Diffusion and Control Mechanism of Environmental Performance Management: Case of Volvo CE

Authors: Ilirian Tahiri, 910920
         Rina Namira Dalimunthe, 900808

Tutor: Helena Forslund
Examiner: Lars-Olof Rask
Subject: Thesis Paper
Course Code: 4FE14E
Date of Seminar: 2016-09-28
ACKNOWLEDGEMENT

Within the time frame of five months, we had an opportunity and had a good experience to make the research during thesis project in Volvo Construction Equipment regarding the Diffusion and control mechanism of Environmental Performance Management. With the support, collaboration and contribution from respective employees in information sharing, interview and company visit in Braås, we get many insights and knowledge to finish this research. We would like to express our gratitude and appreciation for the interviewees in Volvo Construction Equipment: Niklas Nillroth, Rickard Alm, Tony Andersson, Dirk Engelke, Stefan Braunias, and Christian Nilsson, for the time, information and contribution for this research.

We really appreciate and thank you very much for the help, feedback, comments, recommendation and time to our Supervisor, Helena Forslund. Thank you for the advice and tutoring time that you spend with us during the project. We would like to also express our appreciation and gratitude to Lars-Olof Rask and Anders Jerreling, as your contribution, comments, constructive feedbacks, time and suggestion to our thesis to make it better. Another thank you to Askar Muratov as your contribution and advice for this project. Furthermore, thank you for family, friends and all opponents for constructive suggestion, critique and reflections.

Finally, we want to thank each other for good cooperation and collaboration during the thesis.

Växjö, September 2016

Ilirian Tahiri and Rina Namira Ardilla Dalimunthe
ABSTRACT

Authors: Ilirian Tahiri  
Rina Namira Ardilla Dalimunthe

Tutor: Helena Forslund

Examiner: Lars-Olof Rask

Title: Diffusion and control mechanism of Environmental Performance Management: Case of Volvo CE

Background: Trends for more sustainable and environmental friendly business practices have transformed many industries, especially Volvo CE as an OEM within heavy vehicle industry, where company needs to continuously innovate and develop environmental sustainability technologies. Volvo CE is trying to balance the cost and profit with environmental impact through engaging in sustainable operations and do it through the optimization of Environmental Performance Management (EPM). There is a need for Volvo CE to improve their whole supply chain throughout the entire tier of suppliers since the suppliers create a major value within company business and Volvo CE need to find the way on how to diffuse the EPM to supplier networks. Also, to control and evaluate the process, Volvo CE is looking for systematic control mechanism to measure and control the practice of EPM.

Research questions: 1. How does the environmental regulation in heavy vehicle industry impact the EPM of Volvo CE?  
2. How should the EPM be efficiently diffused to the supplier network of Volvo CE?  
3. Which are the effective control mechanisms of the EPM on the supplier network of Volvo CE?

Purpose: The purpose of this paper is two-fold. Firstly, it aims to identify the impact of environmental regulations has in Volvo CE. Secondly, it is set to analyse the possible ways to efficiently diffused the EPM on the supplier network of Volvo CE and identify control mechanisms for the EPM implementation on the supplier network, from the perspective of Volvo CE.

Method: By using Volvo CE as the research object, this study adopts case study method with qualitative approach. The study is conducted in
Volvo CE perspective where it has an abductive approach with the intention to examine the impact of environmental regulation in EPM of Volvo CE, understand how Volvo CE implement the diffusion back to the supplier network and control the process through EPM.

**Conclusion:**

The findings emphasize that the environmental sustainability regulations impact the EPM in Volvo CE are distributed in manufacturing/production, managerial, strategic, technical and compliance area. Volvo CE needs to work a lot with energy efficiencies, material efficiencies and waste reduction management and find the products, which need less energy to produce and environmental friendly. To achieve the efficient of EPM adoption, EPM should perceive to have relative advantage, compatibility, complexity, trialability and observability characteristic. The control mechanism can be built through formal and informal control techniques. Specifically, Volvo CE needs to identify more joint KPI:s with suppliers and include important suppliers in the process. A long-term relationship with an important supplier will alleviate the control of 2:nd and 3:rd tier supplier since the important supplier will have the trust and authority to control, monitor and oversee how they are implementing the environmental aspect in their daily work.
# Table of Contents

1 INTRODUCTION .................................................................................................................. 1  
  1.1 Background ....................................................................................................................... 1  
  1.2 Problem Discussion ........................................................................................................ 3  
  1.3 Purpose and Research Questions .................................................................................... 5  
  1.4 Limitations ....................................................................................................................... 6  

2 COMPANY BACKGROUND ................................................................................................... 8  
  2.1 Volvo Construction Equipment ....................................................................................... 8  

3 METHODOLOGY .................................................................................................................. 10  
  3.1 Scientific Perspective ....................................................................................................... 10  
  3.2 Scientific Approach ......................................................................................................... 11  
  3.3 Research Strategy .......................................................................................................... 11  
  3.4 Research Design ............................................................................................................ 12  
  3.5 Research Process ........................................................................................................... 13  
    3.5.1 Data Collection ......................................................................................................... 13  
    3.5.2 Primary Data ............................................................................................................ 13  
    3.5.3 Secondary Data ........................................................................................................ 16  
  3.6 Data Analysis .................................................................................................................. 16  
    3.6.1 Unit of Analysis ......................................................................................................... 16  
    3.6.2 Empirical Data Analysis .......................................................................................... 16  
  3.7 Scientific Credibility ........................................................................................................ 17  
    3.7.1 Validity .................................................................................................................... 17  
    3.7.2 Reliability ................................................................................................................. 18  
  3.8 Ethical Consideration ...................................................................................................... 19  
  3.9 Summary of Methodology .............................................................................................. 19  

4 THEORY .................................................................................................................................. 20  
  4.1 Theory Model .................................................................................................................. 20  
  4.2 Environmental Regulation in Heavy Vehicle Industry ..................................................... 21  
    4.2.1 Characteristic, Trend and Challenges in Heavy Vehicle Industry ......................... 21
FIGURES

Figure 1. Thesis limitation (Own Construction Figure) .......................................................... 6
Figure 2. Methodology Model (Own Constructed Figure) ...................................................... 19
Figure 3. The framework of theory (Own constructed figure) ............................................... 20
Figure 4. A Model of Five Stages in the Innovation-Decision Process. Retrieved from Rogers (2003, p. 170) ........................................................................................................... 26
Figure 5. Theoretical contingency framework for management control system design and the association with operational performance of manufacturer–supplier relationships. Retrieved from Pernot & Roodhoft (2014) ........................................................................................................ 32
Figure 6. The role of perspective for the understanding of interface-performance. Retrieved from Gebert (2014) ................................................................................................................. 33
Figure 7. Operationalisation Model (Own construction figure) ............................................. 38
Figure 8. Analytical Model (Own Constructed figure) ............................................................ 51
Figure 9. RQ 1 Analytical figure ............................................................................................... 52
Figure 10. RQ 2 Analytical figure ............................................................................................. 56
Figure 11. Diffusion process of EPM. Adapted from Rogers (2003) ........................................ 56
Figure 12. RQ 3 Analytical figure ............................................................................................. 65

TABLES

Table 1. List of Primary Data collection .................................................................................. 15
List of Abbreviation

CO       Carbon Monoxide
CO₂      Carbon Dioxide
CSR      Corporate Social Responsibility
CVM      Customer Value Management
EBP      Environmental Business Practices
EMS      Environmental Management System
EPM      Environmental Performance Management
EPMC     Environmental Performance Management Control
HC       Hydrocarbon
IMCS     Inter-organisational Management Control System
IOR      Inter-organisational Relationship
KPI:s    Key performance Indicators
MCS      Management Control Systems
NOx      Nitrogen Oxides
OEM:s    Original Equipment Manufactures
PHR      Part Handling Review
PM       Particulate Matter
QPM      Quality Performance Management
R&D      Research and Development
RBV      Resourced-Base View
SCOR     Supply Chain Operations Reference
Volvo CE Volvo Construction Equipment
WWF      World Wide Fund
1 INTRODUCTION

This chapter will present the increasing awareness of environmental care and regulations from different institutions. Additionally, it will explain how these regulations will impact the case company of this thesis, Volvo Construction Equipment (Volvo CE). In order to manage the environmental challenges for Volvo CE, the Environmental Performance Management (EPM), is introduced. Subsequently, the researchers will present the impact of environmental regulations in Volvo CE, along with the problem of diffusing and controlling the EPM within the supply chain of Volvo CE. This leads to the purpose and research questions of this thesis along with the limitations area of the thesis.

1.1 Background

Often organizations operate within a dynamic environment and to flourish in this changing world, they need to be aware of and respond to emerging opportunities and threats (Hayes, 2014). Moreover, Hayes (2014) argues that many organizations adapts slowly to changing circumstances and the result is strategic drift and a growing misalignment with their external environment. One important and significant change nowadays is the environmental care, which is becoming more noticed in the world. In fact, trends for more sustainable and environmental friendly business practices have transformed many industries (Prajogo et al., 2014). The heavy vehicle industry has also been one of the few industries, which took higher burden with regards to environmental regulations and standards (Koplin et al., 2007; Länsiluoto & Järvenpää, 2008). In fact, in the Eurozone, institutional regulations concerning Carbon Dioxide (CO₂) emissions are updated every five year, which forces Original Equipment Manufacturers (OEM:s) to continuously innovate and develop environmentally sustainable technologies (Ernst, 2012).

In the case of Volvo CE, it has been a big challenge for the heavy vehicle industry to cope with the regulations, since they have been updated consistently for the last 15 years (Vice President of Environment and Sustainability, 08/02/2016). In fact, strategic objectives at Volvo CE have been highly influenced by sustainability requirements as the role of environmental care has increased significantly during the last decade (Environmental Care & Security Manager, 08/02/2016). Vice President of Environment and Sustainability (08/02/2016) states that the environmental regulations have brought challenges to the overall business strategy, the company tactics and the performance management. Consequently,
environmental regulations led to changes and the company had to reconsider its business model at strategic level and drive continuous improvements in both tactical and operational levels in order to deliver products that are high of quality, sustainable and safe, which leads to high productivity and long-term economic performance.

From a classical point of view, regulations will mainly put an additional burden on the manufacturers, thus harming the industry by increased cost or loss of sales (Ernst, 2012). In most cases, there is a pressure by vehicle manufacturers on their suppliers when it comes to the compliance with the environmental regulations; the environmental management goes only in one-way direction, where OEM:s, as customers, set requirements and control whether suppliers meet those requirements or not (Caniels et al., 2013). However, companies have also recognized the role of environmental performance as a source of competitive advantage (Wagner, 2005). Following that, organizations started to capitalize on environmental performance as a value driver, and accordingly, have came up with new initiatives in operations and manufacturing, such as eco-design (Zailani et al., 2011).

In fact, Volvo CE is trying to achieve higher company value through engaging in sustainable operations and do it through the optimization of Environmental Performance Management (EPM). A clear definition of EPM is important in order to encounter the purpose of this thesis. Environmental performance can be defined as “the measurable results of an organisation’s management of its environmental aspects” (Björklund & Forslund, 2013 pp.232; ISO, 2004). Additionally, Moynihan (2008) defines performance management as “a system that generates performance information through strategic planning and performance measurement routines and that connects this information to decision venues” (p.5). And, a system itself is “a set of entities or interacting units with relationship between them, where these entities or units are part of a mechanism or a method” (Langefors, 1995 pp.55; Miller, 1995 pp.17; www.businessdictionary.com). Hence, the definition of EPM in this thesis is described as a system that generates measurable performance information regarding the environmental aspects through strategic planning and performance management routines. Additionally, EPM is not only mitigating environmental liabilities, but also improving cost advantages, helping to use resources efficiently, reducing waste and improving corporate image (Halliday, 2016).
Therefore, the line of argument asserts that Volvo CE needs to understand the role of EPM in fulfilling the corporate goals, which will ultimately bring changes to their financial performance and public reputation.

Regarding the environmental performance, OEM:s, as focal entities in the heavy vehicle industry supply chain, are trying to achieve maximum levels of sustainable operations; and, they do it not only through the optimization of activities within, but also along their supply chains (Hsu & Liu, 2010). Prior research highlights the significant influence of upstream supplier networks in the environmental performance of vehicles (Koplin et al., 2007; Binder et al., 2008; Caniels et al., 2013). And, environmental sustainability objective is pursued through the adoption of EPM (Halliday, 2016). Therefore, another line of argument claims that EPM has to spread along the initial suppliers of materials, and the uniformity of control mechanisms and performance management should be priority in order to achieve higher company value and long term economic performance. Currently, as Vice President of Environment and Sustainability (08/02/2016) confirms, Volvo CE spends approximately 75 percent of its budget in the product development into the emission reduction/regulation technology. It is clear that the environmental sustainability concern plays dominant role in the company as a whole.

1.2 Problem Discussion

According to Maxwell et al. (1998) the pressure from customers affect the regulations and incentive on environmental issues and firm’s ability to meet customer needs largely depends on how it also handles the environmental performance besides other attributes of its products and services. In Volvo CE, the customer loyalty is retained by keeping strong and long-term customer relationship and continuously delivers customer satisfaction (Global Director Core Value, Management Sales and Marketing, 12/02/2016). Further, he highlights that the process to attain customer loyalty and satisfaction shall be achieved by working with the company's core values, which are Quality, Safety and Environmental Care. Accordingly, Volvo CE should continuously work on increasing customer value by satisfying needs and wants on
several dimensions, that will lead to better positioning in the market, and enhance value proposition (Wagner, 2005).

However, the maximization of economic value for certain member of the supply chain depends on how well the whole supply chain performs (Jonsson, 2008, p.40). In connection to that, as in any other industries, the value chain in the heavy vehicle industry witnesses the increasing importance of suppliers’ input (Laabs, 2009). However, as brand owners, vehicle manufacturers are held responsible for all environmental problems caused by their suppliers (Simpson et al., 2007). As a response to such trends, more and more companies have to look for ways on how to integrate environmental aspects of production and operation into their supply chain process (Koplin et al., 2007).

According to Global Supplier Development Process and VPS Director (23/02/2016), it is important for Volvo CE to disseminate information regarding the environmental regulations as early as possible to suppliers, thus the whole parts (suppliers and company) have the same level of knowledge and information in the supply chain. There is an urgency in “…expanding the scope of environmental performance control beyond the firm’s level, that is from being intra-organisational to inter-organisational through the involvement of supply chain partners” (Prajogo et al., 2014, p.565). At Volvo CE, the control of EPM practices on the supplier's’ current systems is still in progress. There is no well-defined key performance indicators (KPI:s) regarding the environmental performances towards the suppliers as well as the measurement for performance of knowledge-sharing and other mutual initiatives which is carried-out in cooperation with suppliers (Global VPS (LEAN) Director, 12/05/2016; Environmental and HS Leader, 08/06/2016). As suppliers are an important party in the whole supply chain process and to enhance the same level of knowledge and information in the supply chain, moreover, Global Supplier Development Process and VPS Director (23/02/2016) explains that there is a need for improvement in the whole supply chain throughout the entire tier of suppliers. Apparently, increasing the company value requires the efficient diffusion of EPM on the upstream supplier networks. Rogers (2003) explains the “efficiency” of the diffusion by the rate and timely adoption of the innovation.
In order to integrate the environmental guidelines, companies have to construct new criteria for supplier selection and evaluation, which should be complemented by control mechanisms and compliance indicators (Koplin et al., 2007), thus Volvo CE should have effective control mechanisms in place that will ensure the efficiency of the EPM diffusion. Pfister (2009) argues that the effective control as knowing and addressing the root cause of control failures to achieve a high degree of control effectiveness as an outcome. If organization can put more attention to the root cause of control failures, then the effective outcome can be achieved. The control mechanism itself is defined as “the method used to control and coordinate the activities performed by channel members, where the channel members use control mechanisms to have more predictable goals that ensures more certain outcomes within organization” (Cited in Koza & Dant, 2007 pp.281). So, by knowing and addressing the root cause of control failures in the early phase, Volvo CE can come up with the methods to control and coordinate the activities, so that Volvo CE has more predictable goals and certain outcomes. Hence, in Volvo CE, it is crucial to have premium suppliers to drive the technological shift towards sustainable advantage, and supplier selection and performance control should follow this principal (Global Director Core Value, Management Sales and Marketing, 12/02/2016). It means that, careful selection and alignment of environmental key performance indicators (KPI) with critical success factors are important for strategic and operational management of organizations (Bai & Sarkis, 2014). Currently, Volvo CE is looking forward to identify joint KPI:s with suppliers to measure the progress and translate targets and joint actions to fill the gaps in terms of environmental sustainability. Global Supplier Development Process and VPS Director (23/02/2016) points out that it will lead to critical success factors both for Volvo CE and its suppliers.

1.3 Purpose and Research Questions
In order to address the above stated problem, the purpose of this paper is two-fold. Firstly, it aims to identify the impact of environmental regulations in Volvo CE. Secondly, it is set to analyse the possible ways to efficiently diffused the EPM on the supplier network of Volvo CE and identify control mechanisms for the EPM implementation on the supplier network,
from the perspective of Volvo CE. To fulfil above stated purpose, following research questions are presented:

1. How does the environmental regulation in heavy vehicle industry impact the EPM of Volvo CE?
2. How should the EPM be efficiently diffused to the supplier network of Volvo CE?
3. Which are the effective control mechanisms of the EPM on the supplier network of Volvo CE?

1.4 Limitations

This thesis is limited to identify the impact of environmental regulation in the EPM of Volvo CE and analyse the alternative ways on how to diffuse the EPM to the supplier network of Volvo CE (upstream) together with the control mechanism of EPM, from the perspective of Volvo CE. Meaning that the perspective of the suppliers is not taken into consideration regarding the diffusion of EPM to the supplier network of Volvo CE. Additionally, since Volvo CE has more than 2000 suppliers worldwide, this thesis only focuses on three types of
suppliers that Volvo CE underlined as important suppliers to cooperate with, which are Development Suppliers, Direct Suppliers and Structure Suppliers.
2 COMPANY BACKGROUND

This chapter describes the background of the company, where Volvo CE is the research object in this thesis. Here, the overview of Volvo CE, what kind of industry Volvo CE belongs to, Volvo CE vision and mission and company purpose regarding the environmental sustainability process, is described to give the reader the overview of company.

2.1 Volvo Construction Equipment

Volvo CE, as a part of Volvo Group, is one of the market leaders that develops, creates and advertise equipment for construction and related industries. Volvo CE offers a broad range of hard products, supported by solutions in areas such as servicing, financing, used equipment and rental. The range of products is wheel loaders, hydraulic excavators, articulated haulers, motor graders, soil and asphalt compactors, pavers, milling machines and compact equipment (Volvo Report, 2011).

Volvo CE has a vision to create zero accident and provide a safety working environment on the sites. In quality parts, they aim to deliver the number one total quality experience and regarding the environmental care aspect, Volvo CE aims to be the world leader in sustainable transport solution by collaborating with an established environmental organization, such as the World Wide Fund (WWF) climate saver to help reduce CO₂ emissions; greenhouse gases, such as Nitrogen Oxides (NOx), Hydrocarbons (HC), Carbon Monoxide (CO) and Particulate Matter (PM); increase company products’ fuel efficiency and demonstrate what company committed to environmental sustainability (Volvo Report, 2011).

In line with environmental sustainability mission, Volvo CE has a priority in environmental sustainability processes, which has been carried the last decade and is still carried today (Vice President of Environmental and Sustainability, 08/02/2016). Volvo CE supports various engine regulations, test methods and emission standards that are issued by the United State of America, Europe, Japan and the rest of the world (Volvo Report, 2014). According to Vice President of Environmental and Sustainability (08/02/2016), the company aims to reduce energy consumption per manufactured unit by 15 percent over a three-year period, reduce CO₂ emissions by 20 percent in 2020, CO₂ neutral facilities in their operations and replace
fossil fuel with renewable fuel. To restrict the use of chemicals, the Volvo Group has, since 1996, maintained a ‘blacklist’ of prohibited chemicals and a ‘grey list’ of products whose use must be limited. Since Volvo CE is mainly a downstream user of chemicals and relies upon the suppliers of chemicals to report according to the new legislation, Volvo CE participate in maintaining a database, called MOTIV, containing detailed information on over 6,000 chemical products (Volvo Report, 2014).

Volvo CE has more than 2000 suppliers worldwide and the suppliers produce and generate more than 50 percent of the annual turnover of the company (Global Supplier Development Process and VPS Director, 23/02/2016). According to Global Supplier Development Process and VPS Director (23/02/2016), Volvo CE defines three types of suppliers to cooperate with: Development Suppliers, Direct Suppliers and Structure Suppliers. Development suppliers are the suppliers who own the product’s design and develop the process of products, direct suppliers are the suppliers who have close relationship with company and act as premium/key suppliers and structure suppliers are the suppliers who provide for basic components, such as metal products and basically components/products within welding construction which are cutted, bended, welded, grinded and structured.

Volvo CE has achieved some certifications complying with ISO 9001 (Quality Management), ISO 14001 (Environmental Care) and OHSAS 18001 (Occupational Health & Safety). It means that all of the company’s sites and functions aligns with the three core values of Volvo CE: Quality, Safety and Environmental Care (Volvo Report, 2014).
3 METHODOLOGY

This chapter describes the scientific approach that is used in this study. An explorative case study with the positivism perspective is conducted to develop a conceptual and analytical framework to support the diffusion and control mechanism through EPM at Volvo CE. In order to create the understanding of this study, an abductive approachment is applied. To cope with the purpose on how Volvo CE diffuse back to the suppliers and control the process through EPM, qualitative method is used, gaining from purposive sampling, primary and secondary data. Moreover, summarizing and clarification of transcribed interview are done to align with validity and reliability data collection.

3.1 Scientific Perspective

The choice of methods used in this study was raised by the relationship between theory and research questions that presented in the introduction part, which were constructed of both a deductive approach and an inductive approach. This thesis was conducted in an exploratory research, which was known as positivism perspective. In the positivism perspective, the researcher is guided by the belief that organizations exist as concrete entities about which data can be collected to develop a conceptual framework and analytical construction to come up with the analysis and conclusion (Bryman & Bell, 2015). Exploratory research guided the authors during the research process to define and address the specific problems and find out the information why the authors come up with the problems and research questions, which was led to have deep understanding about the problems and did necessary changes when it was needed (Saunders et al., 2012). So that, the coherence and red thread within the research projects can be achieved (Saunders et al., 2012). This thesis used positivism perspective, since the authors found the problems through academic literatures, theory, updated issues and discussion, and it used general theory, such as diffusion theory, inter-organisational management control system, formal and informal control techniques and buyer-supplier relationship to support the conceptual framework and analytical process to conduct the study in diffusion and control mechanism of Environmental Performance Management (EPM) in the supplier network at Volvo Construction Equipment.
3.2 Scientific Approach

There are two types of scientific approach: deductive and inductive approach (Bryman & Bell, 2015). A deductive approach starts with theory and prediction as the assumption to figure out the empirical findings then come up with the observations and analysis. Meanwhile, an inductive approach starts with the observation or empirical findings which will lead to the developed and suitable theory that support the researcher to analyse the information. But, since the research questions required flexibility on this study, and to overcome the limitations from deductive and inductive approaches, the abductive approach was appeared as the best fit for this thesis. It gives flexibility to the authors to create a new theory or build a modification from the existing theory (Saunders et al., 2012). Abductive approach was gained through the identification of academic literature, theory, and observation of the updated issues, to generate a new conceptual framework or modify the existing theory (Saunders et al., 2012). So that, the researchers had flexibility to interpret and explain the data collection (Mantere & Ketokivi, 2010). As Saunders et al. (2012) mention that the abductive approach could provide the development of conceptual model creation and adapt with unexpected changes in the findings and theory during the projects. Therefore, the theories on the topic were observed, consulted and discussed before the interviews took place to have deep understanding and insight on the topic.

3.3 Research Strategy

Bryman & Bell (2015) argue that there are two types of research strategy to conduct the research: quantitative and qualitative research. A quantitative research emphasizes the quantity or amount of data collection and analysis of data. On the other hand, a qualitative research highlight the generation of theory, where mainly focus on words rather than data quantity in data collection. Since the phenomenon was complex and dynamic where the OEM:s were witnessing the increasing of environmental friendly business practices in heavy vehicle industry and the supplier’s network played an important role, it was important to understand and have deep understanding of the context in which the research takes place. Therefore, this study used qualitative data to conduct the research. Due to the exploratory nature of the study, case study strategy was the chosen method.
The case study research is designed from the interaction of the topic and its content (Saunders et al., 2012). Specifically, Saunders et al. (2012) mention that case study research was built from the real-life experience or phenomenon that may refer to specific person, a group, an organization, an event, an updated issues and other real life experiences within a specific time. It is necessary to understand what is the real case of the context (Saunders et al., 2012, pp.185). Moreover, as Stake (1995) observes that case study research is concerned with the complexity and particular nature of the research question, therefore, this study used one single case study which focus only in one company, which was Volvo CE. It gives flexibility to the authors to observe and understand the real case of the context (Meyer, 2001; Saunders et al., 2012) where the authors have possibility to explore and analyse the phenomenon before deciding to use it as a research study (Saunders et al., 2012). Case study offered an opportunity to mix quantitative and qualitative method (Saunders et al., 2012), which in this thesis, it was only used qualitative method as a research strategy to collect data, which was gained from company visit and personal interviews and skype-based interviews of related departments/areas within Volvo CE.

3.4 Research Design
Since this research used exploratory research, where the authors discovered the issues or phenomenon to gain more insights and deep understanding, the research questions are build through “What/Which and How” (Saunders et al., 2012). Specifically, this thesis used cross-sectional design which was built by having semi-structured interviews within limited time requirements and addressed them to the expertise in the related departments/area in Volvo CE (Bryman, 2012). As mentioned above, this study used qualitative method as the research strategy to collect data, thus the related sampling was needed. This study was conducted by using purposive sampling with direct references and respective sources to the research questions that had been asked. Bryman & Bell (2015) argue that purposive sampling acts as the master concept around which different sampling approaches in qualitative research can be distinguished, so that, only samples which are relevant to the research questions are being posed. In this thesis, it meant that all related departments, responsible people and significant processes that were connected to the diffusion and control mechanism of Environmental
Performance Management at Volvo Construction Equipment were included, to get deep knowledge and understanding of the problem from respective departments within the company.

3.5 Research Process

3.5.1 Data Collection
To gain knowledge about the selected topic, we gathered both primary and secondary data. Assembling both primary and secondary data supported this paper to answer the research questions in a trustworthy way. Through semi-structured interviews, the primary data was collected, which means that we used a qualitative method to collect the primary data. Bryman & Bell (2011) mention that in qualitative interview, there is much greater interest in the interviewee point of view, which was fitting in this thesis since the insight from the case company was very important. Gathering information through interviews gave the writers the opportunity to be more flexible when doing interview and adjusting the emphasis if an issue emerge in the course of interviews (Bryman & Bell, 2011). Interviews and the use of categorizing data are common characteristics of a qualitative study.

3.5.2 Primary Data
This thesis used the primary data, which was collected through six semi-structured interviews with six different people in Volvo CE. The interviews where divided into three phases with different objectives and every phase helped one of the research questions. Each phase containing of information from two interviews. In the first phase of the data collection, the idea was to gather information about the impact of environmental regulations on the strategy of Volvo CE and the impact on the practical work inside the plant of Volvo CE. The information from these interviews helped the authors to analyse the research question one. Secondly, in the second phase of the data collection, the information was gathered and focused on the EPM diffusion to the supplier network of Volvo CE, information sharing, and supplier involvement and consequently, interview results regarding this area were conducted
to further analyse the research question two of this thesis. Lastly, the information about internal control mechanism for the EPM was gathered to analyse the research question three of this thesis. The data was gained in the period of time during February until June 2016. Since the idea of this research was connected with the previous projects the author attended the interviews were taken during a long time frame. The majority of the interviews were completed face-to-face and additional interviews were finalized through Skype meetings.

As a single case study applied in this thesis, the data should be analysed qualitatively in order to place more emphasis on why the problem of the thesis occurs (Saunders et al, 2012). Subsequently, as the problem of this thesis came from Volvo CE, it was necessary to have open interviews around some key questions in the interviews. Accordingly, Saunders et al. (2012) states that semi-structured interviews should cover some key questions although their use may vary from different interviews. Moreover, this meant that it was possible to exclude some questions in specific interviews, given a specific organisational context that was faced in relation to the research topic. Interviews in the thesis were conducted through personal meetings with each individual and the data was captured by audio-recording and note taking of the writers, which was consistent with the statement of Saunders et al. (2012) that the data should be captured by audio-recording or note taking. The intention of that was to gain full attention from the interviewees, so that the interviewees focus to the questions and give the proper information that the authors want to achieve. As a result, it made the transcription easy to understand and gave an opportunity to the researchers to build some follow-up questions regarding the feedback information from interviewees (Meyer, 2001). Subsequently, the audio recording became transcribed and the notes helped us fill in parts that were not perceived by the audio-records. The duration of the interviews was from 45 to 75 minutes.

In order to set the expectation for the meeting, the guidance/structure questions were sent to the participants before the actual meeting. The guidance contained of 10-20 questions and the questions were different for each respondent. The reason for having different type of question for different persons was that the person in different positions in the company could give diverse answers. The interview guidances can be seen in Appendix 1-6. The questions were developed gradually and adjusted with the theory, academic literatures and conceptual
framework as well as the order of the questions, to have the coherence and red thread between the topic and the theory context. To have a trustworthy result, the secondary data was gained through reliable business portals, to double check the consistency and data accuracy presented by the interviewees. Moreover, a deep understanding of the context is important to have a clear picture how to develop the conceptual framework for further analysis (Saunders et al., 2012). As a result, not only words were important, but also the voice tone and respondents’ body language, to give the picture for researchers about data accuracy. For example, the researchers could observed the way respondents explained the information, if the respondents had deep understanding about the information that the researchers wanted to achieve or not. The body language and tone voice gave an idea of the respondents knowledge about the topic.

<table>
<thead>
<tr>
<th>Name</th>
<th>Title/Position</th>
<th>Type of Interview</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Niklas Nillroth</td>
<td>Vice President of Environmental and Sustainability</td>
<td>Face-to-face Interview, Company Visit</td>
<td>08/02/2016</td>
</tr>
<tr>
<td>Rickard Alm</td>
<td>Environmental Care and Security Manager at Volvo CE Braås</td>
<td>Face-to-face Interview, Company Visit</td>
<td>08/02/2016</td>
</tr>
<tr>
<td>Tony Andersson</td>
<td>Global Director Core Value, Management Sales and Marketing</td>
<td>Skype Interview</td>
<td>12/02/2016</td>
</tr>
<tr>
<td>Dirk Engelke</td>
<td>Global Supplier Development Process and VPS Director</td>
<td>Skype Interview</td>
<td>23/02/2016</td>
</tr>
<tr>
<td>Stefan Braunias</td>
<td>Global VPS (LEAN) Director</td>
<td>Skype Interview</td>
<td>12/05/2016</td>
</tr>
<tr>
<td>Christian Nilsson</td>
<td>Environmental &amp; HS Leader</td>
<td>Skype Interview</td>
<td>08/06/2016</td>
</tr>
</tbody>
</table>

Tabel 1. List of Primary Data collection
3.5.3 Secondary Data

To help provide additional information, knowledge and understanding to this thesis, secondary data was collected. This thesis used secondary data, which was gained from company website, environmental institutions and environmental regulation website, articles, books and company reports. The secondary data supported the research background and theory framework, and helped the researchers to highlight the findings which were collected through the primary data (Saunders et al., 2012). In order to collect the secondary data, the researchers used Linnaeus University library website, Google Scholar, Volvo CE website, business journals, environmental sustainability, logistic and automotive journals, management accounting and control books and environmental institutions websites to collect the necessary data.

3.6 Data Analysis

3.6.1 Unit of Analysis

The goal of this study was to understand how Volvo CE implement the diffusion back to the supplier network and control the process through EPM. Subsequently, this study examined the impact of environmental regulation in EPM of Volvo CE and furthermore how the EPM could be diffused back to the suppliers of Volvo CE in an efficient way. Suitably, the unit of analysis for this study was environmental performance management. Since the focus of this thesis was to analyze the impact of environmental regulation in the EPM of Volvo CE, to find out how Volvo CE diffuse the EPM back to their supplier’s network and to observe which control mechanisms should be performed to control the diffusion process through EPM, thus EPM should be the unit of analysis.

3.6.2 Empirical Data Analysis

Qualitative data is linked with the social understandings and identifications of incident that happens to people according to Saunders et al. (2012). Meyer (2001) states that there are guidelines that can be useful but that there is no fixed way of analysing qualitative data. The decisions concerning the design of a case depends on the researchers, according to Yin (2009) and Eisenhardt (1989). They also presented different guidelines on how to custom a case. In this study the authors gathered, evaluated, and interpreted data as we advance with each
interview. This depends on that qualitative studies which were communicating and interrelated between the qualitative data gathering and evaluation (Saunders et al, 2012).

As our semi-structured interviews were to be recorded, the structured questions was needed to be prepared before it can be analysed. The first step was to transcribe the qualitative data from the tape into written data. The recorded interviews were reproduced in hand-writing using the actual words and in addition to notes about the respondents’ body language. Meaning that the respondents’ body language showed the data accuracy. For example, the researchers could observed the way respondents explained the information, if the respondents had deep understanding about the information that the researchers wanted to achieve or not. The body language and tone voice gave the researchers an idea of the respondents knowledge about the topic. This process of transcription was done right after each interview took place. It was considered as an important aspect of our research since it would help in the preparation for the next interview regarding the follow up questions, beside the structured questions that already had or sent. After the data had been transcribed, the researchers were doing data reduction process. This was needed to be done, so that only necessary data and clarification of the collected data which was focusing on the intention parts are written (Bryman, 2012). The data was divided in the topics where paragraphs and sentences belonging to specific contexts and they were grouped together. The guide questions regarding the related data were presented to the related position and department (see Appendix 1-6).

3.7 Scientific Credibility

3.7.1 Validity

According to Lincoln & Guba (1985), a researcher can see validity in two ways, the first one is internal validity, which discusses the quality of the data and how precise the reality is according to the research (Yin, 2009). By identifying the correct operational measures for the concepts, it helps to establish the causal conditions where a certain area leads or relates to another area (Yin, 2014). Thus, in this study, to construct validity, the authors ensured to take necessary measures to guarantee the quality of researchers’ data collection. As mentioned, the authors started by sending a summary of the transcribed interviews to the interviewee. By sending the summary of the transcribed interviews, the interviewee got a chance to revise and
ensured that we did not misunderstand him/her. The interviewee could also correct and add new information/feedback, which made this research stronger (Ellram, 1996). So, there was double check for the data collection both from interviewer and interviewee. It therefore made strong internal validity.

After doing the internal validity process, then the findings can be generalized across social settings to see external validity aspect (Bryman & Bell, 2015). External validity is concerned with the question whether the results of a study can be generalized beyond the specific research context by generating representative samples (Bryman, 2012). Since the environmental performance management became more critical and important in the heavy vehicle industry and in Volvo CE, the chosen case would allow the researchers to have a better understanding of the circumstances (Yin, 2009). This was ensured by using diffusion theory as the framework to manage the uncertainty while diffusing EPM back to supplier network and inter-organisational management control system as a concept to cope with the control mechanisms within the supply chain process in heavy vehicle industry.

3.7.2 Reliability

Yin (2009) states that reliability is when the collected and analysed data in the study are the same when other researchers do the same study. The purpose for doing reliability checked is to minimize errors and biases in this study (Yin, 2014). The researchers recognised that another qualitative study on inter-organisational performance management in Volvo CE was probable to reproduce other findings than this study. On account of the different perceptions and focus of the researchers. To assure that the data was collected in a reliable way, only certain and related departments with specialized employees were taken into the interview session to gather more insights and information how Volvo CE works with the environmental regulations, how to diffuse the EPM back to supplier network and control the processes. Few journals/researches showed that there was a positive impact which contributes to the successful environmental management practices and green supply chain process from the balance application of environmental management diffusion and significantly relationship between environmental management purposes and supply chain focus within company.
3.8 Ethical Consideration

Saunders et al. (2012) defines ethic as the standards of behaviour that guide an individual act in relation to the rights and norm, where an individual has to adapt according to the existing and social norms. In the research perspective, by using and performing ethical principles and standards, the researchers had an ethical basis to anticipate any issues and potential risks during the process of doing research (Bryman & Bell, 2015). Therefore, the authors considered all material and issues which could have caused any harm or any potential risks that could appear during the process of doing the research. In order to anticipate any harm to the participants in this research, all participants were informed about the detailed procedures, rules, and intended outcome that the researchers wanted to achieve. Before gaining the data, the agreement and rights between the two parties, the authors and participants, were discussed. Likewise, those were also needed to ensure the validity and reliability data of the thesis. Regarding the confidentiality, anonymity and privacy, both parties discussed which data could be shown in public and which data needed to be confidential.

3.9 Summary of Methodology

To summarize the different approaches that were used in this study, a methodology model was developed to give better understanding and comprehensive overview for the reader. The figure is presented below:

![Methodology Model](image)
4 THEORY

This chapter presents how the study is conducted within the scope of related theory and will help to analyze the empirical findings from Volvo CE. In order to support and analyze the research questions, firstly, the environmental regulations in heavy vehicle industry, which are controlled by REACH regulations and WWF climate saver, and supplier network in heavy vehicle industry are presented. Secondly, Volvo CE, as an OEM, needs to analyze the possible ways on how to diffuse the EPM back on the upstream suppliers of Volvo CE, therefore, the use of diffusion theory will conduct the adoption of EPM. Lastly, by using inter-organisational management control system framework, the effective control mechanism of EPM can be identified.

4.1 Theory Model

In the opening of the theory, the environmental regulations in heavy vehicle industry are presented. This part explains the environmental regulation, which comes from REACH and WWF climate saver, the explanation about general supply chain process and the supplier network in the heavy vehicle industry. Resulting in a general overview regarding the
environmental care for the authors and a base which will be used in analysing the impact of the environmental regulations on Volvo CE. Furthermore, to answer the second research questions, Volvo CE needs to analyse possible ways of diffusing the EPM efficiently on the upstream supplier networks, thus the use of diffusion theory as the framework within the process will be used. Diffusion theory will support the adoption of EPM, which can handle the uncertainty in adopting the EPM. Lastly, by using inter-organisational management control system, the effective control mechanism for EPM diffusion can be posed, which can support further analysis about measurements, joint Key Performance Indicators (KPI:s) and control system (see Figure 3).

4.2 Environmental Regulation in Heavy Vehicle Industry

4.2.1 Characteristic, Trend and Challenges in Heavy Vehicle Industry

Heavy vehicle industry consists of several different types of products, such as trucks, buses, construction equipment, military vehicles, and all of tools, which use vehicle components (Berggren et al., 2015). In heavy vehicle industry, Berggren et al. (2015) state that “the components suppliers operate in a lower scale, R&D projects need to be amortised over longer periods of time, and OEM:s need to carefully consider how to organise their product development internally and externally (Berggren et al., 2015, p. 1019). Furthermore, Berggren et al. (2015) argue that OEM:s such as Volvo, Daimler, IVECO, MAN, and Scania offer integrated products with internally modularised designs where the certain design is made according to required specifications. The difference between heavy vehicle industry compare to passenger car/bus industry is that heavy vehicle sectors are connected more to the R&D aspects due to compliance in the emission regulations and have more demanding technological development regarding the components and designs (Berggren et al., 2015). Hence, the suppliers in heavy vehicle industry are more fragmented because the manufactures have to obey the emission regulations which lead to specific new technologies among the certain components/engines (Berggren et al., 2015).

Recent trends in the heavy vehicle supply chains are attempted to shorten the product life-cycles and sustainable management. According to Pereseina et al. (2014), heavy vehicle
industry builds a product system that allows the economic wealth creation within market, but at the same time, it brings impact to human and environment that come up with pollution and safety issues. The basic competitive priorities are generally considered to be quality, delivery, price, and flexibility to cope with competitive advantages (Olhager & West, 2002). Von Corswant & Fredriksson (2002) claim that despite the decreasing trend of internationalization of production and product development by OEM:s, there is a still high tendency in globalization in terms of sales and usage of common vehicle platforms. Pfaffmann & Stephan (2001) and Faes & Matthyssens (2009) recognize the increasing trend of using platform strategies. As they explain, a vehicle platform consists of some major product parts, which can be standardized to produce high volumes or diversified in order to effectively respond to local requirements, and this serves as a basis for the platform strategy. Accordingly, using platform strategies allows to achieve cost efficiency without undermining the greater product variety (Faes & Matthyssens, 2009).

A wider range of products with short life-cycle time and high customer demands in customization products become a big challenge in heavy vehicle industry (Asadi et al., 2015). Other challenges, such as green energy, ethical and social responsibility, and cost increase, are faced by heavy vehicle industry within the sustainable development of the heavy vehicle supply chains (Xia & Tang, 2011; Abbasi & Nilsson, 2012). The pressures for sustainability aspects and reduce the environmental impacts in the heavy vehicle industry are mainly arise from environmental regulation by government and other stakeholders (Orsato & Wells, 2007). Moreover, Orsato & Wells (2007) state that the external and internal pressures on the supply chain towards environmental sustainability come from the regulatory, organisational, media and community stakeholders. Furthermore, Laabs (2009) states that the pressure on supply chains toward environmental sustainability is a challenge, since suppliers are required to carry the responsibility of product renewability and to upgrade their systems and components regularly. Moreover, suppliers are obligatory to have different jobs, such as fulfilling customer demands, meet environmental and legal requirements and provide just in time logistics. Additionally, Laabs & Schiereck (2008) states that the intensity of competition increases among the heavy vehicle suppliers as a result of the shorter product lifecycle and sourcing behaviours.
4.2.2 Environmental Regulation Barriers in Heavy Vehicle Industry

Environmental sustainability business practices are getting used by most industries within Europe nowadays. In the Eurozone, institutional regulations, such as REACH regulations and WWF climate saver, are aiming to improve the protection of human health and environment from hazardous chemicals and enhance innovation and competitiveness of the EU chemicals industry (EU, 2006). It therefore forces OEM:s to continuously innovate and develop environmentally sustainable technologies. As the result, companies have started to recognize the role of environmental performance as a source of competitive advantage (Wagner, 2005).

OEM:s, as the focal entities within heavy vehicle industry, have to find ways to gain strategic value of environmental management practices and meet the requirements from environmental regulation in controlling gas emission and greenhouse effect. Likewise, as Sirmon et al. (2007) and Kaplan & Norton (2004) argue that environmental management should be conducted through the effective resource allocation within firm operations. Align with this, vehicle manufacturers need to understand the role of environmental performance, which can lead to the changes in company financial performance, company performance measurements and company reputation and find alternative tools and/or methods to help company to reduce environmental impact and optimize the use of company resources.

In heavy vehicle industry, the big challenge is reducing CO₂ emission, greenhouse effect and the reduction of noxious emissions, such as CO, NOx and particulate matters (Berggren et al., 2015). According to WWF Report (2011), the needs for transportation sector that can contribute to climate change mitigation is important. The environmental regulation, such as WWF climate saver and REACH regulation, force every manufacturing and vehicle companies to reduce the use of fossil fuel, avoid to use private transportations and replace them with non-CO₂ transportation tools, i.e. bicycle, raise the efficiency of vehicle fleet consumption, and replace fossil fuel with electric vehicle and renewable energy vehicle, by observing the new technology and new materials which can support the 30 percent reduction of CO₂ emission by 2020 (WWF, 2011). Align with the regulations, REACH regulation and WWF climate saver make rules for every heavy vehicle company, especially concentrated in
Europe continent, to ensure the adoption of CO₂ emission reduction with truly sustainable renewable energy and strengthen certification system for biofuels and bio-energy sources.

Coming from the regulation that it is needed to implement the greenhouses gas-reduction standard, where it should apply to the whole vehicle fleet, set by the average greenhouse gas emissions of a new vehicle entering the fleet. Not only reduce the emission, but also WWF argue that this standard has a positive effect on the automotive markets and fostered innovation in the European vehicle industry (WWF, 2011). Align with the environmental regulations, it therefore brings impact to vehicle company operations. For example, as Sterner & Turnheim (2009) observe that Sweden has eco-systems that are naturally very sensitive to acidification and there is an environmental policy that control the acid rain in Sweden, thus the contribution of vehicle transportation bring huge impact in CO₂ emission. Furthermore, there is a need to transform environmental regulations into the creation of lead markets which enable local firms to construct environmental innovations (Beise & Rennings, 2005). However, comply with environmental regulation, enable companies within supply chain process to integrate the effects of their activities (Carter and Jennings, 2002). Hence, it will further explain how the environmental regulation can stimulate the adoption of environmental technology and innovation, and the use of diffusion theory as a framework in handling uncertainty of the innovation adoption (Wu & Chang, 2012).

4.3 Diffusion Theory
The diffusion theory became popular after Rogers (1983) have developed a model, which explained how the adoption of innovations can benefit organizations to outperform the competition and increase the economic value. However, Abrahamson (1991) criticizes the model as pro-innovation bias, and considers the efficient-choice perspective where organizations independently and rationally adopt technically efficient innovation. Accordingly, Abrahamson (1991) proposes a framework which also explains why organizations time-to-time adopt technically inefficient innovations, and reject the ones, which are technically efficient (Abrahamson, 1991). Coming back to the innovation-diffusion theory developed by Rogers (1983), it mainly covers three areas: 1) processes and contextual
factors affecting the innovation’s rate of diffusion; 2) difference between early adopters and laggards; 3) the structural effects of networks on the sequence of innovation diffusion.

Rogers (2003) defines that the diffusion itself as “the process in which an innovation is communicated through certain channels over time among the members of a social system” (p. 5). Related to the process, Wu & Chang (2012) state that the process of diffusion is complex and dynamic where during the process, it involves an evolutionary property across the time. There are four main elements in the innovation diffusion, namely, innovation, communication channels, time, and social system. Rogers (2003) described the first element in the innovation of diffusion is innovation, which acts as an idea, practice or project which is perceived as an adoption from individual or a group of unit/people. This idea is communicated through certain element where a communication channel is perceived as a process where people or actors that is involved in the process (group process) are creating and sharing related information to reach a mutual understanding (Rogers, 2003). The idea, which is communicated through communication channel, is processed over the given time period, where time is a dimension that measures the rate of adoptions and adopter categorization and exist in the whole process (Sahin, 2006). The time factor depends on decision process. The last element in the diffusion process is the social system, which as Rogers (2003) defines it as a set of interrelated units engaged to solve a problem and accomplish a common goal (p. 23). Additionally, Tate et al. (2013) add that the term of interrelated units may be defined as individuals, groups, organizations, communities, states, or countries.

4.3.1 Purpose of the Diffusion Process
The main idea behind the diffusion process is to provide a framework, which can handle the uncertainty in adopting the innovation (Wu & Chang, 2012). As Sahin (2006) claims the uncertainty is a key obstacle to the change. Uncertainties are consequences of any innovation, and as Rogers (2003) outlines that the consequences are the result of an individual or a social system from the adoption or rejection of an innovation. Furthermore, Sahin (2006) argues that to reduce the uncertainty of adopting the innovation, social systems should consist of the information about the advantages and disadvantages from the consequences of the innovation.
Accordingly, Rogers (2003) proposes attributes of innovations that can help to reduce the level of uncertainty.

According to the model (Figure 4), there are five stages in the process: Knowledge, Persuasion, Decision, Implementation, and Confirmation. According to Rogers (2003), the adopter, which is the member of communication channel, must learn about the innovation, be persuaded from how the members perceive the characteristics of the innovation to form an activity towards innovation as to be qualified with the innovation, decide to adopt or reject the innovation, implement the innovation, and confirm (continued adoption or continued rejection) the decision to adopt the innovation further. Those attributes include five characteristics of innovations that are perceived as (1) Relative Advantage, (2) Compatibility, (3) Complexity, (4) Trialability, and (5) Observability. Moreover, Rogers (2003) argues that the rate of diffusion in adoption of innovation will increase if the adopters perceive the innovation: 1) has an advantage relative to other innovations or perceived better than the existing innovations; 2) compatible with existing practices and values; 3) easy to apply; 4) can be tried or tested on a limited basis before adoption; and 5) offers observable results which can develop and improve for further innovation process. Obviously, the greater perceived of

---

**Figure 4. A Model of Five Stages in the Innovation-Decision Process. Retrieved from Rogers (2003, p. 170)**
relative advantage, compatibility, trialability, and observability, along with less complexity that an innovation can achieve, will adopt more rapidly than other innovations (Rogers, 2003).

Additionally, Frambach (1993) considered the rate and speed of adoption as important factors affecting the efficiency of uncertainty reduction. And, Rogers (2003) defines the rate of adoption as “the relative speed where an innovation is adopted by members of a social system to reach a mutual goal” (p. 221). Moreover, firms perceive the purpose of diffusion as an important process through which they try to improve operational performance along their supply chain networks. Lee & Klassen (2008) and Rao & Holt (2005) suggests that firms can gain number of benefits like reduced costs and enhanced competitiveness, once they are successful in diffusing the environmental business practices (EBP) into their suppliers. Furthermore, Tate et al. (2013) state that business processes, which drive the resource productivity, are becoming as important as those which drive economic productivity. Additionally, Green et al. (2012) argue that through adoption of EBP and clean technologies, firms can achieve improved resource productivity and thereby company performance businesses are also getting aware that the environmental footprint of supply chains is driven by the processes across the various inter-organisational connections in the supply chain networks, with significant impact generated outside of the focal firm (Sarkis, 2012).

4.3.2 Inter-organisational Diffusion
Diffusion theory is commonly used when analyzing the innovation adoption within firms from the intra-organisational perspective (Frambach, 1993; Prajogo et al, 2014). Accordingly, there is a deficiency of empirical studies, which use diffusion theory from the inter-organisational perspective; for instance, how innovation adoption occurs along the actors in the supply chain. Frambach (1993) have considered how supply side factors influences the innovation diffusion; specifically, how innovation supplier characteristics may affect the rate of adoption process on the adopter side. In this study, factors such as quality, information availability, information processing capacity of adopter, innovation characteristics, and competitiveness of the market are perceived to influence the efficiency of the innovation diffusion.
Prajogo et al. (2014) have studied extent and balance of ISO 14001 diffusion within the organisations across five different functional areas, namely production, procurement, sales, logistics, and R&D. ISO 14001 is one of the authorized international standard that is consist of formal systems and frameworks regarding the environmental protection, policies, programmes, and practices (Morrow & Rondinelli, 2002; Prajogo et al., 2014). The findings of this study imply the need for expanding the scope of diffusion beyond the firm’s level, that is from intra-organisational to inter-organisational through the involvement of key supply chain partners (primarily customers and suppliers), where “...it must diffuse across all functions within the organisation to produce changes of managerial practices according to the intent of the standard” (Prajogo et al., 2014, p.567). Seemingly, inter-organisational diffusion also depends on the industry characteristics. Indeed, a high level of competition among firms in a certain industry may enlarge the pressure on an individual firm to adopt a certain technological innovation required by customer demands (Frambach, 1993). Also, it has been identified that the speed and the rate of interorganisational diffusion of know-how will be higher when the innovation supplier has been quite successful in organization and execution of innovation practices within its organization (Frambach, 1993; Koplin et al., 2007).

Researchers also highlight the importance of supplier network characteristics in diffusing the environmental practices. Tate et al. (2013) have laid down the conceptual foundation that examines network effects on the diffusion of environmental business practices (EBP) among suppliers, where EBP refers to “the set of activities employed to manage and advance a firm’s environmental responsibilities and include any business activities that serve the goal of achieving environmental sustainability” (Cited in Tate et al., 2013 pp. 264). This research work utilizes the concept of “network embeddedness” in analyzing the level of diffusion. Here, network embeddedness is defined as the structure and behaviour among the actors within network which influence the outcome/performance of EBP. In essence, two dimensions of embeddedness are considered: structural and relational (Tate et al., 2013). Structural embeddedness refers to the impersonal linkages between network actors, and it relates to the overall pattern of connections (Tate et al., 2013). Structural embeddedness is identified from the structural connection among network actors, which presumes both upstream and downstream networks in relation to the focal firm (Tate et al., 2013), and the
level of structural embeddedness through the ratio of the number of ties between actors and
the number of actors within the network (Ahuja, 2000). On the other hand, relational
embeddedness is built through characteristic of relationships and historical interactions
between network partners. Mainly focuses on collaboration, information and resources
sharing and learning process (Tate et al., 2013). As concluded by Tate et al. (2013), the
increased levels of structural and relational embeddedness are found to be positively
associated with diffusion of EBP which leads to the fact that firms experiencing higher levels
of the embeddedness in the network may also accept higher diffusion and adoption of
environmental business practices.

4.3.3 Diffusion of Environmental Performance Management

As explained before that EPM is a system that generates measurable performance information
regarding the environmental aspects through strategic planning and performance management
argue that the diffusion of innovation standard has to diffuse across all functions within the
organisation through the involvement of key supply chain partners (primarily customers and
suppliers), thus, Koplin et al. (2007) argue that OEM:s should integrate environmental
standards into their supply policy and supply management; specifically, integration should be
done through the modification in purchasing and sourcing structures. Similarly, Kogg & Mont
(2012) recognize the importance of the role that purchasing and supply management function
play in addressing the environmental issues in the upstream supply chain and ensuring the
compliance with respective regulations and standards. As Tate et al. (2013) found the positive
connection between diffusion of EBP with network embeddedness, EPM may be diffused in
inter-organisational perspective through the interaction of supplier network, therefore, Santos
(2014) stresses the importance of supplier selection and development in the integration of
environmental requirements in the vehicle supply chains; “the competitiveness of a company
is strongly linked to its network of suppliers, so the company should aim to maintain a
network of highly qualified providers to meet its needs”. Moreover, both from the operational
performance perspective, trust and collaborative interaction increase the motives toward the
mutual goals (Tate et al., 2013).
Diabat et al. (2013) identify following practices in environmental sustainability management, such as reverse logistics, green purchasing, internal environmental management, design for environment, supplier environmental collaboration. In more detail, supplier environmental collaboration include:

- Conducting educational activities for suppliers about environmental issues;
- Providing direct support to suppliers to improve their environmental performance;
- Forming joint ventures where buying firm collaborates jointly with its suppliers and establishes common long-term programs to develop eco-innovations (Diabat et al., 2013).

Similarly, Santos (2014) lists some most valued practices by vehicle manufacturers in driving environmental sustainability, including cooperation with suppliers in cleaner production and lean practices; setting requirements for eliminating the use of hazardous substances; and monitoring and reduction of hazardous waste and industrial emission.

### 4.4 Inter-organisational Management Control System

According to Gimeno (2004), the “…complexity of interconnections and interdependencies among the organizations and actors within networks makes it difficult to measure, manage and understand the environmental footprint of products or services“ (Cited in Tate et al., 2013, p.265). In case of vehicle industry, as Pernot & Roodhoft (2014) argue that the role of IMCS is important in achieving high levels of operational performance. They claim that due to the increasing trends, like high levels of component outsourcing and extreme competitive pressure, vehicle manufacturers have to implement continuous improvement projects with suppliers, which require appropriate management control system (MCS) to organize and manage the relationships. To describe MCS from inter-organisational perspective, the role of formal and informal control are used. According to Nixon & Burns (2005), MCS influence how decisions are made to attain strategic objectives. In an inter-organisational relationship (IOR), as Langfield-Smith & Smith (2003) argue, this infers creating collaborative incentives to pursue mutual goals, were organization’s performance is maintained through formal and informal control techniques to minimize risks (Cited in Pernot & Roodhoft, 2014, p.157).
Performance outcomes and behaviour controls are built through formal controls to coordinate the IOR (Pernot & Roodhoft, 2014). Formal control is used to mitigate the risks from under-performance, while building trust is used to reduce the fear from under-performance (Pernot & Roodhoft, 2014). By using measurable techniques and evaluation of operational performance against predefined targets, outcomes can be controlled. On the other hand, behaviour controls are maintained as a result of indicating, monitoring, and evaluating compliance with predefined planning, procedures, rules, and regulations (Dekker, 2004). Informal control is built from shared norms, values and common goal between two organizations through meetings, interactions and management behaviour (Pernot & Roodhoft, 2014). Thus, building trust is known as one of the important informal instruments in IMCS. Similarly, Dhanaraj et al. (2004) find that high levels of interaction between actors in the social system are indicating the strong social ties and increasing trust among actors.

### 4.4.1 Formal and Informal Control Techniques

Furthermore, to define the control mechanism under the IMCS framework, we follow the framework that is proposed by Pernot & Roodhoft (2014) to manage company-supplier relationship (Figure 5). Accordingly, Donaldson (2001) states that performance is the central variable in the contingency theory of organizations. This framework helps to visualize the link between the contingency variables of supplier relationships that has influence on risks and management control techniques governing those risks. Moreover, the framework shows in what way the degree of MCS fit can help vehicle manufacturers to deal with contingencies and risks, and also see the effect on the operational performance.

Ittner et al. (1999) have studied how non-price supplier selection criteria and supplier monitoring affect the link between supplier strategies (partnership) and performance. The result of the study has revealed that organizations that do not select and monitor supplier relationships properly, have significantly lower performance than similar organizations that use appropriate selection and monitoring practices (Cited in Pernot & Roodhoft, 2014, p.158). Likewise, Anderson & Dekker (2005) argue that organisational performance also depends on the effective contract management, such as supply contract between company and supplier as
the formal control technique, which also underlines the importance of relationship-specific factors.

Both mentioned studies came up with mainly formal control techniques, including partner selection, supplier certification, face-to-face contact (Ittner et al., 1999), and the supply contract (Anderson & Dekker, 2005). Seemingly, according to the findings of those studies, the use of formal control is not enough to overcome operational performance. Thus, Anderson & Dekker (2005) justify that there is a need for research, which can, within a comprehensive framework of both formal and informal performance control techniques, identify the link between MCS and organisational performance. Gebert (2014) has come up with a framework (Figure 6), which shows how interface performance between buyer and supplier can be controlled.
Figure 6. The role of perspective for the understanding of interface-performance. Retrieved from Gebert (2014)

This figure is used to visualize the use of collaborative/joint KPI from buyer and supplier perspective to overcome the operational performance and minimize risk from underperformance, which mainly act as the formal control techniques (Gebert, 2014). Even though, it highlights predominantly the formal control practices, but the consideration of informal control and respective KPI:s could be included.

To support the formal control technique, some measurements to control and calculate the company’s performance are needed. Cousins et al. (2008) state that “performance measures provide the necessary information for decision makers to plan, control and direct the activities of the organisation” (p.242). Through performance measures, managers can signal and educate suppliers regarding the key dimensions of ongoing performance, and if there are some deviations from what has been planned before, they also help to direct the improvement activities (Cousins et al., 2008). The practice of measuring inter-organisational performance aims to define on how “…companies use performance measurement to manage their relationships and interactions with suppliers and how suppliers respond to the measurement” (Schmitz & Plats. 2003, pp. 711). For instance, through inter-organisational measurements companies evaluate supplier quality, delivery performance, number of suppliers that are ISO 14001 certified and so on.
Schmitz & Plats (2003) have developed a conceptual framework for roles of supplier performance, where they have studied five vehicle manufacturers in Europe within the inter-organisational control perspective. The result of the study has suggested that besides having role as information provider or communication tool, the inter-organisational performance measurement has predominant role as power relationship mediator between the companies and their suppliers. Further, Schmitz & Plats (2003) pointed out, the supplier performance measurement is not primarily used to inform managers to take decisions on the whole supply base, it rather served as a method to communicate the dissatisfaction towards under-performing suppliers. As Moynihan (2008) defines that performance management as a system that generates performance information through strategic planning and performance measurement routines towards mutual goals, the use of performance measurement must capture the whole performance of networks/members within the supply chain process.

In fact, as Talluri & Sarkis (2002) have identified that in order to maintain effective inter-organisational partnerships, there should be a common measurement metrics across multiple dimensions that can provide feedback for improvement both for buyers and suppliers. They further have explained that those dimensions can be both of tangible (e.g. operational performance) and intangible (e.g. trust and relationship status) nature. Ultimately, following those measures should provide with on-time information to suppliers, where the buyer’s expectations are communicated and if necessary guidance for any corrective action can be followed (Talluri & Sarkis, 2002). Furthermore, as Cousins et al. (2008) states, “the investigation of how performance measures assess, and provide incentives for, collaboration, knowledge sharing and joint problem-solving within relationships has been minimal” (p.242). Additionally, Schroeder et al. (1986) argued all supply chain members should all have the same level of understanding regarding performance measures so that there will be less room for manipulation.

4.4.2 Buyer-supplier Relationship and EPM

Cousins et al. (2008) have explored the direct and indirect effects of supplier-related performance measures and buyer-supplier socialization mechanisms on firm performance. They argue that “… monitoring supplier performance is not of itself sufficient, rather, it is the process of socializing the buyer and supplier that is critical to success” (p.239). “Socialization
refers to the process of how employees, suppliers and managers interact with each other, and can help explain why some firms are more successful at managing supply relationships than others” (Cousins et al., 2008, p. 239). The role of inter-organisational socialization mechanisms is important for the flow of learning and information within supply chains; it mediates the relationship between supplier performance measures and performance outcomes (Cousins et al., 2008).

Likewise, Angerhofer & Angelides (2006) highlight the role of collaborative supply chains in the performance improvement. They identified three levels of collaboration, which are: strategic, managerial, and operational. Accordingly, they prescribe different performance measures and metrics under different levels. Apparently, higher level of collaboration (preferably at the strategic level) can significantly improve the information flow between partners, enhance supply chains flexibility which in turn can increase the end-customer satisfaction; but in the other side, it also entails higher costs, due to increased administrative efforts (Angerhofer & Angelides, 2006). Furthermore, collaborative supply chains presupposes that the competitive mission, core operations strategy and the players’ business goals must be aligned with those of the supply chains. Angerhofer & Angelides (2006) have measured this parameter through the Level of Alignment (LA), which measures proximity of supply chain partners’ business strategic to the holistic goal in the collaborative supply chain. Subsequently, the level of alignment impacts the control of the performance in the supply chain; the higher the level of alignment, the better can the centralized control be approached (Angerhofer & Angelides, 2006).

Whereas, socializing in sustainable supply chain management depends on the relative power relationship between the focal company and its supplier, which should be conducive enough in driving successful inter-organisational collaboration (Cox et al., 2001; Cox et al., 2003). Likewise, Frambach (1993) have proposed that the existence of long-term and close relationships between networks of companies enhances the collaboration in innovation development process and thereby increases the speed and rate of technology innovation adoption. Binder et al. (2008) and Caniels et al. (2013) claim that a cooperative approach is characterized by buyer-supplier interaction geared towards know-how sharing, collaboration
and jointly performance improvement. Cho et al. (2012) have researched about buyer-supplier partnership levels in service supply chain management, and through literature review they have come up with partnership evaluation criteria/metrics. Those metrics reflect the view on how the partnership should look like in order to increase efficiency and effectiveness of service supply chains and include following:

1. Extent of mutual understanding and closeness for business growth – long-term perspective.
2. Level and degree of productive and logistic congruency.
3. Level and degree of information exchange.
5. Extent of mutual cooperation leading to continuous improvement.
6. Level and degree of operative interaction between buyer and supplier.
7. Extent of mutual assistance in problem solving efforts. (Cho et al., 2012).

Furthermore, competition, as Bai & Sarkis (2014) recognize, takes place not between companies, rather it is the actors within supply chain networks which compete each other. Gulati et al. (2000) have also recognized that “complementary resource combinations between partnering firms can be a source of competitive advantage, with the idiosyncratic nature of the relational assets making imitation by competitors’ difficult (Cited in Cousins et al., 2008, p. 240).” Hence, the environmental management practices need to be extended to the relationships between firms with their trading partners (i.e. customers and suppliers) (Prajogo et al., 2014). In fact, as Simpson et al. (2007) argue that “suppliers were found to be more responsive to their customers’ environmental performance requirements, where increasing levels of relationship-specific investment occurred.” For example, effective supply relationship management has resulted in collaborative waste reduction, environmentally sound innovation, cost-effective and environmentally beneficial solutions to production problems, and more rapid development and uptake of environmental technologies (Simpson et al., 2007).
As EPM is a system that generates measurable performance information regarding the environmental aspects through strategic planning and performance management routines (ISO, 2004; Moynihan, 2008; Björklund & Forslund, 2013), Bai & Sarkis (2014) recognize the need for integration of environmental sustainability measures in general business process measures. Actually, KPI for environmental performance management should be aligned with critical success factors, which are “activities, functions and measures that will ensure successful competitive performance for the organization (and extensively to the supply chain)” (Bai & Sarkis, 2014). Some examples of environmental performance measures include environmental cost saving, time to implement environmental programs, environmental information availability and accuracy, response to environmental product request, and environmental knowledge transfer satisfaction (Bai et al., 2012).
4.5 Operationalization Model

Based on the content in each chapter of the theory, the authors find focus areas, which are used when further collecting the empirical data. Furthermore, the focus areas are used when formulating the interview questions. As mentioned in the methodology chapter, the three parts are the foundation for the interview-guide of respective correspondents. Firstly, the finding from part one of the theory is that the heavy vehicle industry has more demanding technology development regarding the components and design compare to car or bus industry. It leads to organization structures where heavy vehicle industry has more fragmented structures because of the fact that manufacturers have to obey the emission regulations which lead to specific new technologies among certain components. As a result, the authors discovered the challenges in working with new technologies and new materials in order to support emission reductions. Furthermore, theory highlights the big challenge of reducing different kind of

Figure 7. Operationalisation Model (Own construction figure)
emissions in the heavy vehicle industry, set up by organisations such as REACH and WWF climate saver, for every company to ensure the implementation of emission reduction with truly sustainable and renewable energy and strengthen certifications system for biofuels and bio-energy sources. Hence, the authors focus on waste management and sustainable renewable energy.

Secondly, part two of the theory discuss the advantages and disadvantages of the consequences of innovation, and how to manage the uncertainty. Accordingly, five main characteristics: (1) Relative Advantage, (2) Compatibility, (3) Complexity, (4) Trialability, and (5) Observability are discussed on how to manage the uncertainty and how to diffuse the innovation among channels. As a result, the focus is managing the uncertainty of EPM application. Furthermore, theory mentions the importance of creating a good understanding of EPM for suppliers. This results in having competitive advantages, where company and suppliers are more successful in implementing the EPM into business practices, which lead to the focus on setting the same level of understanding the EPM between company and suppliers.

Lastly, part three of the theory discusses the role of formal and informal techniques control in an inter-organisational relationship where theory states that performance outcomes and behaviour controls are built through formal controls. Additionally, informal control is built from shared norms, values and common goals between two organisations through meetings, interactions and management behaviour. As a result, the focus area is performing information based service, sourcing method and creating environmental compliance KPI:s. Moreover, the theory highlights the importance of choosing suppliers, which comply with the environmental regulations, collaborate with the focal company and embrace the occurring changes. Additionally, organisations that do not select and monitor supplier relationship properly have a significant lower performance compare to similar organizations that use appropriate selections and monitoring practices. Thus, choosing the right suppliers is one of the focus areas. Furthermore, theory underlines the importance of creating performance collaboration and objectives between focal company and suppliers to monitor the buyer-supplier relationship. This results in creating collaborative performance standard.
5 EMPIRICAL FINDINGS

Here, in this chapter, the collected empirical data from company is presented. The making process is based on the Operationalisation model which is appeared in previous chapter. The authors describe the empirical findings by capturing the focus areas to conduct the process of describing the data according to the research questions and theory. Further, the empirical findings are presented starting with the focus areas that are presented each of research questions to give general answers and overview for each research question. The focus areas are the impacts/outcomes from each research question and they are formulated to use in further analysis.

5.1 Environmental Regulations in Volvo CE

Working with new technology and new materials to support emission reduction

Due to compliance in the emission regulations and have more demanding technological development regarding the components and designs (Berggren et al., 2015), heavy vehicle industry is very different compare to other industries within automotive market. The suppliers are more internal structure based on knowledge to select and maintain direct suppliers, have more fragmented suppliers and the industry contains of small suppliers. It has different level of complexity, different level of focus setting, different side of volume, different type of requirements which have variety of products and different machines that have different components which need different types of suppliers with different technology (Vice President of Environmental and Sustainability, 08/02/2016)

The organization’s objective towards sustainability and environmental care aspect increase significantly for these decades. According to Vice President of Environmental and Sustainability (08/02/2016), the environmental regulations bring challenge and opportunity at the same time to whole business strategies, company tactics and KPI:s. Since Volvo CE aims to provide the most sustainable transport solution within the industry, Volvo CE is working with energy efficiencies, fuel efficiencies, material efficiencies and waste management. The big challenge is controlling CO₂ emission and greenhouse effect, where in heavy vehicle industry, the focus is on NOx and particulate matters (Vice President of Environmental and Sustainability, 08/02/2016).
Fulfilling the environmental regulations coming from European REACH Regulation, Environmental Protection Agency and WWF climate saver, cannot give a competitive advantage for Volvo CE because company has been proactively driving the activities towards environmental sustainability for the past 15 years. However, company has to follow the environmental regulation. Volvo CE spent approximately 75 percents of their budget in the product development to emission reduction/regulation technology. Beside working with energy efficiencies, material efficiencies and waste management, Vice President of Environmental and Sustainability (23/02/2016) states that Volvo CE communicates, encourages and involves people/society to get along into company activities. Volvo CE establishes a relationship with WWF climate saver to reduce CO₂ emissions, greenhouse gases and built an infrastructure as Corporate Social Responsibility (CSR), for instance CSR program between company and municipality in Vaxjo.

Volvo CE adopts ISO 14001, occupational, health and safety standards, and has energy and environmental certification. In the working plant within the technical operation, Volvo CE does Eco Operator training program, support the various engine regulations, test methods and emission standards to support environmental sustainability. To support technical side, Volvo CE does global training program about company code of conduct and environmental compliance, and the compliance process is controlled and assessed by third party auditor.

**Focusing in waste management and sustainable renewable energy**

Environmental sustainability itself is to balance the economy aspect, environmental, and reflecting the social dynamics, such as people and process, in the feasible way (Vice President of Environmental and Sustainability, 08/02/2016). Following that, Volvo CE demonstrates some strategies towards environmental sustainability, such as reducing the number of working hours until to 2020; transform fossil fuel to renewable fuel, i.e. renewable electricity, biodiesel, synthetic diesel and gas; reduce waste in manufacturing process, especially the hazardous wastes; and influence society to cooperate and encourage them to act and think Green.
The global environmental regulation is updated every five years, meanwhile the local regulation is updated twice a year. Align with that, Volvo CE has established a strategy for recycling used components where company remanufactured components can be recycled and used several times. In term company footprint, company applies for end recycling where 95 percent of footprint is used in the phase of products (Vice President of Environmental and Sustainability, 08/02/2016). According to Volvo Website (2016), Volvo CE conducts the innovation in wheel loader product platform, where using this platform can increase a significant reduction in CO$_2$ output. Volvo CE always strives for lower fuel consumption, lower cost, lower emission, lower impact on the environment and strong collaboration/long-term relationship with the key customers (Global Director Core Value, Management Sales and Marketing, 12/02/2016).

According to Volvo CE environmental report (2014), Volvo CE is mainly a downstream user of chemicals and to restrict the use of chemicals, the company maintains a ‘blacklist’ of prohibited chemicals and a ‘grey list’ of products where the usage must be limited. Environmental Care and Security Manager Braås (08/02/2016) states that Volvo CE needs to reduce chemicals and substitute old chemicals with better chemicals. Furthermore, he mentions that Volvo CE has decreased the use of chemicals from 400 to 263 chemicals. The concern of environmental sustainability within Volvo CE is basically focused in the manufacturing process, such as laser cutting, welding and painting, and company culture. Volvo CE is trying to reinforce environmental and sustainability values into every process and function. In line with that, the company needs to have good control over all prohibited substances and liquids due to legislation with chemical and replace fossil fuel with renewable fuels. Volvo CE needs to adapt with technology and in company’s structure, as Environmental Care and Security Manager Braås (08/02/2016) states, engage employee’s commitment in all different management levels, ensure that they have good understanding with environmental regulation requirements and responsible for them. To achieve that, all managers in different levels spent five hours a year to discuss the environmental regulations and conduct the actions to meet the requirements, such as Green Map analysis, where this activity is involving every operational and strategic level employee to discuss and plan how to meet and fulfil the environmental regulations in supply chain process within company.
5.2 Diffusion of EPM to the Suppliers of Volvo CE

Managing the uncertainty of EPM application

As Halliday (2016) states that EPM is not only mitigating environmental liabilities, but also improving cost advantages, helping to use resources efficiently, reducing waste and improving corporate image. In Volvo CE, working with EPM provides company an advantage such as energy savings, where consuming less energy is not only protecting the environment, but also delivering benefits that can be counted and benefit on company custom (Global Supplier Development Process & VPS Director, 23/02/2016). Regarding the adoption of EPM, Volvo CE comes up with internally energy saving program, where the company measures the savings in percentage and absolute kilowatt-hours per year, and the result can be compared to expenses. Even though Volvo CE is not in the stage where they can define projects and look for benefits together with suppliers, but Global Supplier Development Process & VPS Director (23/02/2016) states that Volvo CE performs global sourcing where the company buy components worldwide from few suppliers. The implementation of global sourcing brings benefit to the company, in terms of uniformity and consistency in product quality. Additionally, Global VPS (LEAN) Director (12/05/2016) state that Volvo CE sourcing from more control sites, more companies and countries that influence cost and prices (indirect investment).

In Volvo CE, there are three types of suppliers: Development Supplier, Direct Supplier and Structure Supplier. The system sourcing is made in Volvo CE through structure supplier where the suppliers are producing metal components, such as frames, upper frames, centre frames and brackets, basically everything within welding construction which is cut, bended, welded, grinded and structured. They are able to deliver all of these different parts and it simplifies the component sourcing because it is more efficient to deal with one supplier then different amount of suppliers. Moreover, Global Supplier Development Process & VPS Director (23/02/2016) argues that the process of sharing knowledge with supplier to see the benefits of environmental sustainability from environmental legislations is easy to implement. When it comes up with the new innovation, Global VPS (LEAN) Director (12/05/2016) state that Volvo CE does dialogue, negotiation, phone call and redesign engines together with suppliers because suppliers have more know-how in certain components and making design
of goods in order to achieve specific goods/component, so that both Volvo CE and suppliers can planning and setting back-up plan if there is a need to adapt with new technology or change the suppliers.

Volvo CE adopts ISO 14001, environmental regulation compliance and quality and safety standards, where the standards are a framework to cope with Volvo CE Core values, therefore the suppliers must have environmental certifications, energy certifications and compliance. The supply chain process within Volvo CE is not only focus in environmental aspect, but also the price and economic sustainability (Global VPS (LEAN) Director, 12/05/2016). For example, within the whole supply chain process, Volvo CE is working with transportation efficiency, where Volvo CE is trying to find out the new method to reduce the number of distance from delivering or buying goods from suppliers, which this part is included both environmental impact and cost. Therefore, to keep the cost down, Volvo CE has to see in reducing price and finding the certain technological solution/tools, where at the same time, seeing the market situation, where the customers is willing to pay for the price based on customers needs (customization) (Global VPS (LEAN) Director, 12/05/2016). In addition, Volvo CE helps the supplier to develop their LEAN projects. Not only taking benefit for Volvo CE site, but also helping the suppliers increase their competitiveness among other heavy vehicle suppliers (Global VPS (LEAN) Director, 12/05/2016; Environmental & HS Leader, 08/06/2016).

**Setting the same level of understanding in EPM**

According to Global Supplier Development Process & VPS Director (23/02/2016), it is important for Volvo CE to disseminate information regarding the environmental regulations as early as possible to suppliers because suppliers produce and generate more than 50 percent of the annual turnover of the company, thus the whole parts (suppliers and company) should have the same level of knowledge and information in the supply chain. In connection with that, all necessary information are accessible from company’s website and certain individual communication portal between company and suppliers. This aids Volvo CE to make suppliers aware of the benefits of environmental sustainability earlier (Global Supplier Development Process & VPS Director, 23/02/2016). Moreover, Global Supplier Development Process &
VPS Director (23/02/2016) argues that the involvement of suppliers in the early phases for designing company products will be performed as a protection against the situation, which according to legislations, if there are some major changes needed in the end of process, it is not possible for company to alter the products, thus it will impact to costs expansion for both sides. Likewise, Global VPS (LEAN) Director (12/05/2016) mentions that when company produces environmental friendly product, Volvo CE needs to include suppliers, which can take very large share of the components, that need to assemble. Therefore, by involving suppliers in the beginning, there is higher opportunity to do the right processes from the beginning. If the suppliers cannot fulfil for that requirements, then they are not eligible to make cooperation with Volvo CE.

According to Global Supplier Development Process & VPS Director (23/02/2016), Volvo CE has a performance management method where company cooperates and integrate suppliers into their new product development processes and related innovative technologies. It is known as Advance Product Quality Planning (APQP), which this tool helps to ensure the early involvement of Volvo CE suppliers where they can work jointly in the development process. Further, Global Supplier Development Process & VPS Director (23/02/2016) elaborates the function of this mechanism that it starts with the product concept or concept development phase where suppliers work with Volvo CE on the common grounds and understanding regarding the product quality and planning of both the complex and simple components. Global Supplier Development Process & VPS Director (23/02/2016) states that it is obligatory for suppliers to comprehend what is required by them in terms of technology, quality, environmental regulations, and delivery capacity. APQP ensures that both parties are working on the same performance level and standards that are required to maintain Volvo CE’s core values.

Furthermore, Global Supplier Development Process & VPS Director (23/02/2016) states that the level of sharing knowledge between Volvo CE and suppliers is depend on the maturity of the supplier, specifically when there is a new product design where the suppliers also own the design. Company needs to design and make the products according to the specifications and product requirements, therefore, Volvo CE has the official communication portals, including
an interactive supplier portal, which is called VISIT. Furthermore, Global Supplier Development Process & VPS Director (23/02/2016) mentions that the company needs to see the previous pilot projects and achievements of the company where further they can define a project guideline, for instance less energy consumption. In that case a joint collaboration and sharing of expertise can help diffusing EPM successfully but not designing everything from scratch. Additionally, Volvo CE work a lot with life cycle analysis (LCA), include the supplier processes in the whole perspective (Environmental & HS Leader, 08/06/2016).

5.3 The Control Mechanisms for EPM Diffusion in Volvo CE

Performing information-based service, sourcing method and creating environmental compliance KPI:s

To work together with customers and suppliers, it is a challenging combination to be continuously sustainable. It occurs through construction environment challenge where company invites the customer to participate in sharing knowledge and best practices in the construction industry to drive best practices and also doing CSR to engage customer trust (Global Director Core Value, Management Sales and Marketing, 12/02/2016). Moreover, he stated that by doing Product Handover Process where company delivers new machines to the customers and give information about the features, safety and environmental impact, this also helps company to attain customer trust and loyalty.

Further according to Global Supplier Development Process & VPS Director (23/02/2016), it is challenging in terms of managing multiple suppliers for multiple components. Since the Volvo CE deals with global suppliers network as well, it becomes problematic to track the CO₂ footprints. There exists a “System Sourcing method” where Volvo CE deal with limited number of suppliers for multiple range of components that are required for production purpose. In system sourcing, there exists a supplier structure where a list of selected suppliers exists for multiple components. This makes it easier in terms of performance measurement and conservation compatible since it is easier to convince one instead of five and sharing of expertise and knowledge is much easier. Further Global Supplier Development Process & VPS Director (23/02/2016) address that in order to stay in the market, small businesses needs
to innovate and maintain performance level which can lead to cost efficiency and environmental management system implementation. Additionally, Global VPS (LEAN) Director (12/05/2016) mentions that there is a system called SEM (Supplier Evaluation Management), where Volvo CE has a very strict system in what type of quality standard that needed to fulfil, for example like ISO 9001, ISO 14001, ISO Quality Service in Automotive and Quality Service Standard.

Global Supplier Development Process & VPS Director (23/02/2016) states that in future, there can be business dealings on the shared values. The important KPI:s regarding environmental compliance of suppliers include saving kilowatt hours per year or per machine and reduction of usage of hazardous substances. This, in turn, let Volvo CE measure the environmental compliance. Lastly, Global Supplier Development Process & VPS Director (23/02/2016) suggests that Volvo CE is looking forward to identify joint KPI:s to measure the progress and translate targets and joint actions to fill the gaps that in terms of environmental sustainability. According to Volvo Report (2014), it is anticipated that suppliers to Volvo CE will have a well-built and advance quality management system in place and well operational. At least it is mandatory for all suppliers to have a quality system that has been recorded to the latest version of ISO 9001. The Part handling review (PHR) contains an onsite visit from suppliers to Volvo CE to evaluate all handling and installation carried out. This review will typically comprise appraisal of receiving, material storage, handling, installation, testing and shipping as applied to the supplier’s part. If the supplier’s performance is not as required for EPM, the outcome is deprived or relaxed or the action plan is not succeeding, Volvo CE would call the supplier to a management meeting. Quality performance management (QPM) is established for each supplier founded on the criteria such as actual number of odd material recognized contradicting to EMS practice. To limit and influence the environment impacts from the maritime transports Volvo CE encourage the sea carriers to address to the Clean Shipping Index and road transporters to use specific engine class.

Choosing the right suppliers

Volvo CE has chosen to take a holistic view of environmental issues, promoting continual improvements in how they operate and striving for ongoing technical innovations. Whether it
is by researching into new fuels, improving recycling rates, making the factories and offices more eco friendly, using less damaging products and processes, or creating hybrid concepts. Green thinking must underpin everything Volvo CE does (Global Director Core Value, Management Sales and Marketing, 12/02/2016), therefore the chosen of right supplier is needed. Volvo CE ensure every supplier follow REACH regulation, ISO 14001 standard and have CSR formula which are connected to environment and applied to suppliers and sub-suppliers. This is an obligatory demand from Volvo CE to the supplier's (Environmental and HS Leader, 08/06/2016).

In selecting suppliers, company lies on how many suppliers in the market, what quantity is needed, what product needs to buy, how sensitive of the product that company need within a day and so on. “We will not work with the suppliers that will not exist in the future”. (Environmental and HS Leader, 08/06/2016). Usually, Volvo CE works not more than five years with the suppliers. It is because the LEAN project that belongs to suppliers is become more competitive and more standardized, so that the service that suppliers offer become more expensive. Additionally, if company initiate a project and develop the new product/processes, Volvo CE will contact the expertise of that process to start the project. It is become naturally involved the suppliers that is expert in certain areas and working with them (Environmental and HS Leader, 08/06/2016). To get a stable process, it always needs to ensure instruction and specification along with the suppliers and suppliers have to follow all Volvo CE requirements.

Creating collaborative performance standard

The most important areas in EPM which need more cooperation with suppliers is that the suppliers must have ISO 14001 certification and quality service (Global Supplier Development Process & VPS Director, 23/02/2016; Global VPS (LEAN) Director, 12/05/2016; Environmental and HS Leader, 08/06/2016). Beside the certifications and systems, to have more control in both parties, Volvo CE maintains discussion, regular meeting with purchasers, supplier developers and key suppliers which discuss about what the standards, requirement and follow up, phone call between Volvo CE and suppliers and place resident’s engineers, where the suppliers have engineers, sit in Volvo CE premises facility for couple of years, to work, adapt and solve with the innovation and ensure that the products are
produced in the right way. Also, company uses the audit team (third party) to audit and see the environmental awareness of its suppliers.

According to Environmental and HS Leader (08/06/2016), Volvo CE has “Volvo Corporate Standard” where suppliers can see the list of corporate standards through supplier portal and Volvo CE does some follows up to suppliers. This is how Volvo CE diffuse back the quality and safety standard to suppliers. If suppliers do not follow the corporate standards, company will set them into Business on hold status and if suppliers do not improve then Volvo CE will not use them anymore and will search for another suppliers.

The main things that Volvo CE see when having cooperation with their suppliers are cost performance, certain amount of shares with suppliers, type of suppliers and how much of business that Volvo CE has, commercially health of suppliers and risk management of suppliers (Global VPS (LEAN) Director, 12/05/2016). Moreover, he argues that the company has requirements and certification for the suppliers, then Volvo CE only looks for 1st tier suppliers with more focus on strategic supplier and strategic products. Similarly, Environmental & HS Leader (08/06/2016) states that Volvo CE product is mainly built of steel, since almost 90 percent of company machine is made by steel. Thus, only specific and expert suppliers with certain ISO standards will be taken. The supplier (1st-tier) usually have their own control on sub-suppliers and another sub-sub suppliers. But, if there is any certain reason that is needed to see the 2nd tier supplier, 3rd and so on, then procurement department of the company will do that.

Product life cycle in heavy vehicle industry takes couple of years if the manufacturers want to build up new design of product. Compare to passenger car industry where everything needs to be precisely, have more knowledge, more know how, and production time must be 100 percent align with the target, heavy vehicle industry is more flexible. Hence, in the long run, the focus will be not only controlling and securing to have secured suppliers, but also securing the cost side, to ensure the optimization of the whole supply chain process and plant and how company produces and transports the goods the whole way, the used of machine and the whole lifecycle of product from raw materials until produced goods. However, according to
Environmental & HS Leader (08/06/2016), Volvo CE does not have well-defined KPI regarding the environmental performances towards their suppliers. Further, he stated that company is doing continuously improvement in working with suppliers, trying to reduce the amount of conflict KPI:s such as setting the same target depending on what kind of area within the process and update the way company works with sustainability within operation and procurements.
6 ANALYSIS & DISCUSSION

This chapter presents the analytical model and analysis from the collected empirical findings according to the theory to answer all research questions. In the beginning, analytical model is presented to give the clear picture how the analysis is conducted. Then, followed by the analysis of empirical data according to the theory framework in this thesis to answer the research questions. Lastly, the environmental regulation impact in Volvo CE, EPM implementation and effective control mechanisms in Volvo CE are presented with the supporting figures in the making process of analysis chapter.

6.1 Analysis Model

The analysis will be divided into three parts in accordance with the three research questions presented in the thesis. With the help of analytical model, this chapter will explain in detail the different parts in the thesis. Furthermore, the authors will evaluate and compare how the case company is working within the different areas in comparison with what the theory says.

Figure 8. Analytical Model (Own Constructed figure)
In addition the authors will analyse benefit and impact with the work of the case company and also analyse what they should do differently to be more successful and see if there is a room for improvement. This will be used to analyse each research question and lead to the answer for each question.

The model gives us a clearer view of how the three different parts are interrelated with each other. Firstly, environmental regulations in heavy vehicle industry affect Volvo CE, as an OEM. They will therefore affect the EPM in Volvo CE. As a result, there will be new strategies and changes within Volvo CE supply chain process and EPM practices. Secondly, the impact/result from that lead to the diffusion process from Volvo CE to their supplier network; how Volvo CE diffuse the EPM back to their suppliers. In order to manage the uncertainty from adoption of EPM, diffusion theory is used, with the help from inter-organisational diffusion perspective and the involvement of suppliers leads to more supplier specific KPI. Lastly, to control the diffusion of EPM and to make the environmental sustainability works, there is a need to find out the control mechanisms and integrated/joint KPI:s between Volvo CE and their suppliers, where for this process, will be managed by inter-organisational management control system framework.

6.2 Environmental Regulation Impact on Volvo CE

*RQ 1: How does the environmental regulation in heavy vehicle industry impact the EPM of Volvo CE?*

![Figure 9. RQ 1 Analytical figure](image-url)
The environmental sustainability aspect is the main concern within the heavy vehicle manufacturers this decade. Here, the analysis is based on the characteristic, trend, challenges and environmental regulation barriers in heavy vehicle industry as appeared in theory part and information in empirical findings. In Europe, environmental regulation is updated every five years and in case of Volvo CE, the regulations mainly come from regional government, such as Environmental Protection Agency, REACH regulation, and WWF climate saver, where the pressure for sustainability aspects and environmental impacts in the heavy vehicle industry mainly arises from government and other stakeholders (Orsato & Wells, 2007). It is obvious for Volvo CE to put more focus in emission reduction and create environmental friendly products.

Environmental regulations ensure the adoption of CO₂ emission reduction with truly sustainable renewable energy and strengthen certification system for biofuels and bio-energy sources. Therefore, an opportunity is appeared for Volvo CE and any heavy vehicle firms to transform environmental regulations into the creation of lead markets which construct environmental innovations (Beise & Rennings, 2005). As the company who adopts ISO 14001, has energy certification and environmental compliance certification, Volvo CE is included environmental sustainability aspects in every process within company operations. It therefore impacts the measurable performance information where the strategic planning and performance management routines are influenced. Environmental regulations impacts the EPM in Volvo CE in the way company communicates and updates their works with suppliers to come up with environmental sustainability technology and system innovation. As a result, the impact from environmental sustainability requirements is distributed in five areas: manufacturing/production process, managerial, strategic, technical and compliance aspect.

Within the manufacturing/production process in Volvo CE, the concern is basically focused in laser cutting, welding and painting (Environmental Care and Security Manager Braås, 08/02/2016). This area contains of complex specifications where each product has different type of requirements, different variety of products and different machines with certain components and designs (Vice President of Environmental and Sustainability, 08/02/2016). As heavy vehicle sectors are connected more to the R&D aspects due to compliance in the
emission regulations and have more demanding technological development regarding the components and designs (Berggren et al., 2015), Volvo CE does the strategic planning accordingly and demonstrates company management routines. First, Volvo CE spent approximately 75 percent of company budget in the product development to emission reduction/regulation technology (Vice President of Environmental and Sustainability, 08/02/2016). Second, Volvo CE demonstrates some actions towards environmental sustainability, such as reducing the number of working hours until to 2020; transform fossil fuel to renewable fuel, i.e. renewable electricity, biodiesel, synthetic diesel and gas; and reduce waste in manufacturing process, especially the hazardous wastes. Third, following the trend that shows a tendency where manufacturers within heavy vehicle industry apply for common vehicle platform and recycling (Corswant & Fredriksson, 2002; Pfaffmann & Stephan, 2001; Faes & MatthysSENS, 2009) as an alternative to help reducing emission and support for sustainability, recently, company conducts the innovation in wheel loader product platform, which can deliver a significant reduction in the CO₂ output (Volvo, 2016). These are the outcome through EPM where Volvo CE focuses on finding a system and technology solution that can increase fuel efficiency, machine efficiency and productivity which deliver CO₂ emission, NOx and particulate matters reduction within the supply chain process.

To encourage employee and support for environmental friendly action, Volvo CE involves and persuades the employees to have more awareness with environmental sustainability by doing Green Map analysis, where company engages employee’s commitment in all different management levels, to ensure that they have good understanding with environmental regulation requirements (Environmental Care and Security Manager Braås, 08/02/2016). As a result, company creates a concept where all managers in different levels have to spend five hours a year to discuss about environmental regulations, plan how to meet and fulfil the environmental regulations and conduct the actions to meet the environmental sustainability requirements (Environmental Care and Security Manager Braås, 08/02/2016).

In managerial and strategic aspect, beside working with energy efficiencies, fuel efficiencies, material efficiencies and waste management, company established a partnership with regulation institution such as WWF climate saver to reduce CO₂ emissions and greenhouse
gases and being a part of it. Corporate Social Responsibility activity with local government such as Vaxjo Kommun is made, to involve more people/society to be aware of environmental sustainability. According to Halliday (2016), EPM is not only mitigating environmental liabilities, but also improving cost advantages, helping to use resources efficiently, reducing waste and improving corporate image. These activities, therefore, give benefit and opportunity to Volvo CE in increasing company trust and good image; also gaining a long-term relationship with suppliers to achieve more competitive advantages within the market.

In technical side, in terms of greenhouses gas-reduction standard from environmental regulation, company maintains a ‘blacklist’ of prohibited chemicals and a ‘grey list’ of products where the usage must be limited. Resulting in the decreasing amount of chemicals use from 400 to 263 chemicals (Environmental Care and Security Manager Braås, 08/02/2016). Accordingly, Volvo CE is working and looking for environmental sustainability components. As an impact in EPM, Volvo CE establishes a system for recycling used components where company remanufactured components that can be recycled and used several times and applied for end-recycling and 95 percent of footprint is used in the phase of products to deliver positive impact to environment (Vice President of Environmental and Sustainability, 08/02/2016). Another action is Volvo CE does Eco Operator training program, support the various engine regulations, test methods and emission standards to support environmental sustainability. These are tied with the commitment from Volvo CE as company core values are safety, quality and environmental care.

Sirmon et al. (2007) and Kaplan & Norton (2004) argue that environmental management should be conducted through the effective resource allocation within firm operations. Therefore, in compliance side, beside adopting ISO 14001, quality standard as well as occupational, health and safety standard, Volvo CE provides their employees with global training program about company code of conduct and environmental compliance, so that the environmental sustainability aspects is distributed evenly among all employees. And, the third party is used to assess/audit the output from doing those standards.
6.3 Diffusion of EPM on Volvo CE Supplier Network

RQ 2 : How should the EPM be efficiently diffused to the supplier network of Volvo CE?

Referring to Rogers (2003) about the innovation, in this paper, we apply EPM as an innovation and the authors argue that in analysing the EPM, diffusion theory is used to handle the uncertainty from the changes within the adaption of innovation process. To start with the analysis how should EPM be efficiently diffused to supplier networks, the authors based the analysis using Figure 11 as the framework of diffusion process of EPM and adaption of EPM.
As mentioned before, EPM is a system that generates measurable performance information regarding the environmental aspects through strategic planning and performance management routines (ISO, 2004; Moynihan, 2008; Björklund & Forslund, 2013). Referring diffusion theory by Rogers (2003, p.5), here in this study, EPM is perceived as an innovation that is communicated and shared between Volvo CE and supplier networks over period of time among customers, stakeholders, local government, EU regulations and environment and sustainability regulation and compliance. In terms of efficiency, we define the degree of efficiency in EPM adoption as probability of timely adoption and the rate of adoption. These parameters are suggested by Frambach (1993) and Rogers (2003). Hence, to reach the efficiency of EPM adoption, the adopters (Volvo CE and suppliers) need to enhance the high level of innovation characteristics. If the greater perceived of relative advantage, compatibility, trialability, and observability, along with less complexity can be achieved, then EPM will be adopted rapidly (see figure 11).

In prior condition, environmental regulations, sustainability and customer demands in heavy vehicle industry force OEM:s to come up with the new technology and innovation to cope with the competitive advantage within the heavy vehicle market. Similarly, recycling and vehicle platform trend are also influence the strategic planning and performance management routines within heavy vehicle manufactures. By using vehicle platform strategies, it allows company to achieve cost efficiency without creating the greater product variety (Faes & Matthyssens, 2009), so that company can create a product with less energy used and less cost. In fact, according to Volvo website (2016), company conducts the innovation in wheel loader product platform, which can deliver a significant reduction in the CO₂ output. Accordingly, company needs to find the way how to diffuse EPM to the supplier networks to align both with environmental requirements and company objectives. The process starts from Knowledge phase, where Rogers (2003) stressed that adopters must learn about the innovation and have deep understanding about advantages and disadvantages from the consequences of the innovation to reduce and manage the uncertainty of adopting the innovation (Sahin, 2006). To expand the scope of diffusion from intra-organisational to inter-organisational perspective, we argue that by using network embeddedness through the
optimization of structural and relational embeddedness, Volvo CE and suppliers may achieve higher adoption of environmental business practices to reach the mutual goals.

In case of Volvo CE, first, structural embeddedness is identified from the type of suppliers that Volvo CE works with. Volvo CE is working with Development Supplier, Direct Supplier and Structure Supplier, where these three suppliers have ISO 14001 certification, quality and safety standards and Volvo CE ensures that all suppliers follow REACH regulation and environmental sustainability requirements before starting project. Since in most cases Volvo CE does not look beyond 1-tier supplier, this requirements are needed to ensure that the suppliers who works with Volvo CE comply the regulation and it will be easy for Volvo CE to have a systematic coordination mechanism with selected suppliers rather than many suppliers, so that both parties commit to reach the mutual goals in time with the target. Hence, to have a systematic coordination mechanism, Volvo CE shares and communicates information and requirements to suppliers through company internet page and supplier interactive portal called VISIT, where every specification, request or requirement is mentioned (Global Supplier Development Process & VPS Director, 23/02/2016). As Prajogo et al. (2014) state that the diffusion of innovation standard has to diffuse through the involvement of key supply chain partners and integrate the environmental standards into supplier’s supply policy and supply management, by doing these process the uncertainty and miscommunication can be minimized earlier. Second, relational embeddedness is built through collaboration, information and resources sharing and learning process (Tate et al., 2013). From inter-organisational perspective, EPM may diffused through the interaction of supplier network, trust and collaborative interaction, therefore Volvo CE does dialogue, site visit, regular meeting with purchasers, supplier developers and key suppliers, negotiation, phone calls and redesign engines together with suppliers when coming up with innovation and integrating the adoption of innovation. “By involving suppliers in the beginning, there is higher opportunity to do the right processes from the beginning, so that both Volvo CE and suppliers have the same level of understanding” (Global VPS (LEAN) Director, 12/05/2016). In addition, Volvo CE also helps the suppliers develop their LEAN projects (Global VPS (LEAN) Director, 12/05/2016; Environmental and HS Leader, 08/06/2016), where by providing direct support to suppliers to improve their environmental performance, it can
increase the level of trust and motives toward the mutual goals (Tate et al., 2013; Diabet et al., 2013).

The second phase is Persuasion, where the adopters perceive the characteristics of the innovation to form an activity towards innovation, as to be qualified for innovation to make further decision (Rogers, 2003). In this phase, there are five characteristics of innovations that are perceived as (1) Relative Advantage, (2) Compatibility, (3) Complexity, (4) Trialability, and (5) Observability. If the higher level of these characteristic can be reached by Volvo CE and suppliers, it will lead to higher adoption of EPM.

(1) Relative Advantage
The relative advantage of innovation is perceived in which the new innovation is better than existing innovation (Rogers, 2003), thus in the long term, it delivers economic profitability and environmental benefit. Regarding the adoption of EPM, Volvo CE focuses in energy saving and performs internally energy saving program, where the company measures the savings in percentage and absolute kilowatt-hours per year, then, the result can be compared to expenses. As Global Supplier Development Process & VPS Director (23/02/2016) states that energy savings deliver benefit, not only protecting environment, but also benefit which can be counted, like consume less energy. So that in the long term, company may achieve both economic profitability and environmental benefit.

Koplin et al. (2007) and Kogg & Mont (2012) recognize the importance of purchasing and supply management function in addressing the environmental issues where OEM:s should integrate environmental standards into their supply policy and supply management through the modification in purchasing and sourcing structures. In means that firms who adopt ISO 14001 in their supply chain process aim for developing and maintaining good environmental management practices, which will bring positive contribution in environmental benefit side. In fact, Volvo CE adopts ISO 14001 to manage and ensure all process within company, align with the regulations and Volvo core values, and regarding vehicle platform strategies, recycling and shorten product life cycle, Volvo CE performs global sourcing where the company buys components worldwide from few suppliers. For instance, there are structure
suppliers who produce metal components and everything within welding construction, are able to deliver all of these different parts, so that it simplifies the component sourcing because the process is more efficient and deal with one supplier leads to better coordination in the development process and achieve environmental standard, thereby help company to establish market power among competitors, create mutual shared value and long term economic profitability. “By doing global sourcing, supplier all over the world can fulfil company needs in various plants without providing more transportation requirements and it will lead to the reduction of \( \text{CO}_2 \) footprint and less cost in transportation side” (Global Supplier Development Process & VPS Director, 23/02/2016).

(2) Compatibility
As an innovation, EPM should be compatible and meet the conditions/requirements with existing practices and value (Rogers, 2003). As a firm which adopts ISO 14001, environmental regulation compliance and quality and safety standards, the environmental management practices should be consistent with the existing values, past experiences, and needs of suppliers. To achieve that, Volvo CE ensures all their suppliers have environmental certifications, energy certifications and compliance in order to meet company values and environmental standard. In Volvo CE, regarding the adoption of EPM diffusion process, company does investment in time by inviting suppliers to Volvo CE facilities and meeting with Volvo CE experts to meet company core values and environmental sustainability requirements (Global VPS (LEAN) Director, 12/05/2016). By communicating the company needs, learning from the experts and setting certain requirements with suppliers, suppliers predict and start thinking about product’s design, price and costs. For instance, suppliers can look what company needs because they have more specific components that compatible in new technology innovation project and cheaper than Volvo CE has. On the other side, Volvo CE maintain and control for the environmental sustainability impact, so that the process meets both cost and sustainability standard. Specifically, by having more know-how knowledge and same level of understanding, supplier can apply previous working experience and adapt with the changes during the joint project with Volvo CE, where the information availability and information processing capacity of adopter are important to influence the efficiency of the innovation diffusion which will increase the rate of adoption of innovation (Frambach, 1993).
In order to increase the relative speed of adoption in innovation, EPM should be easy to implement and easy to apply (Rogers, 2003) within the supply chain process. In Volvo CE, before starting a project or making a new product, Volvo CE integrates the project with suppliers through a portal called Advance Product Quality Planning (APQP), which this portal helps to ensure the early involvement of Volvo CE suppliers where they can work jointly in the development process. This is done by Volvo CE to ensure their suppliers aware and understand with the concept so that within the process, errors can be minimised. As Global Supplier Development Process & VPS Director (23/02/2016) explains, involvement starts in the concept phase or concept development. This jointly product planning process helps supplier, especially, in case of complex components and makes sure that a supplier fully understand Volvo CE’s specifications, requirements and needs regarding environmental sustainability (Global Supplier Development Process & VPS Director, 23/02/2016).

In order to reduce complexity and uncertainty, Diabat et al. (2013) identify following practices in environmental sustainability management, such as conducting educational activities for suppliers about environmental issues which it therefore lead to the increasing rate of adopting EPM because suppliers get knowledge and capability to follow and fulfil company requirements. When it comes to technical practices, suppliers will easy to follow the process and do the project. Accordingly, Volvo CE does dialogue, discussion, information sharing, regular meeting with suppliers, follow up and involved suppliers earlier in the process because suppliers have more know-how in certain components and making design of goods in order to achieve specific goods/component. Moreover, Global VPS (LEAN) Director (12/05/2016) explains if within the process, there is something that is really complex, then the resident engineers of suppliers who is based in Volvo CE site and premises facility for couple of years, work, adapt and solve the innovation with Volvo CE, to ensure that the things is going in the right way. In fact, Volvo CE shares the information and requirements through company website and common platforms, depends on certain materials, environmental requirements and special/certain components. By doing this, suppliers will have more knowledge about company needs and to-do list, also the speed and the rate of inter-organisational diffusion of know-how will be higher when the innovation supplier has been
quite successful in the execution of innovation practices within its organization (Frambach, 1993; Koplin et al., 2007).

(4) Trialability
Another perceived characteristic for EPM adoption is trialability, where the innovation can be tried on limited basis by the potential adopters before the adoption (Rogers 2003). Regarding the adoption of EPM, Volvo CE should be able to experiment the environmental management practices earlier before deliver them to suppliers, so that Volvo CE can see the most suitable process that fit into company operations and whether some adjustments are needed. In Volvo CE, according to Global Supplier Development Process & VPS Director (23/02/2016), company is able to make suppliers aware of the benefits of environmental sustainability earlier. Moreover, taking the suppliers in the early phases for designing company products will perform as a protection against the unexpected situation in further process and therefore minimize uncertainty, reduce cost and environmental impact. The more knowledge sharing and given information that Volvo CE gives to suppliers in the beginning, the less uncertainty can be resulted during the process because suppliers aware with the requirements and standards in the beginning, thus the high degree of adoption can be achieved. In Volvo CE, accordingly, company needs to have a team, which is working and developing some current states, baseline, review the previous pilot projects and achievements of the company, define what kind of strategy that is needed to follow, develop high-level action and detailed action plans, divide responsibilities and amount of database in order to see how the current environmental practices work then will be compared for further implementation in conducting new innovation, especially focus on environmental care. “If this area is developed well, it will give you competitive advantage and you might have better access to your customer as well.” (Global Supplier Development Process & VPS Director, 23/02/2016). Following that, a joint collaboration and sharing of expertise can help diffusing EPM successfully. In Volvo CE, company is involving the suppliers in site visit, negotiation and dialog how to achieve with the standard and requirements and see whether suppliers can work on it or not (Global VPS (LEAN) Director, 12/05/2016).
(5) Observability
Since Volvo CE works a lot with life cycle analysis (LCA) and environmental sustainability product, included the supplier processes in the whole perspective, company is trying to reduce the amount of conflict within the supply chain process, such as setting the same target with suppliers depending of what kind of area and keeping the suppliers updated with company works. As an innovation, the implementation of EPM should offer observable results which can develop and improve for further innovation process and adopted accordingly (Rogers, 2003). As Global Supplier Development Process & VPS Director (23/02/2016) points out, the closest suppliers of Volvo CE need to fully understand what it requires, in terms of technology, quality, environmental regulations, delivery and capacity. In Volvo CE, the supply chain process is not only focus in environmental aspect, but also the price and economic sustainability (Global VPS (LEAN) Director, 12/05/2016). One aspect that is essential in Volvo CE is transportation part. By performing global sourcing and in most cases Volvo CE does not look beyond 1-tier suppliers, Volvo CE is trying to reduce both environmental impact (company footprint) and operational cost. However, Volvo CE is still working and trying to find out another alternative and the best practices in transportation efficiency, to distribute products and components without delivering them to many different places and suppliers. Accordingly, to keep the cost down, company has to see what strategy and practical actions that is needed to reduce price and find the certain technological solution/tools, where at the same time, see the market situation. Hence, Volvo CE does continuously looking for new fuels/eco-friendly energy, improving recycling rates, making the factories and offices more eco friendly, Green thinking mindset, using less damaging products and processes, and creating hybrid concepts.

Within the EPM diffusion process in Volvo CE, the collaboration between company and suppliers also depends on the maturity and the type of suppliers that Volvo CE cooperates with. Specifically, Volvo CE observes for suppliers who own a design and have specific component requirements for making a new product innovation. Beside that, Volvo CE helps suppliers in developing their LEAN project and helping their financial area in term of company risk. As Diabat et al. (2013) and Santos (2014) recognize that supplier environmental collaboration including provide the direct support to suppliers to improve their
environmental performance and forming joint ventures or cooperation with suppliers in cleaner production and lean practices, give benefit and competitive advantage both for Volvo CE and suppliers.

The third phase in diffusion process is Decision, where in this stage, the adopters have to take decision to adopt or reject the innovation. Since the EPM is coming from Volvo CE, thus suppliers have to adapt accordingly and follow the standards and requirements from company. If the suppliers cannot meet the company requirements, then Volvo CE will look for another suppliers. Then, fourth phase is Implementation, where the adopters, both Volvo CE and the suppliers take an action towards the implementation of innovation. Here, Volvo CE is still working and improving the implementation of EPM and communicating it with their suppliers to reach mutual benefit and shared value. Lastly, the adopters have to make further decision whether continue the adoption or reject the adoption with another innovation in the Confirmation phase. In Volvo CE, company is continuously working with previous and current projects to have some constructible ideas for next innovation. Therefore, Volvo CE should continuously updated the way they work with sustainability within operation and procurements. Further, Global VPS (LEAN) Director Volvo CE (12/05/2016) stressed that heavy vehicle industry has different level of complexity, different level focus setting, different side of volume and different requirements, then of course like Volvo CE, company needs to have certain suppliers and manage the way they work with suppliers. However, according to Global Supplier Development Process & VPS Director (23/02/2016), the influence for suppliers in terms of the adoption of EPM is limited. Furthermore, he mentions that company needs to identify suppliers, define the project, what kind of requirement is needed to reach mutual benefit and create shared value. If Volvo CE and suppliers can react the changes accordingly and follow process; both suppliers and Volvo CE will achieve a greater perceived of innovation characteristic.
6.4 Effective Control Mechanisms of EPM

RQ 3: Which are the effective control mechanisms of the EPM on the supplier network of Volvo CE?

As mentioned earlier in the thesis, the importance and the impact of suppliers are high when implementing an innovation. According to Nixon & Burns (2005), management control systems (MCS) influence how decisions are made to attain strategic objectives. Appropriately in an inter-organisational relationship (IOR), it is important to create collaborative inducements to pursue mutual goals and this is controlled by formal and informal control techniques in order to minimize the risk (Langfield & Smith, 2003). KPI:s regarding environmental agreement with suppliers is one type of formal control technique, this can include saving kilowatt-hours per year or machine and reduction of hazardous substances. Also, an informal control technique can be Product Handover process where Volvo CE delivers new machines to customers and give information about the features, safety and environmental impact, consequently this will lead to increased trust for the company.

Likewise, the Global Supplier Development Process & VPS Director (23/02/2016) suggests that Volvo CE is looking forward to identify joint KPI:s to measure the progress and translate targets and joint actions to fill the gaps in terms of environmental sustainability. Furthermore, Volvo CE needs to have long-term agreement and contact with important suppliers in case of collaborating planning activities and clear responsibility since there are rules and directions needed to follow. This is necessary for companies to implement besides having relevant performance indicators in order to create a successful and effective system. Additionally, Frambach (1993) has proposed that the existence of long-term and close relationships between networks of companies enhances the collaboration in innovation development.
process and thereby increases the speed and rate of technology innovation adoption. In contrary, according to Environmental and HS Leader (08/06/2016), Volvo CE works not more than five years with the suppliers because the LEAN project that belongs to suppliers have became more competitive. As a result, the service from suppliers become more expensive. Also, an increase speed of the innovation repels doubts that can be created in both parties. In specific, Cousins et al. (2008) state that monitoring supplier performance is not of itself sufficient; rather, it is the process of socializing the buyer and supplier that is critical to success. Cousins et al. (2008, p. 239) mention that “Socialization refers to the process of how employees, suppliers and managers interact with each other, and can help explain why some firms are more successful at managing supply relationships than others”.

Consequently, different OEM:s should focus on reducing the problems caused by suppliers and do this in an early phase. In order to fulfil this, it is fundamental that OEM:s select and monitor their suppliers carefully. Accordingly, as Global VPS (LEAN) Director (12/05/2016) mentions that there is a system called SEM (Supplier Evaluation Management), where Volvo CE has a very strict system in what type of quality standard that needed to fulfil, for example like ISO 9001, ISO 14001, ISO Quality Service in Automotive and Quality Service Standard. As Binder et al. (2008) points out that automotive suppliers (especially first-tier) lack the competence for all in-house development and production of subparts, and therefore they “…should develop skills (relationship-specific assets) for effectively and efficiently managing their sub-suppliers in accordance to the overall project requirements.” Global Supplier Development Process & VPS Director (23/02/2016) mentions that the control of EPM practices on the suppliers’ current systems is still in progress. He explains that in order to comply with the REACH regulations, there will be eventually compliance from all the tiers of suppliers to avoid forbidden substances used. Since in most cases Volvo CE does not look beyond the first-tier suppliers, the first tier suppliers need to set specifications and targets to their suppliers which in the end leads to work on same environmental objectives throughout the supply chain. It leads to another implication that OEM:s should look beyond their first-tier suppliers and see whether the suppliers of their direct suppliers comply with environmental requirements and whether they possess the required know-how for realization of environmental performance standards. Obviously, this will spread the environmental
requirements up to the sub-supplier level, and thereby will improve the depth of environmental performance diffusion. Moreover, when one party, OEM:s control along the supplier network whether the environmental compliances are met, the balance of shared perception among supply partners will definitely increase.

According to Volvo Report (2014) every supplier of Volvo CE are forced to have a quality system that has been documented to the latest version of ISO 9001. And the part handling review (PHR) contains an onsite visit from suppliers to Volvo CE to evaluate all handling and installation carried out. This review will typically comprise appraisal of receiving, material storage, handling, installation, testing and shipping as applied to the supplier’s part. If the supplier’s performance is not as required for EPM, the outcome is deprived or relaxed or the action plan is not success, Volvo CE would call the supplier to a management meeting. Quality performance management (QPM) is established for each supplier founded on the criteria such as actual number of odd material recognized contradicting to EMS practice. To limit and influence the environment impacts from the maritime transports, Volvo CE encourage the sea carriers to address to the Clean Shipping Index and road transporters to use specific engine class. In order to integrate the environmental guidelines, companies have to construct new criteria for supplier selection and evaluation, which should be complemented by control mechanisms and compliance indicators (Koplin et al., 2007).

In Volvo CE, as Global Director Core Value, Management Sales and Marketing (12/02/2016) states, it is crucial to have premium suppliers to drive the technological shift towards sustainable advantage, and supplier selection and performance control should follow this principal. And, as Simpson et al. (2007) notice, “…such environmental performance goals may be influenced by the same factors which influence other supply chain level performance elements (i.e. quality, cost and lead time reductions)”. It means that, careful selection and alignment of environmental key performance indicators with critical success factors are important for strategic and operational management of organizations (Bai & Sarkis, 2014). Furthermore, in heavy vehicle supplier networks, the environmental performance should help suppliers to focus not only on environmental sustainability but also on organizational strategy (core competencies and capabilities), which will improve their competitive stance in the
market. When the suppliers recognize the advantage of environmental performance management in driving operational efficiency and value for whole chain, the depth and balance of coordination within and between the members of supply chain networks will mostly likely increase.

Finally, we can also draw the importance of inter-organizational relationship in EPM. Simpson et al. (2007) claim that “supply relationship conditions that exhibit traits of high investment and governance will provide for a more effective deployment of a customer’s environment-related performance requirements”. Additionally the IMCS should enable the knowledge sharing and execution of common projects between Volvo CE and its suppliers. Respectively, conjoint KPI:s should address the amount and frequency of information exchange. Nevertheless, as Global Supplier Development Process & VPS Director (23/02/2016) outlines, currently, Volvo CE does not invest in supplier capability when it comes to environmental sustainability. Additionally, in order to maintain environmental performance, the OEM must not only continuously monitor its suppliers on intangible (relationship status) perspective, but also on the tangible (operational performance) (Cousins et al., 2008). In fact, Global Supplier Development Process & VPS Director (23/02/2016) states that it is obligatory for suppliers to comprehend what they require in terms of technology, quality, environmental regulations, and delivery capacity. Binder et al. (2008) and Caniels et al. (2013) claim that a cooperative approach is characterized by buyer-supplier interaction geared towards know-how sharing, collaboration and jointly performance improvement. In Volvo CE, one of the control mechanisms is APQP, which this control mechanism ensures that both the parties are working on the same performance level and standards that are required to maintain Volvo CE’s core values. Apparently, this will create a loop for both sides in order to provide feedback in on-going progresses regarding environmental management; also, it allows providing timely information to suppliers, where OEM:s can communicate their expectations and improvement actions to be carried out. Once OEM:s frequently monitor their suppliers and provide with timely information, and do it along the supplier network (including first-tier, second-tier, and third-tier suppliers), the likelihood of deep and balanced diffusion of environmental performance management will be high.
7 CONCLUSION

In the following chapter, the summary from three research questions will be presented according to the analysis and discussion that the author made. Some reflections will be pointed out in the conclusion part and lastly, the suggestion for future research is created.

7.1 Conclusion of Research Question

Heavy vehicle manufacturers are witnessing the high influence of environmental friendly business practices and environmental sustainability compliance. Environmental regulations impacts the EPM in Volvo CE in the way company communicates and updates their works with suppliers to come up with sustainability technology and system innovation, and the impacts are distributed in five different areas: manufacturing/production area, managerial area, strategic area, technical area and compliance area. Resulting in spending approximately 75 percent of company budget for product development regarding the emission reduction technology within the supply chain proces. Specifically, Volvo CE focuses on producing and creating new environmental sustainability technology and heavy vehicle products; does Green Map analysis; establishes partnership with regulation institution and CSR; focuses on prohibited chemicals and recycling method; eco training program and employee training program.

Accordingly, to successfully attained the environmental sustainability requirements, it depends on how well Volvo CE delivers information, manage the coordination with their suppliers and control the process. The process of diffusing EPM back to Volvo CE suppliers consists of five phases and using structural and relational embeddedness within the interorganisational diffusion perspective in understanding and learning process to help Volvo CE and suppliers adapt with the changes through EPM. This can be done by identifying the type of suppliers, building supplier interactive portals and distributing information as early as possible to the suppliers. Moreover, to reach the efficient diffusion of EPM, EPM should be perceived as relative advantage, compatibility, complexity, trialability, and observability. In Volvo CE, this is done by performing internally energy saving program, using system sourcing method, choosing the suppliers which adopt ISO 14001, energy and environmental compliance certifications, having more know-how knowledge and sharing the same level of
understanding with suppliers. Beside that, discussion, negotiation, site visit and regular meetings with suppliers are important to keep the proactive collaboration up.

From inter-organisational perspective, there is a need for OEM:s within heavy vehicle industry to build systematic control mechanism, to have clear responsibilities and coordination between company and suppliers along with cooperative collaboration establishment toward mutual goals. This can be done through formal and informal control techniques. Formal control techniques can be KPI:s regarding the environmental agreements between buyer and supplier. Specifically, Volvo CE needs to identify more joint KPI:s with suppliers and include important suppliers in the process. Preferably, this requires long-term agreement and contact with suppliers, which we can see that Volvo CE is lacking since they do not work more than five years with the same supplier. Moreover, Volvo CE performs the informal control techniques through product handover process in order to build trust for the company. A long-term relationship with an important supplier will alleviate the control of 2:nd and 3:rd tier supplier since the important supplier will have the trust and authority to control, monitor and oversee how they are implementing the environmental aspect in their daily work. Since Volvo CE does not have insight in their daily work, it would be beneficial for Volvo CE to release this to a premium supplier. Consequently, the high productivity and long-term economic performance can be achieved.

7.2 Suggestion for Future Research

The authors believe that this thesis cannot be generalised in a wider sense because the probability of doing a similar research is low due to the different requirements from stakeholders, suppliers, government and regulations coming from different institutions. Accordingly, Volvo CE, as an OEM in heavy vehicle industry, is facing some barriers regarding the environmental sustainability business practices, so that the company strategies may change in the future, therefore the authors believe that to ask the same questions to Volvo CE in the future will not give the same results as this thesis received.
Apparently, in order to successfully diffused the EPM, there is a need for baseline, strategy definition, planning for integrated approach, development of action plans, division of responsibilities and a set of control mechanism which measure and control and evaluate the diffusion process. In the following, future research subjects could be:

- As explained in analysis that more focus on supplier opinions and ideas may lead to higher success of EPM adoption, a study could be conducted in supplier side, to have point of view from supplier side, how suppliers of Volvo CE experience the EPM adoption and follow the standards from company together with the demands from environmental sustainability regulations. In this study we only see from Volvo CE side, so further research can be done in supplier’s area.

- Regarding the environmental sustainability regulation and CO₂ emission reduction, the standards and regulation are applied strictly in Europe. Another qualitative and/or quantitative analysis can be done in OEM:s in Asia or conduct a comparative analysis regarding the environmental sustainability regulation and CO₂ emission reduction between Europe and Asia, or several area where Volvo CE distributed to see how companies adapt with environmental sustainability aspect within heavy vehicle industry and how suppliers react and adapt with the changes in company strategies.

- Since the use of collaborative/joint KPI:s from buyer and supplier perspective mostly overcome the operational performance (formal control), another research area could be done in the informal control, how to measure, manage, control and evaluate the informal control from other management control disciplines and theories.
8 REFERENCE LIST


Appendix I (Construction questions and guideline for RQ1), Niklas Nillroth, Vice president of Environmental & Sustainability, 08/02/2016.

1. Can you give a general overview of environmental regulations faced by Volvo CE?
2. Can you describe how the heavy vehicle industry looks like nowadays?
3. Which body imposes the environmental standards and requirements?
4. Are there any global and regional environmental regulations? Can you elaborate on that?
5. What are the impacts of environmental regulations on company strategy?
6. Have environmental regulations radically changed the business model of Volvo CE?
7. To what extent can environmental sustainability be a value-adding activity?
8. What are the consequences and penalties of non-compliance with environmental standards?
9. How are environmental issues solved in general? Can you describe important initiatives undertaken by Volvo CE regarding environmental sustainability?
10. What are the challenges of integrating environmental performance indicators in current operational management?
11. Which areas of operations are most affected by environmental regulations?
12. How are delivery flexibility and contractual responsiveness affected by environmental performance requirements?
13. Do environmental performance requirements complicate the quality awareness and product performance management process?
14. How is environmental performance management conducted?
15. Which Key Performance Indicators (KPI:s) are used?
Appendix II (Construction questions and guideline for RQ1), Rickard Alm, Environmental Care and Security Manager Braås, 08/02/2016.

1. Can you give a general overview of the regulations faced by Volvo CE?
2. How do you implement these regulations in the production?
3. Which areas on the operational level are most affected from the environmental regulations?
4. How do the regulation affect your operational efficiency?
5. Are you more productive or does it take a long time to work following these regulations?
6. To what extent do you meet with the persons who are involved in the product strategy of Volvo CE?
7. How do you implement the required changes to meet the regulations?
8. To what extent do you take ideas on how to work from different sites of Volvo CE?
9. What is the reason to not work in the same way in every site of Volvo CE?
10. How is the information about the regulations coming to you?
Appendix III (Construction questions and guideline for RQ2), Tony Andersson, Global Director Core Value, Management Sales and Marketing, 12/02/2016.

1. Volvo CE works with three core values (?,?,?), how tightly related are those three values? Which one of them is most valued by customers?
2. What kind of advantage or benefit can environmental compliance bring besides “positive image”? Is it an element of strategic product positioning?
3. How can environmental sustainability contribute to customer value proposition?
4. How do you recognize the customer value that Environmental Performance create?
5. Which Key Performance Indicators (KPI:s) do you use to measure the value created by environmental sustainability?
6. Which product/service attributes (functionality, quality, price, time) are impacted most by environmental regulations? What are the cost and benefit consequences of those impacts?
7. What are the best practices to improve customer relationship management when it comes to environmental issues?
8. How is the functionality and quality affected when you integrate environmental care in development and production of products?
9. In which way do customer relationship management change after introducing new environmental standards?
Appendix IV (Construction questions and guideline for RQ2), Dirk Engelke, Global Supplier Development Process & VPS Director, 23/02/2016.

1. How do the environmental regulations affect the supplier-relationship management practices at Volvo CE?
2. How can Volvo CE communicate the awareness and knowledge about environmental sustainability to its supplier networks?
3. How can we understand development supplier?
4. When Volvo CE comes up with new innovation, how do the suppliers receive and adapt with the changes?
5. In what way do Volvo CE cooperate with and integrate suppliers into their new product development processes and related innovative technologies?
6. To which extent does this collaboration with suppliers help to see the benefits of environmental sustainability? How the market trends (system sourcing, shorter-product life-cycle, and global sourcing) impact this?
7. What can be the relative advantage of new EPM adoption for the suppliers? How can the relative advantage of EPM lead to creation of shared value?
8. Have the adoption of EPM by the supplier led to business process improvements? In which way? What is the change in practise?
9. How does the supplier views on complexity of EPM affect the acceptance and implementation of EPM?
10. To what extent are your suppliers able to try the new EPM practices beforehand in order to observe the benefits of them?
11. What are the impacts of buyer-supplier relationship on the EPM control? Do you look beyond your first-tier suppliers and see whether their direct suppliers comply with environmental requirements?
12. What are the important KPI:s in controlling the environmental compliance of suppliers?
13. How can the control of EPM along the supplier network affect the cost/utility dimension of the product?
14. Do you invest in building supplier capability when it comes to environmental sustainability? If yes, how does it impact the efficiency of EPM adoption by suppliers?
15. How do you ensure that environmental KPI:s are aligned with critical success factors both for Volvo CE and its suppliers?
Appendix V (Construction questions and guideline for RQ 2 and 3), Stefan Braunias, Global VPS (LEAN) Director Volvo Construction Equipment, 12/05/2016

(Construction questions and guideline for RQ2)

1. What are the most important areas in EPM, which need more cooperation with suppliers?
2. Do the suppliers follow some other regulations regarding environmental sustainability, which are different than what Volvo CE has?
3. How does the Volvo CE usually diffuse back to suppliers the quality or safety standards?
4. To what extent is Volvo CE aware about the environmental performance of its suppliers? Do you see any areas in this aspect that need further improvement?
5. If Volvo CE would have started to initiate a project concerning interface management control between its suppliers, which criteria do you think need to be considered?
6. Which process is followed when declaring the requirements from Volvo CE to the suppliers?
7. Do you invest in building supplier capability when it comes to environmental sustainability? If yes, how does it impact the efficiency of EPM adoption by suppliers?
8. When Volvo CE comes up with new innovation, how do supplier receive and adapt with the changes?
9. In what way does Volvo CE cooperate with and integrate suppliers into their new product development processes and related innovative technologies?

(Construction questions and guideline for RQ3)

10. What type of KPI:s are used to measure the performance of mutual projects or operations between Volvo CE and its suppliers?
11. How does Volvo CE measure the performance of knowledge-sharing and other mutual initiatives carried-out in cooperation with suppliers?
12. How do the process looks like when creating the conjoint KPI:s together with your suppliers?
13. What are the roles of conjoint KPI:s in controlling that requirements (environmental, safety, quality) are fulfilled by suppliers?
14. Do Volvo CE have a common platform, besides APQP, in order to share the needs and/or required information with its suppliers?
15. How do you ensure that environmental KPI:s are aligned with critical success factors both for Volvo CE and its suppliers?
16. How can the control of EPM along the supplier network affect the cost/utility dimension of the product?
17. What are the impacts of buyer-supplier relationship on the EPM control? Do you look beyond your first-tier suppliers and see whether their direct suppliers comply with environmental requirements?
18. Can you describe how the heavy vehicle industry looks like nowadays?
1. Which are the most important areas in EPM, that needs more cooperation with suppliers?
2. Do the suppliers follow some other regulations regarding environmental sustainability, which are different than what Volvo CE has?
3. How does Volvo CE usually diffuse the quality and safety standard to the suppliers?
4. To what extent is Volvo CE aware about the environmental performance of its suppliers? Do you see any areas in this aspect that need further improvement?
5. If Volvo CE would have started to initiate a project concerning interface management control between its suppliers, which criteria do you think need to be considered?
6. When Volvo CE comes up with new innovation, how do supplier receive and adapt with the changes?
7. In what way do Volvo CE cooperate with and integrate suppliers into their new product development processes and related innovative technologies?
8. What type of KPI:s are used to measure the performance of mutual projects or operations between Volvo CE and its suppliers?
9. How does Volvo CE measure the performance of knowledge-sharing and other mutual initiatives carried-out in cooperation with suppliers?
10. How do the process look like when creating the conjoint KPI:s together with your suppliers?
11. What are the roles of conjoint KPI:s in controlling that requirements (environmental, safety, quality) are fulfilled by suppliers?
12. Do Volvo CE have a common platform, besides APQP, in order to share the needs and/or required information with its suppliers?
13. How do you ensure that environmental KPI:s are aligned with critical success factors both for Volvo CE and its suppliers?
14. How can the control of EPM along the supplier network affect the cost/utility dimension of the product?
15. What are the impacts of buyer-supplier relationship on the EPM control? Do you look beyond your first-tier suppliers and see whether their direct suppliers comply with environmental requirements?