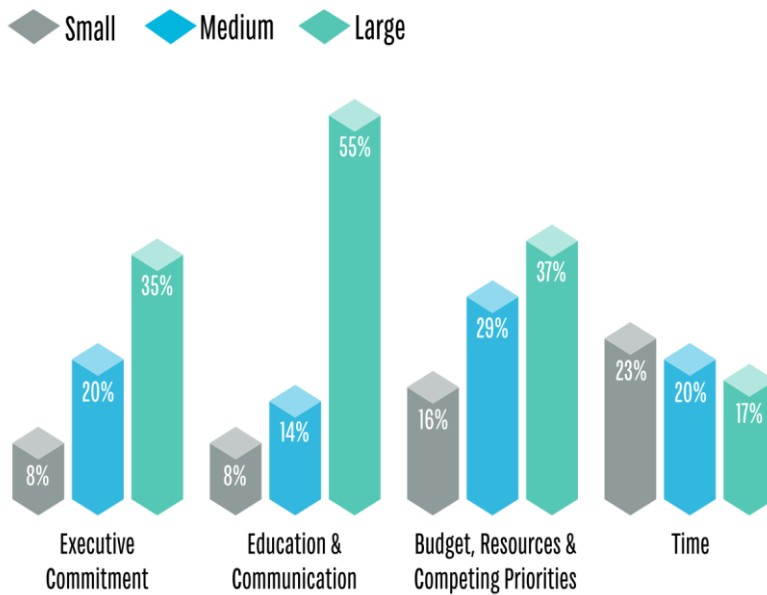


Figure 27: Biggest hurdles to sustainability education in the company (GreenBiz, 2014)

Education Methods (Preferred by Advanced Programs) (Chart 13)

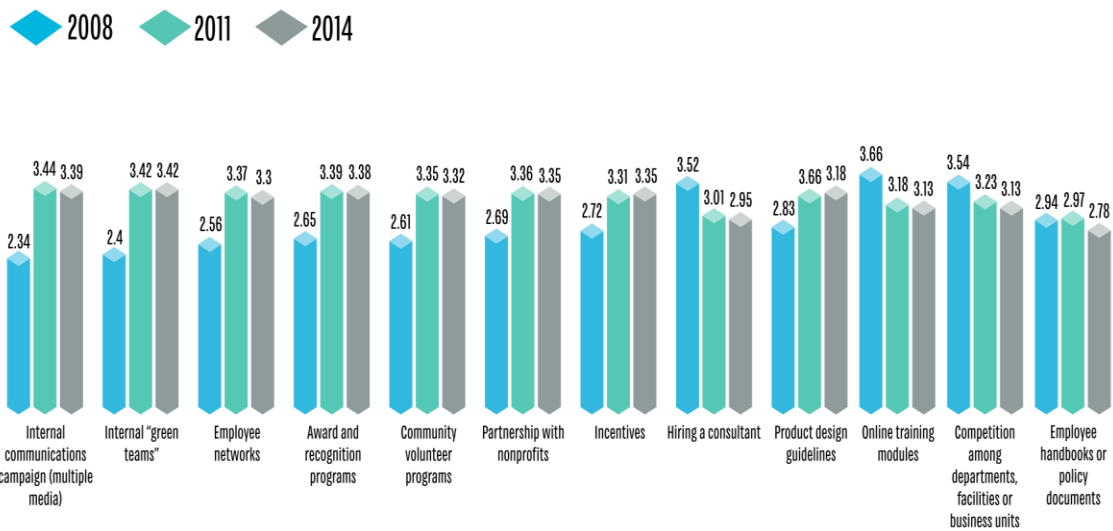


Figure 28: Several popular form of education (GreenBiz, 2014)

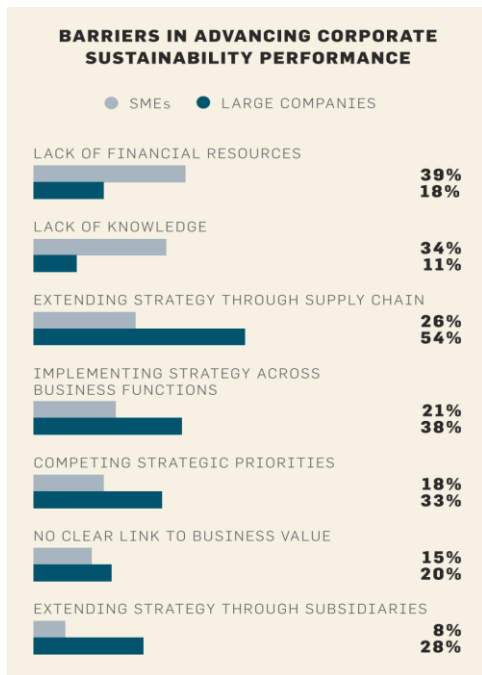


Figure 29: Barriers in Advancing Corporate Sustainability Performance (UN Global Compact, 2013)

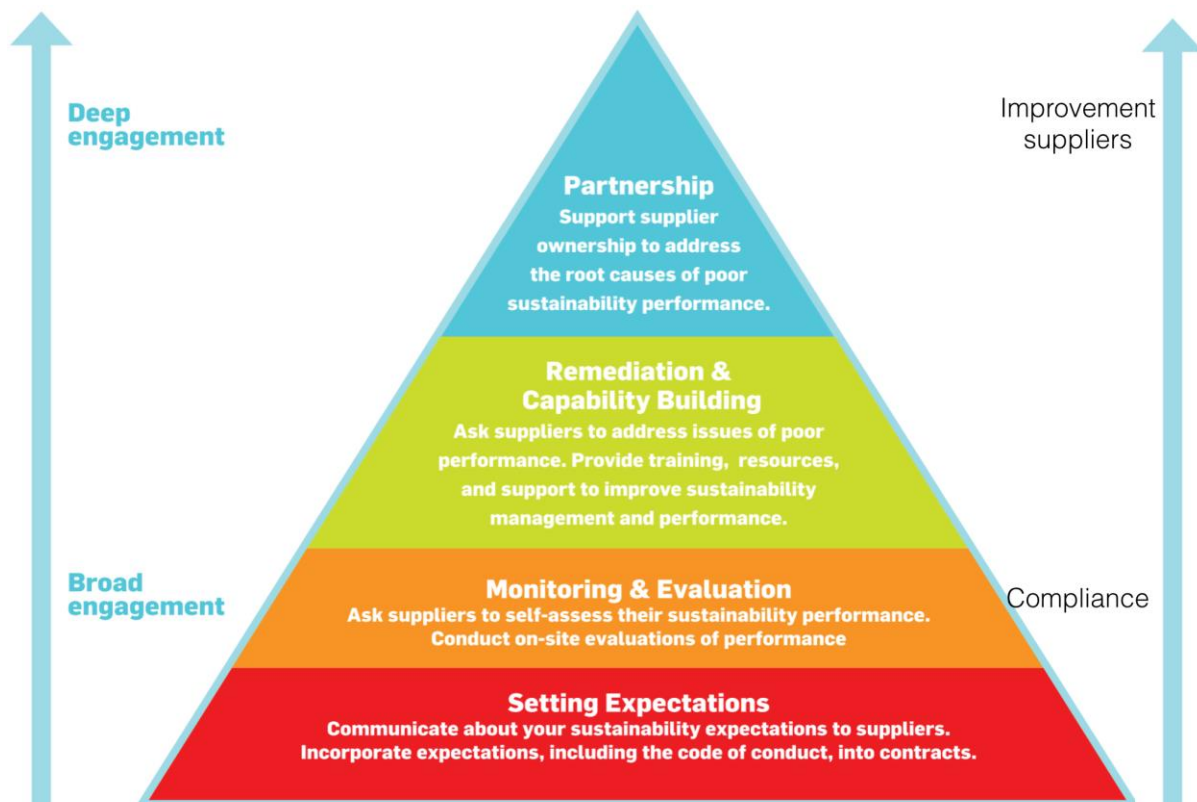


Figure 30: Types of suppliers and characteristics in supplier database (UNGC and BSR, 2010)