



Norwegian University of
Science and Technology

Sustainable Supply Chain Management & Its Integration Among the Norwegian Industries

A Research Paper On How Norwegian
Industries Collaborate When It Comes To
Sustainable Innovation And Shared Value
Creation.

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Master in Science of Project Management

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Abstract

This Research paper named **Sustainable Supply Chain Management and Its integration Among the Norwegian Industries for Shared Value Creation** has been written as the fulfilling the Master's Thesis criteria for Master of Science in Project Management at the **Department of Industrial Economics and Technology Management (IØT)**, NTNU.

This research was based on the Work-Package 3 of the **Sustainable Innovation and Shared Value Creation among Norwegian Industries (SISVI)** project run by **Norwegian University of Science and Technology (NTNU)**, funded partly by **Norwegian Research Council** and the collaborating industrial partners.

The whole study was carried under the supervision of **Prof. Luitzen De Boer** and co-supervisor **Malena Ingemansson Havenvid**, both based at IØT, NTNU.

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Finally, I offer my acknowledgements to all my friends, relatives and well-wishers, whose constant support and encouragement has shaped me into what I am today.

Abbreviations

3BL: 3 Base Lines

APICS: American Production and Inventory Control Society

CS: Corporate Sustainability

CSR: Corporate Social Responsibility

GSCM: Green Supply Chain Management

ICT: Information and Communication Technology

IISD: International Institute for Sustainable Development

IØT: Industrial Economics and Technology Management

LCA: Life Cycle Analysis

LCM: Life Cycle Management

NTNU: Norwegian University of Science and Technology

R&D: Research and Development

SCOR: Supply Chain Operations Reference

SD: Sustainable Development

SISVI: Sustainable Innovation and Shared Value Creation in Norwegian Industries

SME: Small and Medium Enterprises

SSCM: Sustainable Supply Chain Management

WCED: World Commission on Environment and Development

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1 Introduction

In today's globally competitive market, the business organizations should go beyond the profit maximizing goal. They are expected to include the social as well as environmental agenda in their practices. The final customers have become more aware about the sustainable practices of the production houses, the carbon footprint they leave, the working situation of the employees, energy reduction practices and corporate social responsibility (CSR) stances of the companies (Kogg, 2009).

Besides focusing on reducing the cost of production and overall supply chain practices, every company should focus on gaining unique 'competitive advantages' to survive the increasing competition. This thing as noted by Porter and Kramer, 2006, lies in creating effects in the interface between the focal firm and other actors-individual organizations (Håkansson et al, 2009).

As environmental concerns are intricately related to different aspects of supply chain, its concerns are felt in the business environment and legislation. Corporate sustainability leverages business organizations and their supply chain partners (buyers, suppliers) with the systematic initiatives to reduce energy and environmental, reducing materials wastage and regulatory overheads, and generating greater profits, all of which are even more significant at a time of increased global competition and economic downturns. Thus sustainable supply chain has become new emerging trend of industrial growth, also positioned as new business innovation.

However, it is not easy to adopt such new innovative management methods into organizations easily. These emerging technologies, management methods and state-of-the-art productions systems may affect different aspects of supply chain management, such as; supply policies, production process, inventory management, and distribution channel (Parker & Su, 2012).

The challenges in sustainability integration is also offered by the additional costs, use of tool and techniques, level of carbon foot prints, legislation and so on. Thus a lot have been done lately in the research of sustainable supply chain management integrations.

Now, this research work aims to offer the understanding of the major concept of sustainability thriving these days, the theories and framework offered for the sustainability integration process. It utilizes these basic concepts to figure out the actual situation of Norwegian firms' sustainability integration within the companies and their supply value chain. This work will try to analyze if those existing framework are viable for the Norwegian small and medium scaled Enterprises (SMEs) and if not, propose a hypothetical framework suitable in this situation.

Additionally, the research paper aims to find the barriers hindering the whole adoption scenario, the extent to which those factors are acting as hindrances and discussing the possibility of improving their extent. Finally, the paper concludes by providing necessary recommendations and suggestions. This will also include discussing the limitations of the whole work and factors to be considered for the further study.

1.1 Background of thesis/ SISVI Project

This master's thesis work is based on the research project named Sustainable Innovation and Shared Value Creation (SISVI) among the Norwegian firms.

Fierce international competition for Norwegian industry requires excellence when it comes to innovation. A firm's ability to continuously develop and find new ways of aligning resources, activities and product offerings is crucial for obtaining and maintaining competitive advantages (De Wit and Mayer, 2010).

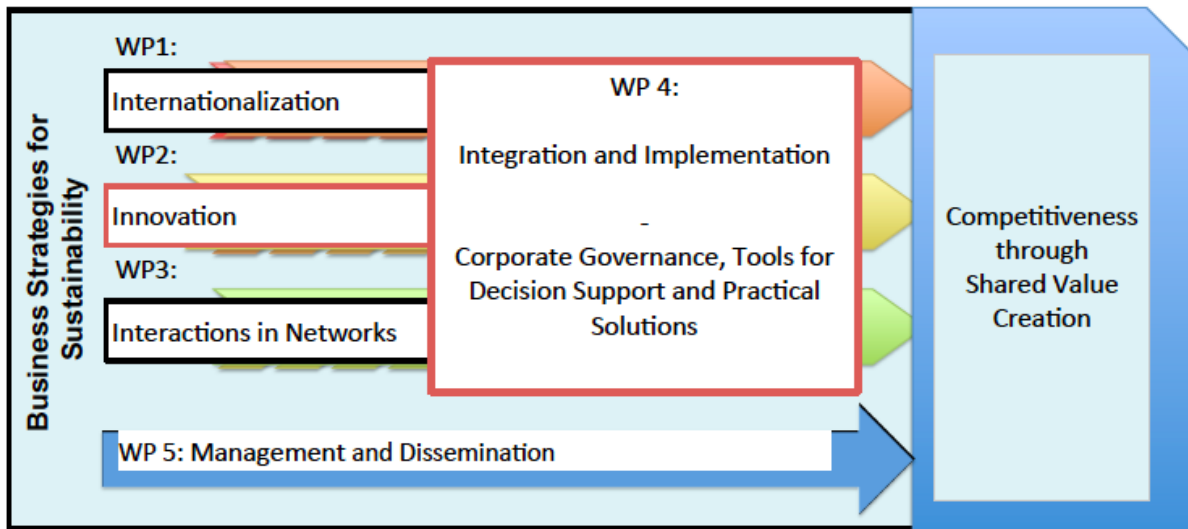


Fig 1: Work packages 1-4

Based in this concept of sustainability, SISVI aims to provide Norwegian industries with four building blocks which they can make use to achieve their own unique competitive advantages. This project also emphasizes Environmental and green aspects as drivers for innovation. Moreover, the main purpose of this project is to develop knowledge that will strengthen the industry's long term competitive advantage in more consistent way with the concept of sharing the values.

1.2 Objectives of the SISVI Project

The primary objective of SISVI is: To develop knowledge, based on high quality scientific research, that allows Norwegian industry actors to develop unique capabilities for strengthening their international competitiveness through innovation, sustainability and shared value creation.

(SISVI PROJECT, IØT, NTNU, 2015)

This will be achieved through the secondary objectives which are:

1.2.1 Seek and build knowledge about the challenges, opportunities and risks for Norwegian firms related to sustainability, responsibility and shared value creation in the context of

- Internationalization processes
- Innovation processes
- Interactions in the supply chains and networks where the firms operate

1.2.2 To integrate this knowledge across the traditional research disciplines of internationalization, innovation and supply chain management

SISVI aims to increase the social value and acceptability of innovation processes in firms and facilitate the emergence of new business models that embed sustainability and social responsibility throughout the entire business cycle. The project aims to contribute to programs under Horizon 2020, e.g. the Responsible Research Initiatives (RRI), GARRI.2.2015 which in the long term aims to contribute towards the innovation and competitiveness objectives of innovation and to enhance mainstreaming and standardization of RRI and CSR processes at the EU and global level. SISVI will also seek collaboration with Research and Competence Training Network for Sustainability-Driven Innovation which was started in January 2013 under the European FP7 program with the goal to study sustainability-driven innovation (SDI). Finally, SISVI will seek knowledge from the FP7 project on Sustainable value creation in manufacturing networks, operating from 2011-04-01 to 2014-03-31. This fits well since SISVI will start just after the closure of this project, and the manufacturing industry is represented by the core companies in SISVI. The overall goal of this project is also relevant for SISVI, and SISVI can contribute by demonstrating the further development of knowledge created in this project. Examples of such knowledge include industrial models, solutions and performance standards for new sustainable and more performing production and service networks, governance and business models, a new methodology to support sustainable life cycle decisions and sustainability assurance performance standards for complex business processes in integrated production and service networks.

(SISVI PROJECT, IØT, NTNU, 2015)

1.3 Where does this Thesis-work fit in this project?

This master thesis basically falls in Work package-3 and Work package-4 (WP3 and WP4), as this research centers around the interaction among the participating firms when it comes to mutual long-term benefit, specifically focusing on sustainable supply chain and their efforts of integrating the measures into the organizational system. This work package, through this thesis work first explores what areas are the existing (participating) firms currently basing the partnership; the resource sharing, information, innovations, expertise, etc. Factors responsible for long term benefit, such as different sustainability dimensions (Social, Economic, and Environmental), decreasing energy and resources consumption through recycling, reuse and similar innovative ideas like life cycle analysis, and core values are conceptualized.

This work is followed by Work Package-4 where the integration and implementation work takes place. This is done in accordance with the performance measurement and analyzing the different kinds of barriers and bottlenecks in the whole process as closed-loop system. Actions like Surveys, data collection and Empirical calculations based on the response are performed. The recommendations and practical solutions are

1.4 Theoretical Background/Framework

SCM, as we envision, is a new management philosophy that states that individual businesses no longer compete as an independent autonomous units, but rather as supply chains. Therefore, it is an integrated approach to the planning and control of materials, services and information flows that adds value for customers through collaborative relationships among supply chain members (Chen and Paulraj, 2004)

This thesis is primarily built on the **Strategic Management Theory** emphasizing the development of collaborative advantage (e.g. Contractor and Lorange 1988, Nielsen 1988, Kanter 1994, Dyer and Singh 1998, Dyer 2000), underscoring our understanding that a supply chain is composed of a network of interdependent relationships developed and fostered through strategic collaboration with the goal of deriving mutual benefits (Ahuja 2000).

This thesis work utilizes the concept of **Industrial Network Approach** which is based on the understanding that the ability of the firm is based on its level of interaction with partnering firms (Håkansson,1982, Snehota, 1995). Through the interaction, the business relationships can lead to innovation-the development, revolutionary production processes and new solutions (Håkansson & Waluszewski, 2002).

As firms are highly dependent on other firms for gaining access to key resources (such as knowledge, technical components, skills and strategic operations), the interface between the internal and external environment of the firm becomes thinner due to the bonds (between actors), links (between activities) and ties (between resources) (Håkansson & Johanson, 1992). A great number of empirical studies have shown that usually firms form close bonds with a set of specific suppliers and customers, in addition to a selection of other types of relationships (Ford et al., 2003).

Specific technological and organizational structures as well as investment patterns are formed as activities and resources are shaped in relation to each other across organizational boundaries over time (Håkansson

& Waluszewski, 2007). Therefore, one of major issue to achieving sustainable innovation depends in appreciating the match between established network structures of actors, resources and activities, and new sustainable solutions.

This perspective sees firms as the part of interdependent actors, activities and resources that are totally inter-related. This further implies that to have benefits (innovation, revenues and learning), firms, and their activities and resources are dependent on those of other firms and actors, activities and resources.

1.4.1 Why were these theoretical background chosen?

As it has been clearly known, the thesis here is dealing with the sustainable shared value creation among the Norwegian firms in long term. As it is suggested by previous articles and research works (Porter, 1980; Dyer and Singh, 1998; Hakansson and Snehota, 2006), that the supernormal return values can be generated only with the collaborative relationship with identical firm. On the contrary, resource based view states, this profit can be accumulated by only those who has rare resources, values and non substitutable (Dyer and Singh, 1998). Now, this **Strategic Management Theory** is the only medium that can help us understand the both the concept and how to create the strategic edge in long term (sustainable) utilizing both the above concepts, protecting the resources, mutually exploiting each of the partnering firms' expertise, innovation technology etc.

Secondly, the inter-relationship derives its reasons for existence from the work of Hakansson and Snehota (1982, 2006) that states no organization is an island and must forge relationship with others in regard to the works they perform (Activities) and resources within the network, suggesting the enterprise should be conceived as a transaction function rather than a production function. It looks deeply into the content of relationships in terms of the business practices that are applied in initiating, developing and maintaining business relationships (Håkansson & Snehota 1995; Håkansson & Johanson, 2001).

Additionally, both these theory are based on a large number of empirical observations in several industries regarding business-to-business relationships and how they matter - for the strategies and practices of the individual firm (Håkansson, 1982; Håkansson et al., 2009), as well as for innovation (Håkansson & Waluszewski, 2007). Thus it is very useful for the individual firms to understand how to implement new sustainable solutions in relation to other firms and actors to create collaborative shared value.

1.5 Research Questions

Besides this, I would also like to direct and converge my supply chain integration practices with the sustainability perspectives; which are more or less the measurement of environmental, social and economic influences brought about the supply chain practice incorporated by the companies within the company or across the business network.

Thus, the **key research questions** around which this thesis work will be centered around are listed as follows:

- ❖ **What is Sustainable Supply Chain Management and what is meant by the process of Sustainability Integration?**
- ❖ **What is the level of Sustainable Supply Chain Integration among the Norwegian firms?**
- ❖ **What are the hurdles faced by the Norwegian firms while integrating sustainable supply chain and possible measures to ensure better performance?**

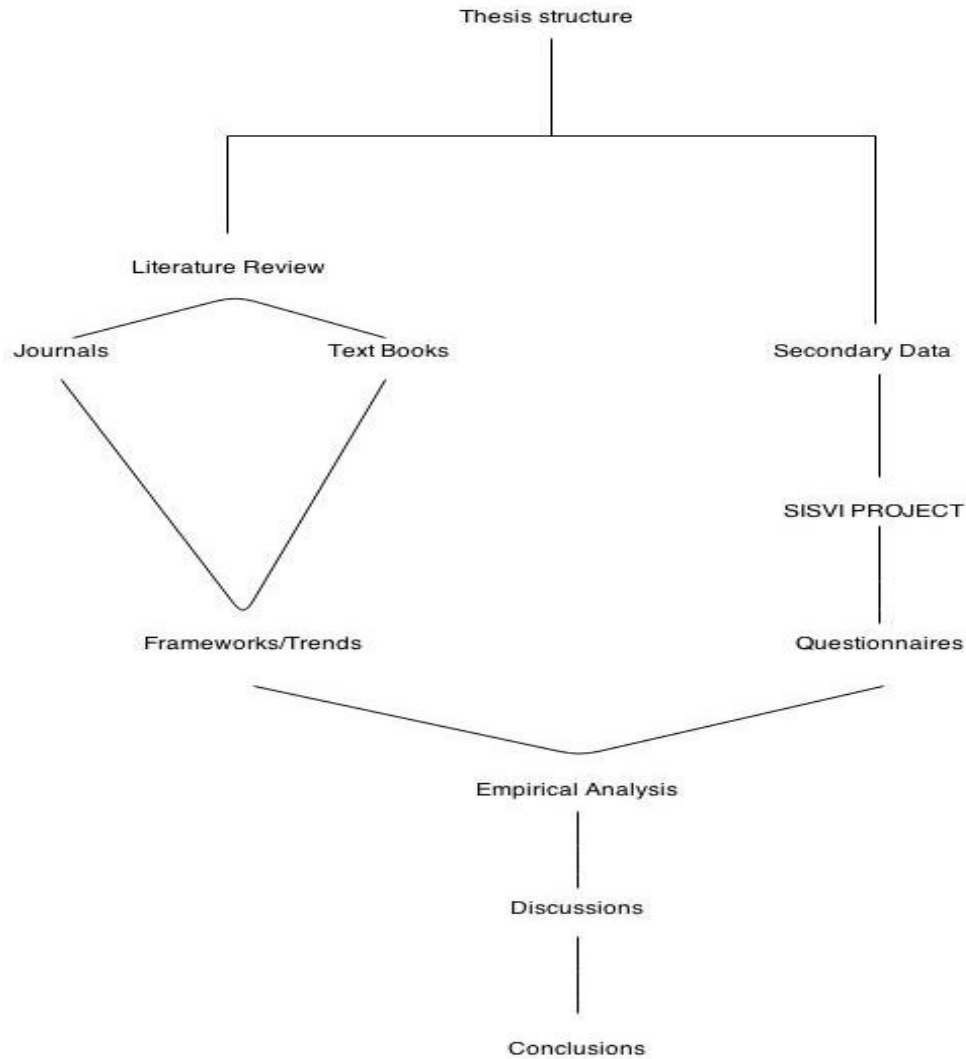


Fig 2: Structure of the Thesis

Above chart shows how this thesis is organized in order to tackle the different research questions as mentioned earlier. The whole thesis has been divided into Literature Review, Empirical Analysis, Discussions of the Empirical Results and finally, conclusions and recommendations.

The **first research question** will be dealt by the **Literature review** in the **chapter 2** in this thesis paper. The theories discussed there will attempt to draw the conceptual facts and understanding of the necessary theories, definitions, terms, models, frameworks and practice of supply chain management with sustainable approach. This will also try to reflect on the **Sustainability integration** process in practices and which could be possibly relevant in regards to Norwegian firms to build on possible integration method.

The **second research question** shall be dealt by the **Empirical Calculation (Chapter 3)** calculated out off the responses of the participating firms towards the **survey questionnaires** (As shown in the figure above). The Empirical calculations generally will be accessed in the Excel spread-sheet and displayed in clear graphical bar diagrams. They will also be elaborated in texts.

The **third research question** shall be answered through the **Discussions and Conclusions (chapter 4)**. The author after the analysis of the Empirical calculations and Norwegian firm's stance towards sustainability integration shall contrast it with the literature review discussed in chapter 2, will come to discuss the hindrances and possible measures for the sustainability integration among the Norwegian firms' Supply Chain practices.

1.6 Methodology

This thesis is primarily based on the theoretical understanding, existing literature concepts, secondary data obtained out of the questionnaires and finally formulating hypothetical conclusions based on the outcome of the empirical calculations. Although, the author does make some numerical and empirical calculations for the data, the entire calculations performed have been totally basic excel and arithmetic calculations. The thesis hasn't necessarily employed the experiments utilizing complex parameters, measuring and analyzing those using specific mathematical functions, formulas or relations. Thus, this thesis work can be dominantly regarded as **qualitative research** work rather than quantitative.

To reach the objective of delivering the master's thesis based on the **Sustainable Supply Chain Integration Practices** among the Norwegian industries, and also to suggest some areas of focus in future to attain the desired performance standards in terms of service-level and logistic costs, various methods were utilized as methodology. Different articles were extracted from different scientific journals and text books. Similarly, relevant chapters of textbooks were referred for corresponding concepts and theories.

In addition, data was collected secondarily from the survey questionnaires conducted among the participating firms. Empirical calculations were then conducted in Excel spread-sheet and transferred into necessary diagrams and analyzed. They are further explained in detail in the following points.

1.6.1 Literature Gathering

Fink provides the following definition, "A literature review is a systematic, explicit and reproducible design for identifying, evaluating and interpreting the existing body of recorded documents" (Seuring and Muller, 2008).

Literature reviews usually aim at two objectives: first, they summarize existing research by identifying patterns, themes and issues. Second, this helps to identify conceptual content of the field and can contribute to theory development.

From methodological point of view, literature reviews can be comprehended as content analysis where qualitative as well as quantitative aspects are mixed to assess structural (descriptive) as well as content criteria. A process model proposed by Mayring (2008) contains four steps as shown in the figure 3 below.

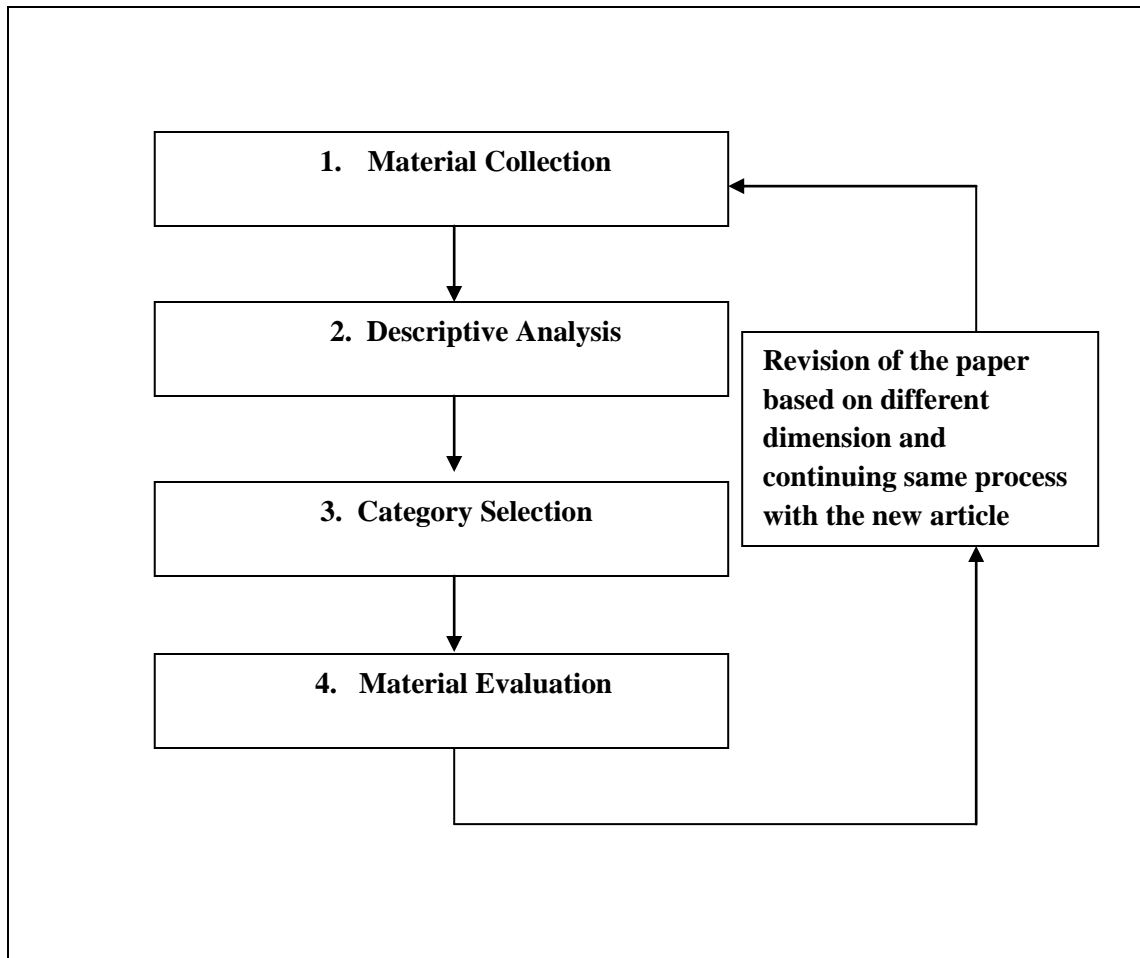


Figure 3: Analytical literature review process suggested by **Mayring**, 2008

1. **Material collection:** The first and foremost step was to define the materials to be collected. It was done on the basis of key words like **Sustainable Logistics and supply chain management, Sustainability, Corporate social Responsibility Networking among the business firms, shared value, and innovation** as a whole; key concepts and practices in the present time. The author also searched literatures on **sustainable supply chain models, theoretical frameworks for supply chain modeling and empirical analyzing techniques** currently in practice, **barrier and limitations** business organizations are facing when it comes to the **management integration**, both internally and externally.

For this, several resources; journals that publish the scientific research papers, databases, text books and secondary data have been utilized. Some of the key journals are **SCIENCEDIRECT, ELSEVIER, PROJECT MANAGEMENT DATABASE, ACADEMIA.EDU, BIBSYS (NTNU DATABASE FOR RESEARCH JOURNALS), OREA.NO, SCOPUS.COM** and textbooks like **STRATEGIC LOGISTICS MANAGEMENT** (Stock and Lambert, 4th edition), **LOGISTICS**

AND SUPPLY CHAIN MANGEMENT, (Martin Christopher, 4th Edition) has been thoroughly utilized, for the undertaken work.

2. Descriptive analysis: The formal aspects of the material were assessed; the number of publications year, providing the background for subsequent theoretical analysis. The author utilized this to pick the articles no earlier than 2000 as the ideas there would have been obsolete. The articles then were read and analyzed checked if it fitted the framework of the present work.
3. Category selection: The different dimensions of the literatures were selected; which key concepts and terminologies or definitions seem really important from the paper. This step also utilized highlighting the frameworks, supply chain modeling in terms of sustainability, performance measuring techniques, diagrams, necessary charts and figures, etc.
4. Material evaluation: Now, the selected theories, frameworks, models and definitions were evaluated if they were really fitting to the structure of the theory. They were counter evaluated by comparing with different frameworks, models and theories derived from different authors and publication, and the best that fitted was utilized with reasoning (Seuring and Muller, 2008, Mayring 2000).

1.6.2 Secondary sources of data

Similarly a list of survey questionnaires were sent to around 70 Norwegian firms; questionnaires mostly dealing on the buyer-supplier relationship, mutual co-operation among the firms of the business network, technical adaptation and collaborations among the partnering firms, and the stance of the firms on the sustainability related practices; barriers and opportunities.

The writer mostly utilized the secondary data provided by Malena Ingemasson Havennvid (Post-doc at 'Department of Industrial Economics and Technology Management, IØT, NTNU), who was chiefly responsible for the primary survey and field visits. Nevertheless, the writer took part in the company related seminars, conferences and feedback sessions, then and now with the supervisors for the positive input and the motivation.

1.6.3 How is the survey questionnaires integrated into the Research?

A set of questionnaires were sent to Norwegian firms. The questionnaire is available on the appendix of the thesis, in the end. Although, there were roughly 50 questions (including sub-questions), the author only utilized those questions relevant and really related to **supply chain integration** among the firms, **the sustainability issues**, **the mode of relationship between the buyer and supplier (local, national and international level)** in the supply chain network and **their environmental performances**.

The author utilized the reports available at the **Questback Essentials** research domain and made empirical calculations in the **Excel** spread-sheet to come up with the results. It is mentioned secondary

here because the data analyzed were made secondarily available through Post-Doc. Malena Havenvid Ingemansson, who was directly responsible for the design of questionnaires and their handling. Also, the questionnaires among the chosen Norwegian firms don't necessarily indicate the actual figure or status of the whole Norwegian industrial sector.

The data analyzed are presented as the **Empirical analysis** in the coming chapters of this thesis work. These were further utilized to recognize the barriers, limitations and the possible opportunities for the supply chain integration in relation to the long term shared value and sustainable relationships.

1.7 Delimitations of the Methodology and Literature Review utilized

Any literature review and methodology has its delimitations as a boundary. It focuses towards particular section and may overlook other aspect beyond that boundary; reasoning might be time limit or the right of access to the literatures. In this research work, following are the listed delimitations.

1. The literatures were selected from peer-reviewed scientific journals focusing on sustainable supply chain and logistics. The articles selected are genuine, authorized and copyrights held by the author. Basically, articles were picked on the basis of relevancy and highest number of citations in the research papers.
2. The articles utilized are all printed in English; hence the papers published in foreign language still relevant to the project might have been omitted. For eg. Author's limited knowledge of Norsk limited him utilizing the papers published in Båkmol and understanding the Norwegian industrial rules and regulations.
3. Only few of the papers demanding the public purchasing were utilized. Some of them requiring direct purchase were sought out in different sources and scientific domains. It was taken in great consideration not to violate the public purchase laws and intellectual property right (copyrights, trademarks).
4. Papers focusing on pure mathematical modeling of the sustainable supply chain management were omitted. The mathematical simulations, variables and formulas for the measurement of sustainable supply chain performance were excluded.
5. The literatures were taken care not to be older than 2000 and also that they didn't relate directly to certain mode of business organizations and geographical location. For eg. Papers directly related to automotive and fashion industries, in South East Asian nation, India were not entertained.

2 Literature review

Literature review is the collection of existing texts derived from scholarly papers published by renowned researchers in the accredited scientific journals. These texts include the current understanding of the particular research to be addressed available in the scientific world, which provides substantive contribution to the theoretical and methodological areas of the specific topic.

Literature review is conducted by surveying books, scientific works, and any sources showing importance to particular area of research and by doing this, offers a description, summary and also the critical arguments of those works in adherence to the research questions being investigated.

2.1 Overview of sustainability and supply chain management

There have been a lot of ongoing debates regarding the significance and integration of the sustainability in a business organization context. It has been defined in several ways, one being “the creation of the resilient organizations through integrated economic, social and environmental systems” (Bansal, 2010). Another definition defines it as “a development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987- Brundtland mid 1990).

Previously, sustainability focused on environmental issues but, as the time went on they started adopting triple bottom line (3BL) concept, which is most helpful in understanding the concept of sustainability amid the existence of multiple comprehensions of this term. Dyllick and Hockerts, 2002 have framed the three dimensions of sustainability as the business case (economic), the natural case (environmental), and the societal case (social).

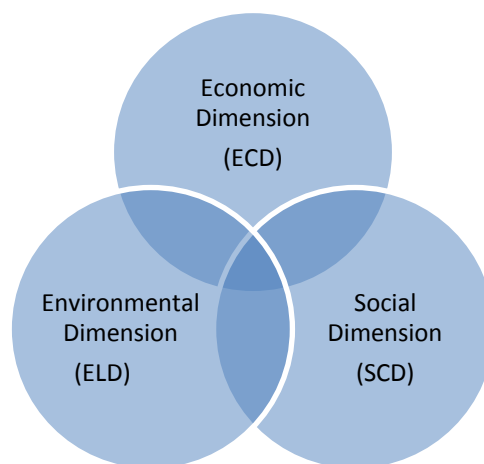


Figure 4: 3 BL concept of sustainability

(Source: Carter and Rogers, 2008, adapted from Dyllick & Hockerts)

Table 1, shows the summary of representative definition of corporate and business sustainability in different research works. The definitions are based on the scan of the journals and chiefly based on the work of Ahi and Searcy, 2013.

Definition Source	Definition
IISD, 1992, p. 11	For the business enterprise, sustainable development means adopting business strategies and activities that meet the needs of the enterprise and its stakeholders today while protecting, sustaining, and enhancing the human and natural resources that will be needed in the future.
Dyllick and Hockerts, 2002, p. 131	Corporate sustainability can accordingly be defined as meeting the needs of a firm's direct and indirect Stakeholders (such as shareholders, employees, clients, pressure groups, communities etc), without compromising its ability to meet the needs of future stakeholders as well.
Van Marrewijk, 2003, p. 102	In general, corporate sustainability and, CSR [corporate social responsibility] refer to company activities e voluntary by definition e demonstrating the inclusion of social and environmental concerns in business operations and in interactions with stakeholders. This is the broad e some would say "vague" e definition of corporate sustainability and CSR.
Caldelli and Parmigiani, 2004, p. 159	The approach to CS [corporate sustainability] implies integration of criteria of economic, social and environmental performance (referring to the triple bottom line: people, planet, profit) in company's decision-making processes. To the above aspects we add a fourth dimension, that of principles: every firm is by definition guided by a system of values, which determines its context and orientation.
Steurer et al., 2005, p. 274	While SD [sustainable development] is commonly perceived as societal guiding model, which addresses a broad range of quality of life issues in the long term, CS [corporate sustainability] is a corporate guiding model, addressing the short- and long-term economic, social and environmental performance of corporations.
Bansal, 2010, p. 1	Business sustainability n. the creation of resilient organizations through integrated economic, social and environmental systems.
Slawinski and Bansal, 2010, p. 1	We define business sustainability as the ability of firms to respond to short-term financial, social and environmental demands, without compromising their long-term financial, social and environmental performance.
Hassini et al., 2012, p. 2	We define business sustainability as the ability to conduct business with a long term goal of maintaining the well-being of the economy,

	environment and society.
--	--------------------------

Table 1. Definitions of corporate and business sustainability from different researchers

In broader and more recent sense, sustainability signifies the resiliency of the organizations over time where they are closely related to healthy environmental, economic and social systems so they are well positioned to respond to internal and external shocks. In this regards, they are increasingly paying attention towards the life cycle implications of their decisions, resulting in the more attention towards the **supply chain management** (Ahi, Searcy, 2013).

2.1.1 Characteristics of sustainability

Reviewing the definitions of sustainability and their nature of addressing by different writers in table 1, the term sustainability is seen to possess following 7 characteristics:

1. **Environmental focus**: This definition contains the language related to the environmental dimension of the sustainability. For e.g, recycle and reuse of the product, natural resource exploitation, use of water, chemical wastages disposed, life cycle impact of the products, etc.
2. **Economic focus**: The definition contains the language related to the economic dimension of the sustainability. It defines terms like shared value creation, sales return, revenues generated, etc. It may also contain monetary savings in terms of reducing transportation cost, inventory management, logistics and freight, energy consumption, etc.
3. **Social focus**: it contains terms related to the social dimension of the sustainability. It contains terms like contribution towards the society, creating employment opportunities, donations to the national and international non-governmental organizations.
4. **Stakeholders’ focus**: this definition includes the reference towards stakeholders; customers, suppliers, consumers, etc. For more broad understanding, stakeholders can be sub divided into primary and secondary stakeholders according to their direct and indirect influence in sustainability of the supply chain network. The figure below helps best to understand the various forms of stakeholders in the supply chain network.

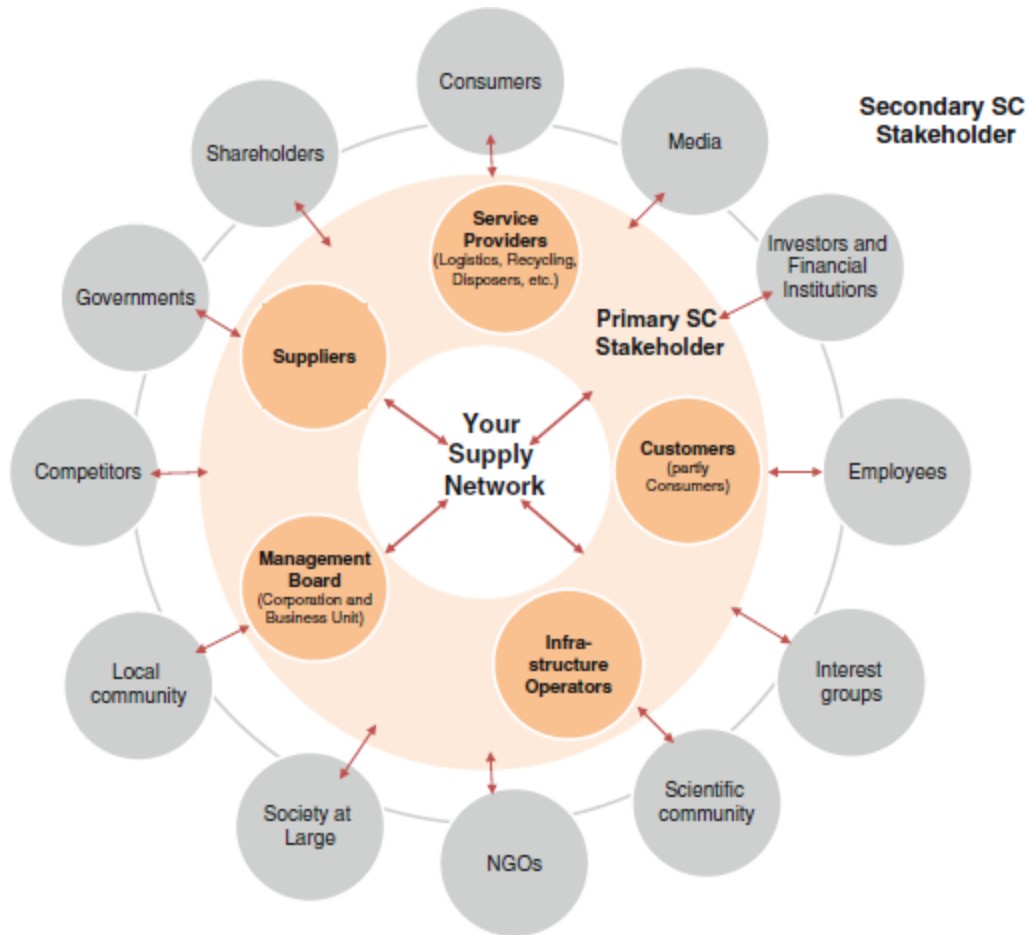


Fig 5: Primary and secondary stakeholders in the supply chain network (Cetinkaya, Cuthbertson, Tyssen, 2011, p.36)

5. **Volunteers' focus**: this definition includes reference to the voluntary nature of the business organization.
6. **Resilience focus**: this definition refers to the ability of the business organization to recover from or adjust easily to changes, disaster or misfortune (Merriam-webster dictionary).
7. **Long term focus**: it refers to the future or long-term focus of the individual firm or the collaborating firms of the business network. These might include keeping the relationship between firms intact, the mutual competitive advantages continuous, exchange of information and expertise on check as well.

(Ahi, P., Searcy, C, 2013)

2.2 Supply chain management

The term 'supply chain management' was first coined by consultants in the early 1980s (Oliver and Webber 1992) and has since gained tremendous attention (La Londe 1998). Basically, a typical supply chain (figure 4) is simply a network of materials, information and services processing links with the

characteristics of supply, transformation and demand. The term ‘supply chain management’ has been used to explain the logistics activities and the planning and control of materials and information flows internally within a company or externally between companies (Christopher1992, Cooper et al. 1997b, Fisher 1997).

The following diagram helps to clearly understand the modern concept of the supply chain management, extracted from the research work of many scholars and adopted into one.

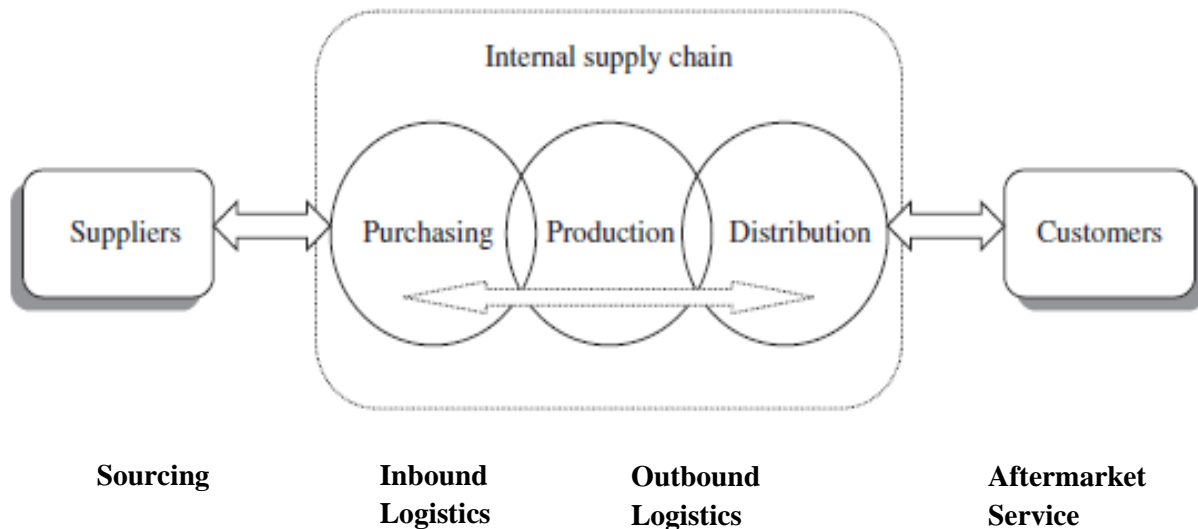


Fig 6: Basic understanding of Supply chain, adopted along with Mabert and Venktaraman

Mabert and Venktaraman, 1998, have developed supply chain model based on the flow from raw material to consumer. The figure shows the general structure of the supply chain model and a sample of elements.

- **Sourcing:** in addition to the supply of raw materials and components through a network of vendors, it also includes product development support through subassembly design and tooling production of process changes.
- **Inbound logistics:** this component focuses on effective and efficient movement and storage of required materials to meet production schedules. Utilizing the limited quantity of input materials, manufacturing should produce a high quality and price competitive product in time efficient manner.
- **Outbound logistics:** it focuses on movement of finished goods and through a well planned distribution network to global markets for consumer use.
- **Aftermarket service:** it recognizes the need to support the product either through replacing the parts of the products or customer service representatives to product-use questions.

(Mabert and Venktaraman, 1998)

As shown in the figure above, previously SCM has been used to explain the planning and control of materials, information flows and the logistics operations internally within a company and also externally between companies (Cooper et al, 1997).

In addition, researchers have also used it to describe strategies, inter-organizational issues (Cox 1997, Harland et al. 1999), to identify and describe the relationship a company develops with its suppliers (e.g. Helper 1991, Hines 1994, Narus and Anderson 1995), and to understand the purchasing and supply perspective (e.g. Morgan and Monczka 1996, Farmer 1997). The researchers have huge amount of literatures with terminology including ‘supply chains’, ‘demand pipelines’ (Farmer and Van Amstel 1991), ‘value streams’ (Womack and Jones 1994), ‘support chains’, and many others. The origins of the concept of supply chain management (SCM) are still unclear, but its development appears to start along the lines of physical distribution and transport (Croom et al. 2000), based on the theory of Industrial Dynamics, and derived from the work of Forrester (1961). This approach shows that focusing on a single element in the chain cannot assure the effectiveness of the whole system (Croom et al. 2000).

Table 2 shows a collection of different views on **sustainable supply chain management** by different scholars and researchers. These definitions are derived from the review of published articles on this topic. It is suggested to take the definition as suggestive rather than figurative, as it is presented only to give reader a general view from different perspectives by the writers.

Source of definitions	Definitions
Jorgensen and Knudsen, 2006, p. 450	The means by which companies manage their social responsibilities across dislocated production processes spanning organizational and geographical boundaries.
Carter and Rogers, 2008, p. 368	The strategic, transparent integration and achievement of an organization’s social, environmental, and economic goals in the systemic coordination of key inter-organizational business processes for improving the long-term economic performance of the individual company and its supply chains.
Seuring and Muller, 2008, p. 1700	The management of material, information and capital flows as well as cooperation among companies along the supply chain while taking goals from all three dimensions of sustainable development, i.e., economic, environmental and social, into account which are derived from customer and stakeholder requirements.
Seuring, 2008,	The integration of sustainable development and supply chain management [in which] by merging these two concepts, environmental and social aspects along the supply chain have to be taken into account, thereby avoiding related problems, but also looking at more sustainable products and processes.
Ciliberti et al., 2008, p.	The management of supply chains where all the three dimensions of

1580	sustainability, namely the economic, environmental, and social ones, are taken into account.
Font et al., 2008, p. 260	Adding sustainability to existing supply chain management processes, to consider environmental, social and economic impacts of business activities.
Pagell and Wu, 2009, p. 38	The specific managerial actions that are taken to make the supply chain more sustainable with an end goal of creating a truly sustainable chain.
Badurdeen et al., 2009, p. 57	Involvement of the planning and management of sourcing, procurement, conversion and logistics activities involved during pre-manufacturing, manufacturing, use and post-use stages in the life cycle in closed-loop through multiple life-cycles with seamless information sharing about all product life-cycle stages between companies by explicitly considering the social and environmental implications to achieve a shared vision.
Haake and Seuring, 2009, p. 285	The set of supply chain management policies held, actions taken, and relationships formed in response to concerns related to the natural environment and social issues with regard to the design, acquisition, production, distribution, use, reuse, and disposal of the firm's goods and services.
Wolf, 2011, p. 223	The degree to which a manufacturer strategically collaborates with its supply chain partners and collaboratively manages intra- and inter-organization processes for sustainability.
Closs et al., 2011, p. 102	Reflection of the firm's ability to plan for, mitigate, detect, respond to, and recover from potential global risks. Risks involving substantial marketing and supply chain considerations include product development, channel selection, market decisions, sourcing, manufacturing complexity, transportation, government and industry regulation, resource availability, talent management, alternative energy platforms, and security.
Wittstruck and Teuteberg, 2011, p. 142	An extension to the traditional concept of Supply Chain Management by adding environmental and social/ethical

Table 2: A list of different views on sustainable supply chain management

The modern definition defines SCM as “a dynamic process that includes the continuous flow of materials, funds and information across the multiple functional areas within and between supply chain members (Jain et al, 2009). The supply chain encompasses all activities associated with the flow and transformation of goods from raw materials stage (extraction), through to the end user, as well as the associated information flows. Material and information flow both up and down the supply chain. Supply chain management (SCM) is the integration of these activities through improved supply chain relationships to achieve a sustainable ‘competitive advantage’ (Seuring and Muller, 2008).

Over the time, the researchers have broadened the focus of the SCM. The most recent scholars emphasizes additional aspects, such as risk (Collichia and Strozzi, 2012), performance (Hansi et al, 2012), and integration (Fabbe-costes and Jahre, 2007). Additional emphasis have been put on the internal and external networks of relationships (Stock et al, 2010), and government of supply networks (Pilbeam et al, 2012).

2.3 Characteristics of sustainable supply chain network

The different definitions of sustainable supply chain in table 2 have different focus areas. These research papers help to characterize the supply chain management in terms of different perspectives. With the help of these literatures and some additional researches on their focus, supply chain management can be characterized in terms of following different areas:

1. **Social accountability:** It assures that the people related to the supply chain Network; producing, handling, servicing or packaging and shipping activities are treated in most humane ways possible. No forced child labor, slavery, fair wages, and safe working conditions.
2. **Climate change/Carbon and Environmental management:** One of the goals of today's smart companies is to have a good environmental performance. This creates positive impacts on companies' profits, reputation, job satisfaction for employees and also positive impact on the society as whole. This is achieved through the realization of carbon footprints of the company, and hence acts accordingly to reduce the climactic impacts on the whole business and the supply chain Network.
3. **Energy efficiency:** The main goal is to have the tasks accomplished by using as less energy as possible. In supply chain perspective, the largest savings of the energy can be achieved through targeting power systems of office buildings, warehouse, or manufacturing facilities.
4. **Waste management:** Within supply chain network, waste management involves the safe disposal of hazardous wastes, recycling and reusing, liquids, toxic chemical wastes and gaseous wastes, along with the company's unique disposal methods.
5. **Water management:** It is very important to manage water resource at stages of supply network. It is important to all ranges of companies from those related to agriculture to textiles and food or beverage industries.
6. **Air Emission:** This refers to the focus on substantially decreasing the emission of toxic and global warming gaseous wastes into the atmosphere. Gases like CO₂, SO₂, H₂S, CH₄, NO are taken as ozone layer depleting and pollution creating gases. Companies within sustainable supply network put special focus on every stages to reduce the emission rate.
7. **Chemical management:** Manufacturing firms utilize a lot of chemicals and produce considerable amount of chemical wastes too. Sustainable supply chain requires good understanding of the chemicals used in the production process and their impacts. Common chemicals of concern are drugs, dyes, solvents, pesticides, food additives, preservatives, paints etc.

8. **Raw material extraction:** The understanding of where a company's raw materials come from lies at the core of sustainable supply network. One needs to understand where they come from and how they were extracted. Each material has environmental and social impacts. For example: minerals, chemicals for plastic toys, fabrics, wood for furniture, cotton for all clothing we wear.

This also includes the focus on the packaging materials and those boxes used to ship and deliver the products, like plastic bags, corrugated boxes, shrink sleeve foils, metal cans, folding cartons, metallic wraps, etc.

9. **Transportation:** How a company transports and ships its products in the global market, from the production facilities to its final customers, is another most important aspect of the sustainable supply network (Jaffe, 2010).

2.4 Sustainability Integration in supply chain

In this paper, sustainability integration is analyzed with relation to Operations and SCM, more specifically, in the manufacturing context. The APICS (The Association for Operations Management) a major body in the areas of production, inventory, materials management, purchasing, logistics, SCM and more, provides definitions on sustainability in the light of Operations management (OM). OM contributes to good corporate practices by controlling the inputs and outputs, used in the transformation process, which helps enable sustainability as business practices. In this regard, sustainability refers to, "a corporation's processes, products, and services being aligned in a way that is socially, economically, and environmentally responsible" (APICS, 2011; APICS Operations Management Body of Knowledge Framework). APICS had dubbed this as corporate sustainability.

According to APICS, there are six major elements of sustainability implementation. They are as follows:

(a) **Process innovation** is to improve the process or develop an entirely breakthrough process to cope with the fluctuation on customers demand and sustainability.

(b) **Clean production** involves waste minimization and avoidance, if possible reusing waste products, reclaiming products at the end of its lifecycle, avoiding and reducing waste and potential pollutants, toxic and hazardous chemicals in product or service as well as transportation to market.

(c) **Closed-loop manufacturing** is a system where products are produced without harmful or waste products using renewable energy. The materials used in the production are not discarded, but re-used and re-cycled.

(d) **Reverse logistics** involves planning, implementing, and controlling the flow of relevant information, materials and products from the consumer to the producer for the purposes of recapturing value or proper disposal.

(e) **Sustainable procurement** or **green purchasing** refers to buying goods and services with less environmental than other products or services having similar performance requirements.

(f) **Life cycle management (LCM)** manages the potential impacts and environmental effects associated with a product, processes, or service, from the stage of procuring of raw materials to manufacture, transport, consumer use and disposal.

2.4.1 Triggers of sustainable supply chain

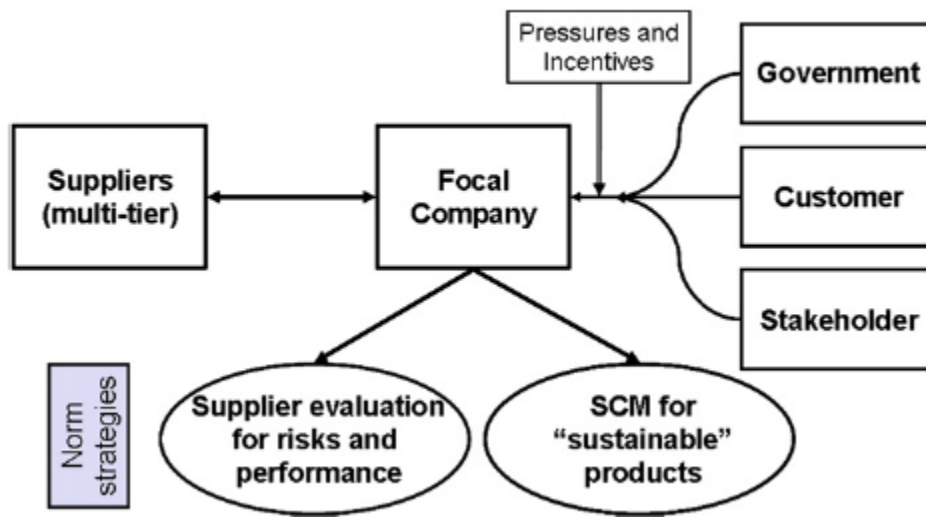


Fig 7: Triggers of Sustainable supply chain, Sources: Seuring and Muller, 2008

As an initial step, the triggers for the field and related action are identified as presented in above figure. The starting points are external pressure and incentives set by different groups. The stakeholder has wide range of descriptions, but two group; customers and government are clearly visible.

Customers are the most important because it is only the customers who after appreciating the service and products offered, justify the existence of the supply chain (Seuring and Muller, 2008). On the other hand, the legislative and administrative body, be it local, municipal, national and international government group, the come up with lot of rules and regulation, namely, carbon footprint laws, environmental protection laws, etc to be abided by the organizations while operating.

Now, to tackle these triggers companies come up with two strategies. The first one, supplier evaluation for risk and performance basically depends upon key managerial decisions. The mangers conduct the action of listing and delisting the supplier companies at different tiers, on the basis of their sustainable supply chain credibility. In addition, the action of monitoring, accessing and measurement of financial performance, cost of adopting are also accessed (Seuring and Muller, 2008).

Similarly, the second strategy generated is SCM for sustainable products which focus on producing all kinds of products that have or aim at an improved environmental and social quality, which can be related back to the already mentioned implementation of environmental and social standards. The ultimate aim is to satisfy customers and gain a competitive advantage in the market (Min Galle, 2001).

For specifying product related requirements, **life-cycle assessment** is the method to be relied on most often. Again, the focal company is in charge of addressing this and requesting it from suppliers, but joint initiatives would help to implement this product based green supply (Faruk, Lamming , Cousins PD, Bowen FE, 2002)

2.4.2 Supply chain operations Reference (SCOR) model



Figure 8: Source: Stuart, Parker, Xu (adapted from Supply chain Council, 2008)

In any supply chain, there are multiple participants and who are inter-related both in managerial and operational activities, co-related in terms flow of materials, finance, information and the product, both upstream or downstream.

SCOR model for sustainability extends from suppliers' suppliers to customers' customer along a supply chain, as shown in the above figure.

The activities that relate participants in the supply chain can be organized as **five different processes: Plan, Source, Make, Deliver and Return** (Supply chain Council, 2008). This involves the operations management fields such as procurement, inventory, production, transportation and orders.

The environmental management aspect provides different perspectives for maintaining sustainable supply. For example, evaluating carbon emissions, air pollutant emissions, solid and liquid waste generated and recycled waste in organizations are evaluated to improve environmental performance of the participants.

Sustainable *Source* processes include green purchasing, in which an organization assesses the environmental performance of their suppliers, and sets criteria for the suppliers to undertake measures to ensure environmental performance (Shi, V.G., Koh, S.C.L., Baldwin, J. and Cucchiella, F, 2012). Selecting appropriate suppliers requires manufacturers to develop green purchasing strategies that add environmental, health and safety elements to their sourcing initiatives and pursue green sourcing (Xie, Y. and Breen, L., 2012). Green purchasing involve the sourcing of environmentally friendly (decomposable materials) to help reduce the life cycle cost and provide competitive edge.

2.4.3 Framework for the sustainability adoption

Integrating sustainability in firms' supply chain brings radical changes in supplier selection and coordination, in addition to the manufacturing operations. This has to deal with implementing associated information procedure in various corporate units, and also re-adjusting the routine of the staffs. This effect leads manufacturers and managers to seek confirmation of the adopting decision from time to time. For example, if the information regarding the sustainability is not flown correctly, the conflicts arisen may lead to reversing of the adoption decision.

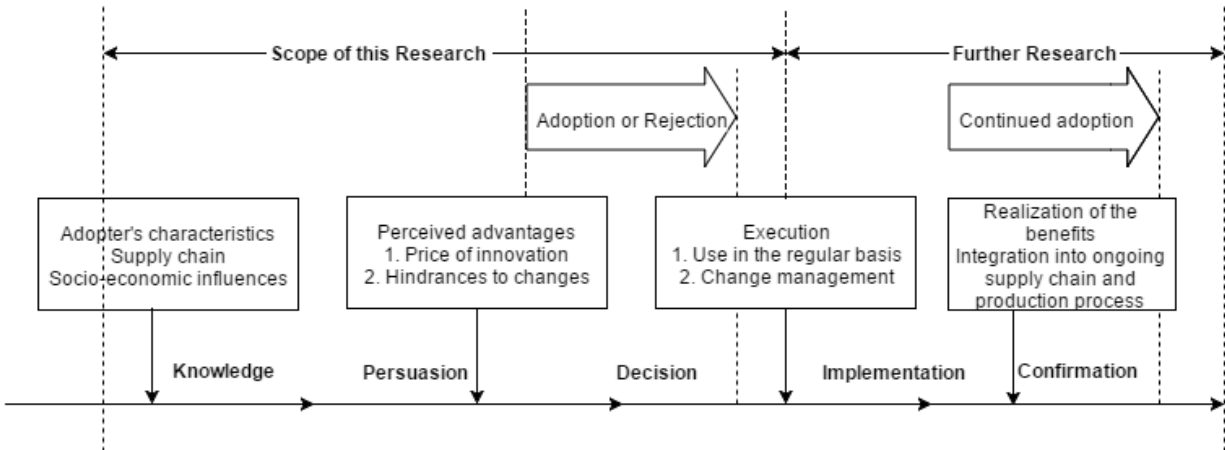


Fig 9: Framework for adopting corporate sustainability as business innovation

Thus to support managers throughout entire decision process, a framework as shown in the above figure is developed, based on the Innovation Diffusion Theory in the time dimension (E. Rogers, 2003).

To support supply chain members making appropriate decisions throughout their entire **decision process of sustainability adoption**, Rogers' Innovation-Decision Process (IDP) divides the decision process into 5 stages: (1) **knowledge**, (2) **persuasion**, (3) **decision**, (4) **implementation**, and (5) **confirmation**, through which an adopter passes from first knowledge of an innovation, to forming an attitude toward the innovation, to a decision to adopt or reject, to implementation of the new idea, and to confirmation of this decision.

SCC's SCOR model as described above in Figure 9 used in the stages 4 and 5 of the Rogers' model for making the adoption possible in the long run (SCC, 2008, "Supply Chain Operations Reference (SCOR) Model, Version 9.0," *Supply Chain Council (SCC)*, US: Supply Chain Council.)

- (1) **Knowledge** concerns the awareness and understanding the concept of existing sustainability. In this stage, the managers and manufacturer look at the burning issue and need of sustainability integration. They understand the basic concept like impacts created on environment, society and the economic situation of the surrounding.
- (2) **Persuasion** stage is related to the analyzing the perceived characteristics of sustainability and benefits that lead to the use. The managers and planners assess the benefits this innovate sustainability strategy is going to bring, in the forms of company branding, corporate social responsibility, loyal customers and recognition by the legislative bodies, in local and national level.

- (2) **Decision** stage concerns the adoption or rejection of sustainability in organization. The managerial level board analyzes the cost of implementing sustainability in the supply chain. The comparison is made in terms of the manpower, money; technology utilized, shared in terms of time dimension and checked if it caters to the benefit as discussed in earlier steps. If the benefits to achieve demand too much cost and impractical for adoption, it is dropped or made certain adjustments.
- (3) **Implementation** stage involves operational and organizational issues to be faced when putting the new idea to use. This may involve the organizational structure, hierarchy, flow of information, day to day activities of the staff members. Implementation might also involve the company's stances regarding the transparency, trust when it comes to collaborating with other organizations.
- (5) **Confirmation** Decision makers confirm the integration of sustainability after recognizing the benefits of the adoption process. As a result, sustainability is adopted as a long term commitment.

The decision processes before stage 3 is about the optimism of end-users and management regarding their expected values of sustainability and the risks of change and uncertainty caused by the adoption of this practices that lead to a decision to adopt or reject sustainability. Establishing measures that improve the perceived values, e.g. relative advantage of sustainability could help increase the rate of adoption throughout Rogers'.

2.5 Tools for sustainability Adoption

The fear of organizational change can be removed by the implementing information transparency and related ICT systems, SCOR model and life cycle management (LCA). Hence, the fear of change is removed and the reinforcement of organizational readiness to realize the benefits of implementing sustainability is restored.

2.5.1 Use of ICT

The Climate Group [9] has argued that industries can reduce the carbon markets by using modern ICTs. The group states that % of emissions can be reduced by ICT application. For example: (a) *Online media* transfers information online by eliminating all CDs and (b) *E-commerce* – contributes 3% reduction in shopping transport emission.(c) *Videoconferencing* – it is assumed that 30% of air and rail travel is business travel, and 30% of business travel can be avoided globally through videoconferencing.

2.5.2 Use of SCOR model

The implementation of sustainability with aim of offering better cost control, planning and risk management, customer service, supplier relationship management, talent acquisition, research and development, the SCOR model can be used to link performance metrics, processes, best practices, and people into a unified structure.

Deliver processes of SCOR model defines manufacturing firms and their suppliers, are responsible for much of the environmental performance. Besides, *Source* and *Make* processes that include tiers of supplier, product design, manufacturing and packaging, affect different aspects of the environment: such Greenhouse Gas (GHG) emissions and solid and liquid waste generation. The possibilities for reducing the environmental impact of various activities in a sustainable supply chain can be systematically reviewed with the SCOR model. Decreasing the emission of GHG is one of the major concerns to address when it comes to adopting sustainable supply chain system.

2.5.3 Use of Life cycle Analysis (LCA)

El-Haggar (2007) emphasized cradle-to-cradle concepts to boost the SCOR model. This concept prioritizes remanufacturing and recycling in the LCM processes to deal with end-of-life products in the supply chains, with *Source*, *Make* and *Return* processes all having a key role. The product recovery and waste reduction can be attained by using reverse logistics technique that addresses the products at end of the life cycle and returns to the supplier.

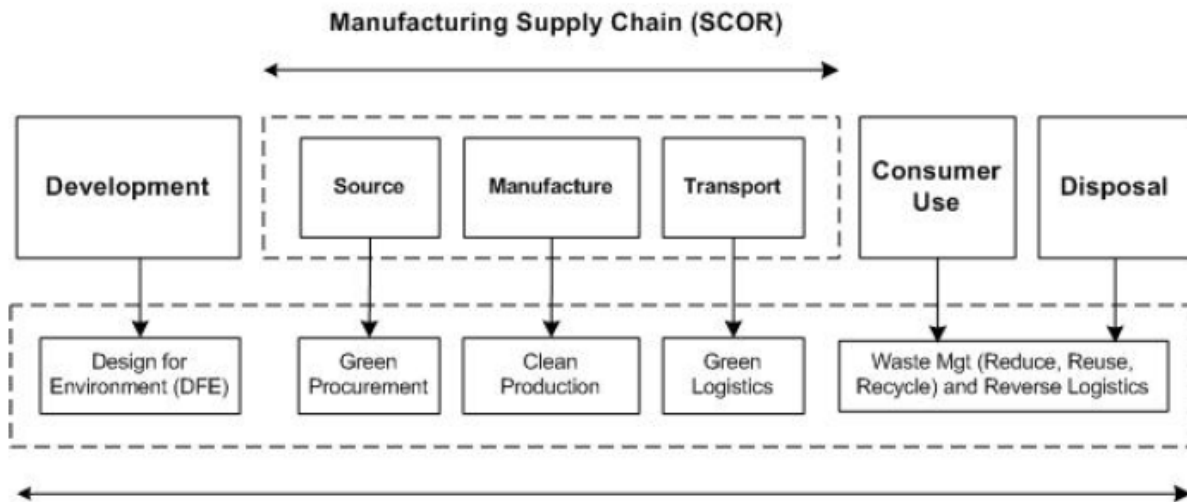


Fig 10: manufacturing supply chain (SCOR)

LCM approach process is used to reduce the costs of production and wastes in **make** process (SCOR model, Fig 8.) that involves manufacturing, product design and packaging. Among the *Make* processes, Design for Environment (DFE) is an important process of sustainable supply chains for determining a product's environmental impact at the design phase, which requires not only the availability of *green sourcing strategies*, but also the consideration of efficiency and *eco-effectiveness of the manufacturing process*.

LCA that represents a cradle-to-cradle philosophy requires not only implementing sustainability in *Source* and *Make* processes but also the *Return* processes. This forms a closed loop supply chain to retain sustainability, while on the other hand, reduces the legislative pressures on waste reduction.

Adopting sustainability in the supply chain through LCM demands firms to develop related sustainable practices that makes changes into all five primary SCM processes as shown in the figure 8 above (SCOR model, SCC, 2007), thus reducing uncertainty and the anxiety of change.

2.6 Summary of the Literature Review and Delimitations

As shown in the literature gathering section (methodology), this thesis has used vast range of paper according to the publication year. It is good to have basic understanding of the terms like logistics and supply chain, sustainability, corporate social responsibility, which have so many perceptions from different perspectives during different times. Nevertheless, these lots of variation could be confusing at times. The sustainability as a complex term, in many research articles, are defined in terms of Green supply chain management (GSCM) and Sustainable supply chain management (SSCM). Though, not very different from each other, this paper addresses sustainability on the sustainable supply chain management basis. The reason behind this could be writer's inclination towards sustainability in more broader terms (Social, Economic and Environmental) in supply, chain rather than green purchasing (supplier selection and purchasing). The availability of more articles on SSCM being another reason.

It is also noted that, although lot of paper have been reviewed for the conceptual understanding and the coining of the supply chain and sustainability terms, the framework and sustainability integration process have been chiefly referred from recent research works (For ex. Seuring and Muller, 2008; Parker, Xu and Young, 2008) and even more recent characteristics and focus of sustainability and sustainable chain (Slawanski and Bansal, 2010 ; Wolf, Closs, Wittstruck and Teuteberg, 2011, Pilbeam, 2012; Hassini, 2012; Ahi, Searcy, 2013).

Still, the author has noted considerable delimitation to these available literatures. Most of these literatures which are based on quantitative research were based on larger firms like IKEA, for example, and those which are purely qualitative are researched derived by analysis of the available literature which are already insufficient to address current supply chain trends. The fact that this research thesis is based on small and medium enterprises (Norwegian) might make some of the consideration in literature even more irrelevant.

Another thing to be noted is, the author couldn't find much works done previously in this regard in Norwegian industrial context, and even those found couldn't be made use because of his limited knowledge of Norwegian language. Thus, much literatures regarding the specific Norwegian supply chain, suppliers and consumers, supply chain process, seems to be missing in the literature. It makes it difficult to have perfect image of what the Norwegian firms prioritize when it comes to sustainable and resilient supply chain and shared value .Of course, it is widely known they have been very cautious regarding the environmental dimensions, but the social and economic stances, the stakeholder relationships have been difficult to figure out.

Additionally, no matter how latest the articles were utilized, the newer tools like use of ICT, LCA have insufficiently discussed (being still a new idea) and the framework for the sustainability integration to be insufficient as well. To tackle this, the author comes up with more feasible framework relevant in Norwegian SME context, in the coming chapter, following the discussion of Empirical calculations.

3 Empirical calculations

Many a times, a research work might involve the collection of numerical data. These data either derived from the experiments in lab, computer simulation, survey or social experiments (questionnaires) are categorized into different parameters and analyzed for comparison. Sometimes they are compared and contrasted with a known set of standard values. This process is called empirical calculation.

As a response to the **Research Question 2**, the author, in this chapter compiles a set of data available from the **Questback Essential Database** and group them into specific conditions related to Social, Economic and environmental dimensions of sustainability. They are also sub grouped into conditions like level of employment generated, pollution, use of energy and natural resources like water, contribution to the society, transportation cost and so on.

In the latter part, calculations are also made for the data related for the hindrances or the factors acting as barrier to the sustainability integration among the Norwegian supply chain. Specifically, the extent of how the barriers like government legislation, standards, cost of implementation, distrust, etc put influence while making the sustainability adoption difficult.

3.1 Data collection:

The author utilized the secondary data out of survey questionnaires made available through **SISVI** Project. A list of questionnaires (26 questions and some sub-questions) were designed and dispatched to some 21 participating firms via **Questback Essentials** domain. The questionnaires were based mainly on their mutual cooperating relationship, trust and transparency, sustainability performances based on economy, society and environment, international purchasing, hindrances and so on. The whole questionnaire is attached in the end as appendix for clearer idea.

The participating firms comprised of organizations related to maritime, aquaculture (fishing), oil and gas/offshore, furniture and some others too. Diagram below shows the exact image of the participating firms.

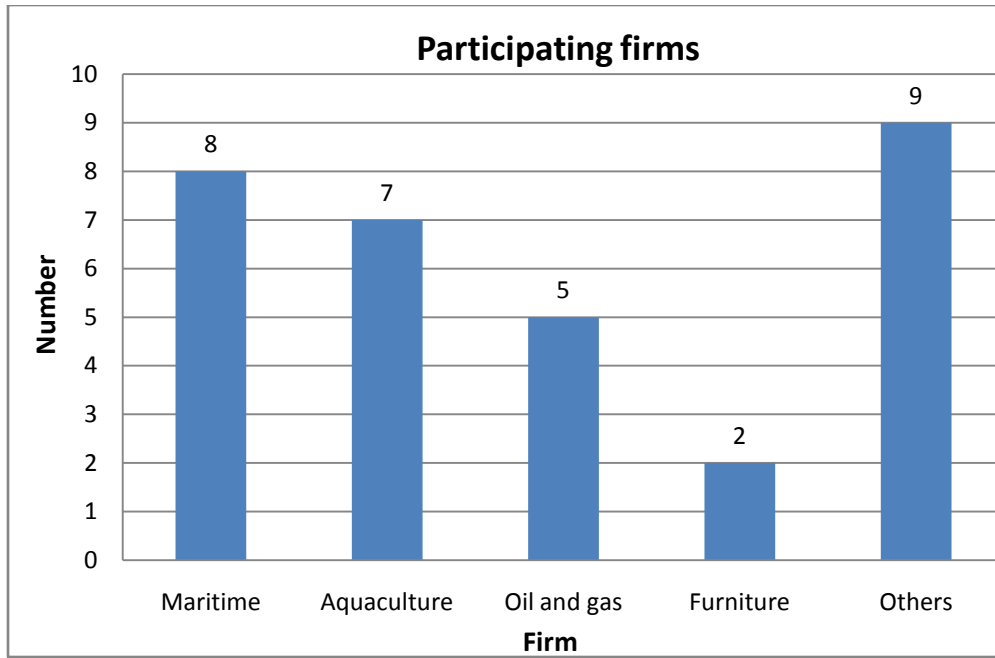


Table 3: Firms participating in the survey questionnaires

3.1.1 Norwegian firms' stance regarding the sustainability in their supply chain

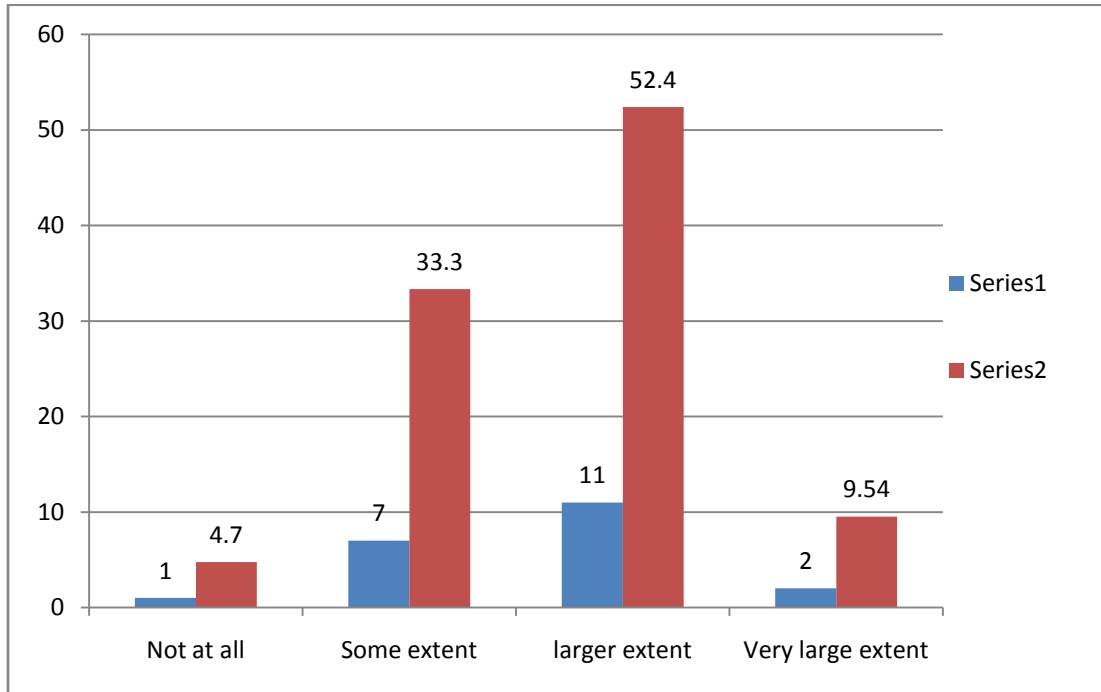


Table 4: Norwegian SME's stance towards sustainability

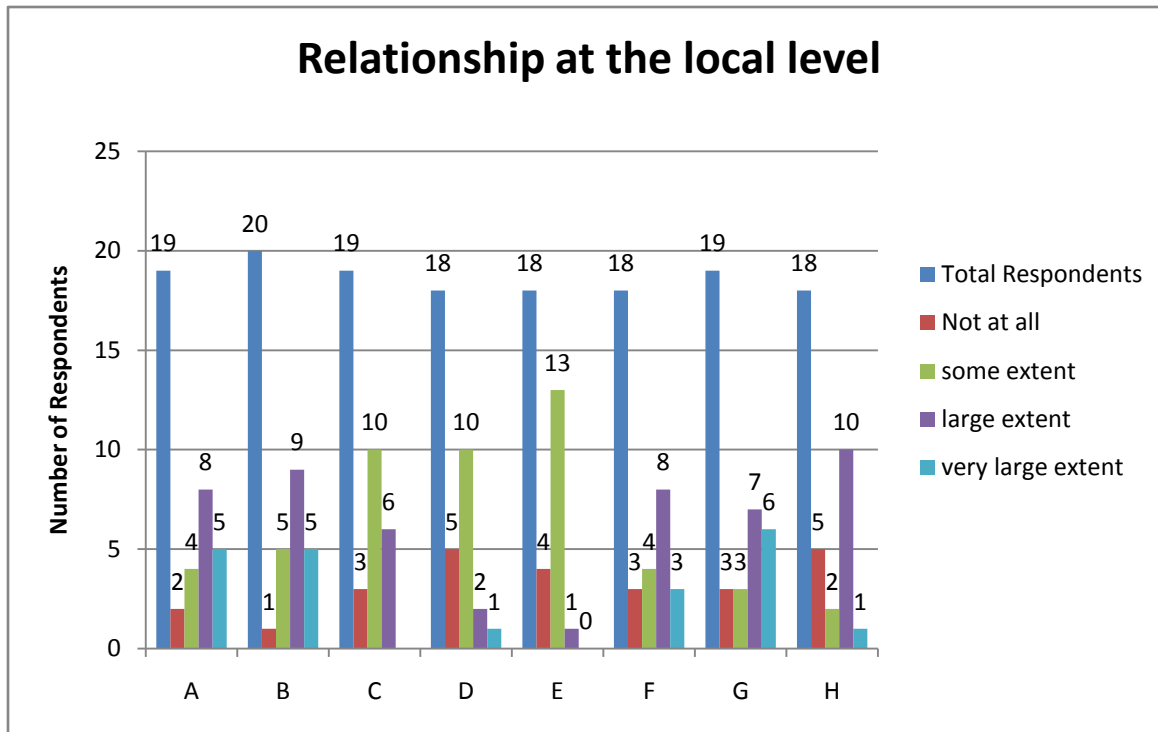
As shown in the table above (blue showing the no. of firms and maroon showing percentage), it is clearly seen that 60% or more have taken sustainability seriously as one of the factor that determine the performance measurement. Fifty two percentages of the firms (11 out of 21) shows large extent of inclination towards sustainability integration whereas, almost ten percentages of the firms participating shows very strong likening towards the concept of sustainable supply chain.

3.1.2 Relationship among the collaborating firms

3.1.2.1 Relationship at the local level

When asked about the collaboration with their collaborating partners in supply chains, they came with the following response towards different modes of relationship they are experiencing.

The diagram below shows the kind of relationship collaborating firms are practicing among them, in their supply chain collaboration and sharing technical and social adaptations. The figure also shows the partnering firms' stances regarding different modes of relationships, to what extent they think is affecting their organizational structure.



- A. Relationships that are based on trust
- B. Trust based relationships also based on formal contracts
- C. Relationships based solely on Formal contracts
- D. Short-Term exchange of goods and information without modifications
- E. Short-term relationships with some minor social adaptations
- F. Short and long-term relationships where it made technical adjustments
- G. close cooperative relationships with social and technical adaptations in the long term
- H. Close cooperative relations, also in the long term, where we go into more business partners in the social and technical adaptations

Table 5: Relationship with partnering firms' at the local level

The dark blue bars show the total number of responding firms to each of the relationship type denoted by the legends A-H. It is seen from the above diagram that different modes of relationship have different extent of effect among the collaborating firms. It is seen that, relationship that is based on trust and contracts (legend A and B) and Close relationships with technical and social adaptations (Legend G), have been mostly effective relationship (13 out of 19, i.e 78%) mode among the collaborating firms.

Additionally, the Trust based relationship also based on formal contract (Legend B in above bar diagram) where 14 out of 20 (70%) has been another major kind of relationship as shown by the responding companies.

3.1.2.2 Relationship at the National level

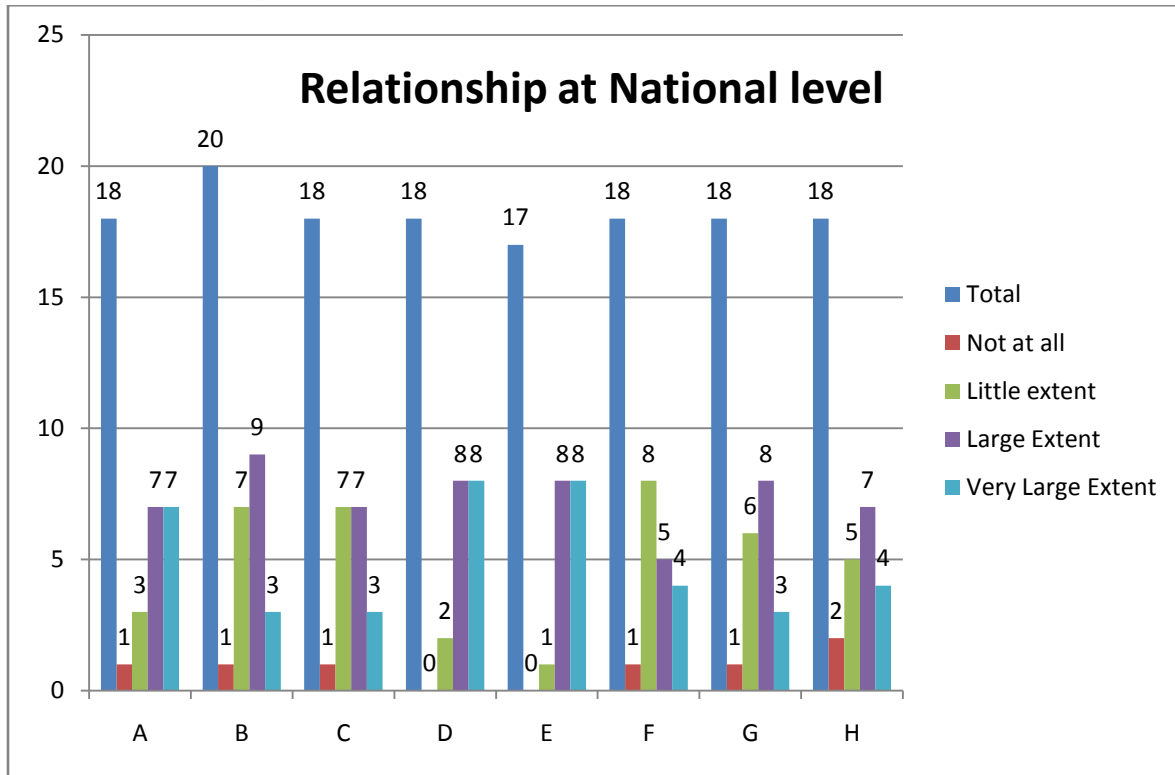


Table 6: Relationship at the National level

In the survey, 16 out of 17 participating firms (more than 90% Legend E) stated they were inclined to short term relationship regarding the exchange of goods and information with slight modification. Similarly, 14 out of total 18 respondents (Legend A) voted for relationship based on trust played major role while collaborating.

3.1.2.3 Relationship at international level

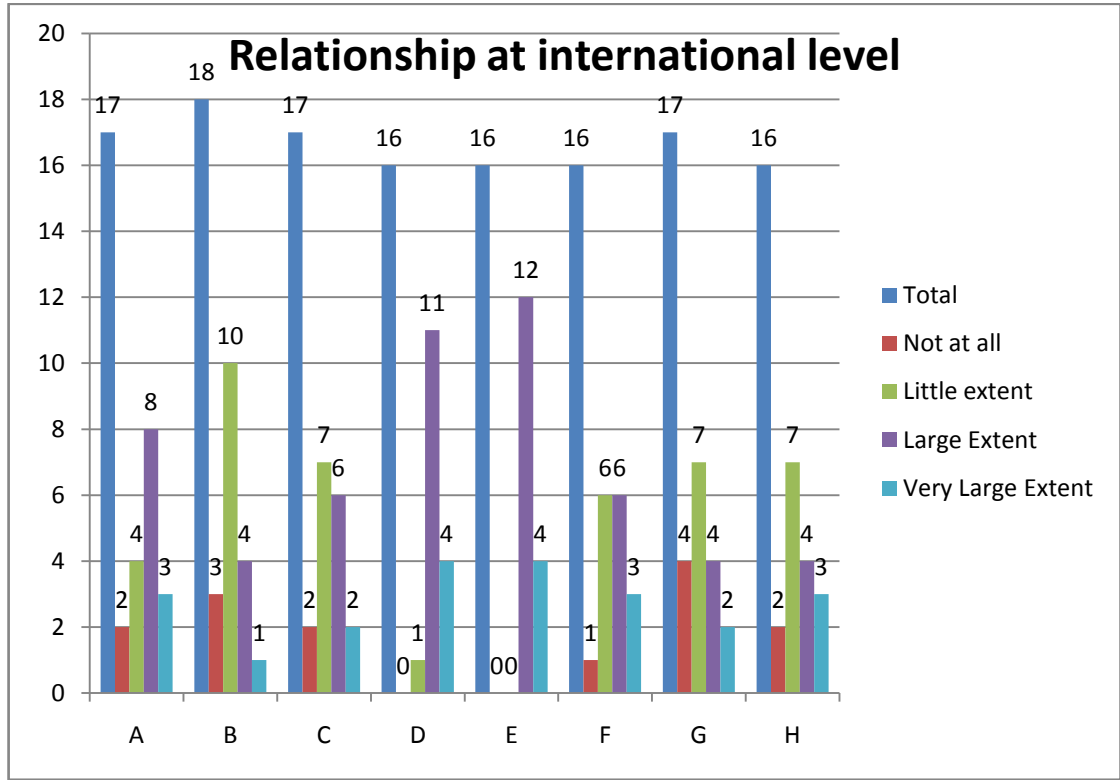


Table 7: Relationship at the International level

The participating firms show more or less the same identical behavior as in National level, when it comes to its relationship with international collaborators. In Legend E, i.e. refers to short term relationship with slight modifications, 16 out of 16 participants show great extent of response towards this.

3.1.3 Collaboration with the buyers

From the survey, it is clearly seen that participating firms are really open regarding collaborating with other firms for mutual benefits. Out of 21 responding firms, 15 (86%) have noted larger extent of collaborating activities, as shown in the graph below.

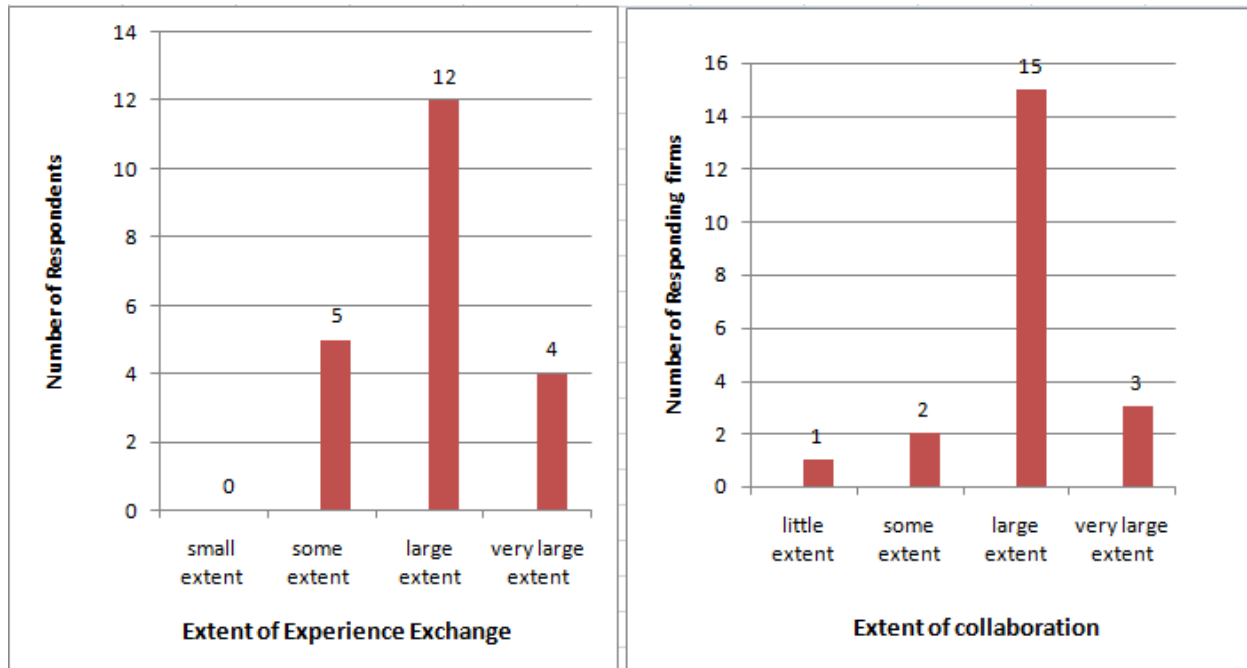


Table 8: Collaboration with the buyers and experience exchange

The firms collaborate in different modes like sharing the information, exchanging the experiences, technology, manpower and common investment in research and development if possible. The second graph above shows the level of experiences exchange among the collaborating firms and as seen above, is very positive, as 16 out of 21 responding firms (76%) show larger extent of experiences exchange among the partnering companies.

3.1.4 Social performances:

3.1.4.1 Procurement social requirement

The social requirement for procurement has been followed in less extent. Out of 19 respondents, 11 said they followed the social criteria for the procurement. This means half more than 50% said they had slight consideration for social criteria for the buying and selling with the suppliers. Only 30-35% showed the larger extent when of consideration towards social criteria before undertaking procurement works.

3.1.4.2 Donating to charities

The response to the questionnaire related to the participating firms' stance towards charities show very positive performance in this regard. Almost 75 % of the companies are donating charities to national and international non-governmental organizations in some extent, where 30 % even claiming to have donated at larger extent. Nevertheless, 25 % show disinclination towards donating to charities in any form.

3.1.4.3 Contribution towards local community, sports, etc

Out of 20 participating firms, 4 noted that they had at least some level of contribution towards local community in terms of sports and other local activities. Most notably, 8 firms responded with contribution in bigger extent and another 8 noting contribution in very big extent.

This means 80% of the companies showed they had bigger contribution towards society and 20% showing at least some level of societal performance in terms of sustainability. In short, all the firms participating are positive towards social impacts in terms of sustainability

3.1.4.4 Sales commitment towards conscious consumers

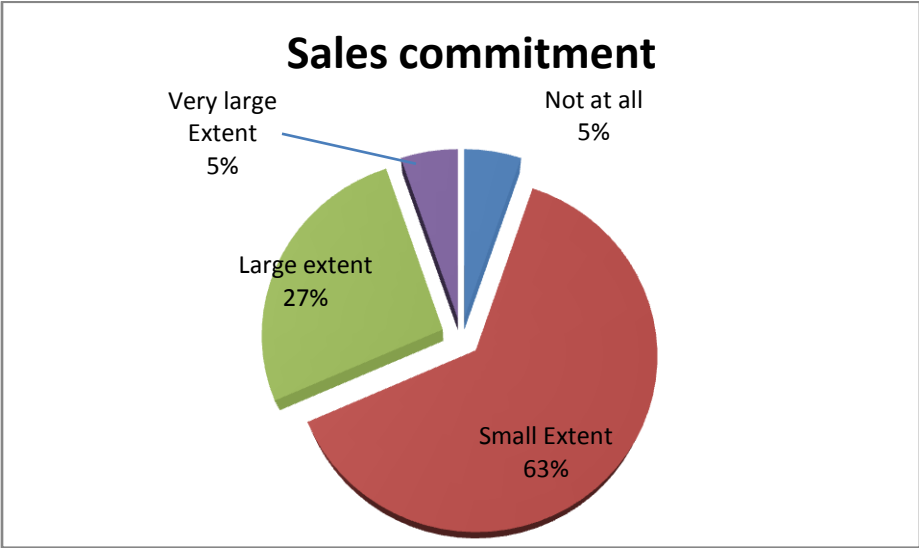


Chart 1: Sales commitment towards the conscious consumers

Only 5% companies are not committed towards the conscious consumer at all. This means that 95 % of the company are committed towards the conscious consumers and pay heed to the actual demand and criteria set by them, nevertheless, the extent to which they are committed is very poor. The graph above shows 30-32 % of companies are really committed in large extent but those who are weakly concerned stand out at more than 60%.

3.1.5 Economic performance

3.1.5.1 Recruitment from society:

From the survey questionnaires, it is seen that more than 50 % of the participating companies focus on recruiting from the community. Hence, the sustainability in terms of economic aspects among Norwegian firm is motivating. Out of 20 companies, 12 responded that more than 50 percent of the recruitment came from the local community. Whereas, 8 companies registered even more than 60 % employees were from the local community.

3.1.6 Environmental performances

3.1.6.1 Focus on clean transportation

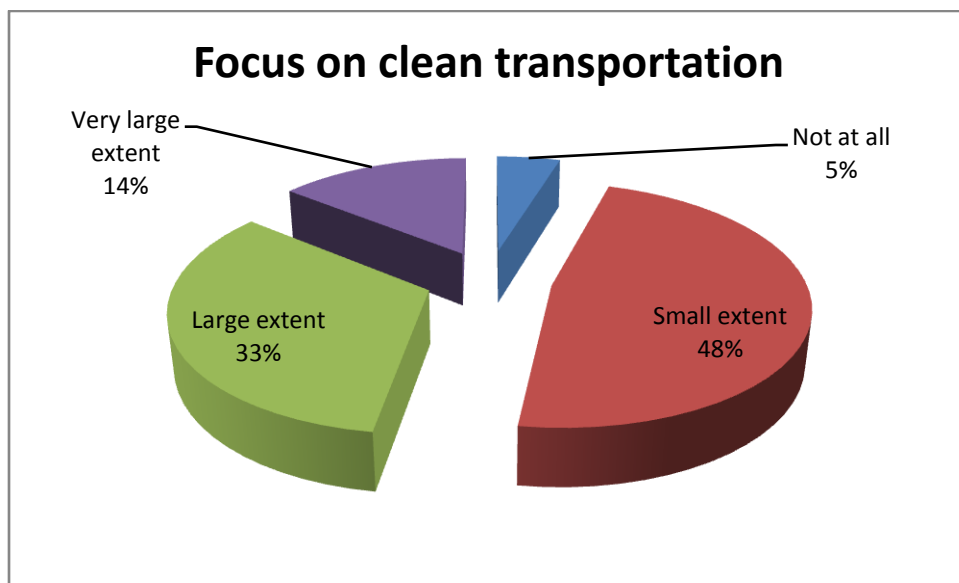


Chart 2: Focus on cleaner Transportation

More than 50 % of the participating firms in questionnaires have responded with positive stances towards focusing on Clean Transportation. Also, it is seen, from the chart above that only 5% of companies are less active towards acting on fuel saving and pollutants emitted.

3.1.6.2 Reusing of the materials

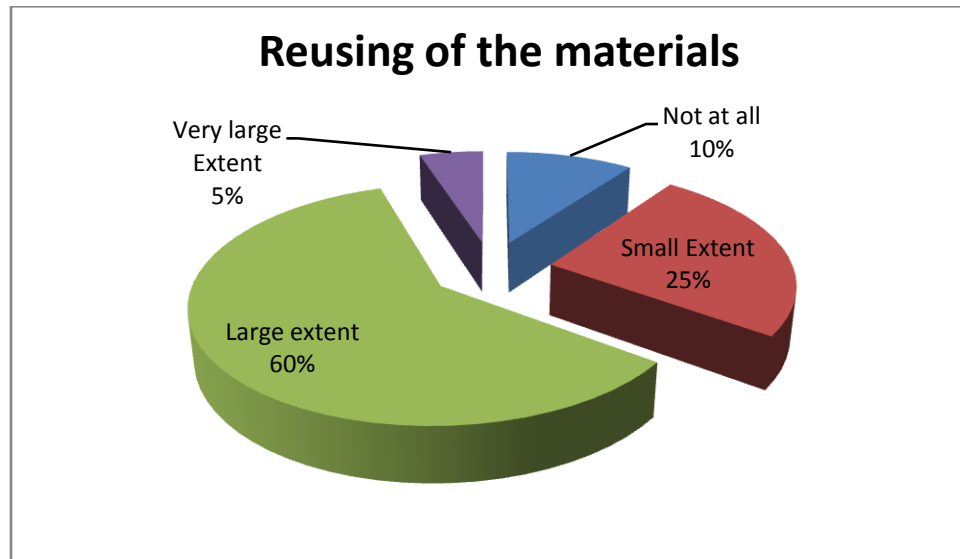


Chart 3: Reuse of the materials

The survey questionnaires prove that Norwegian firms are very conscious towards reusing of materials. As shown by the above pie chart made from survey data, more than 65 % of the responding firms are actively utilizing reusing of materials. In this way, large quantity of wastes is minimized and energy saved.

3.1.6.3 Procurement setting environmental criteria

In the survey of 20 responding firms, it is seen that 7 firms (35%) have greater extent of procurement through the set environmental criteria. This is a really good thing to observe as 6 other firms show at least some extent of following the environmental criteria, making 65 % inclination towards the environmentally friendly procurement. On the other hand 7 don't have any measures towards environmental criteria. This doesn't seem really optimistic because 35 % showing indifference towards the environmentally friendly procurement is a huge number to increase for betterment.

3.1.6.4 Through certification

7 out of the total 20 participating firms have no adherence towards the certification. This means 35 % really have no consideration towards certifications like ISO 9001/ 14001 and 30 % of the companies have really less extent of environmental performance based on those international standards. 35% of the remaining has only noted the larger extent of the influence by the certifications systems.

3.1.6.5 Research and development

The participating firms, about more than half showed inclination towards Researching and developing the sustainable solutions. The survey further show that 35 % of total firms responding, have at least some extend positive on spending on Research and Development activities that would assist the sustainability integration in the firm's value chain or within the company.

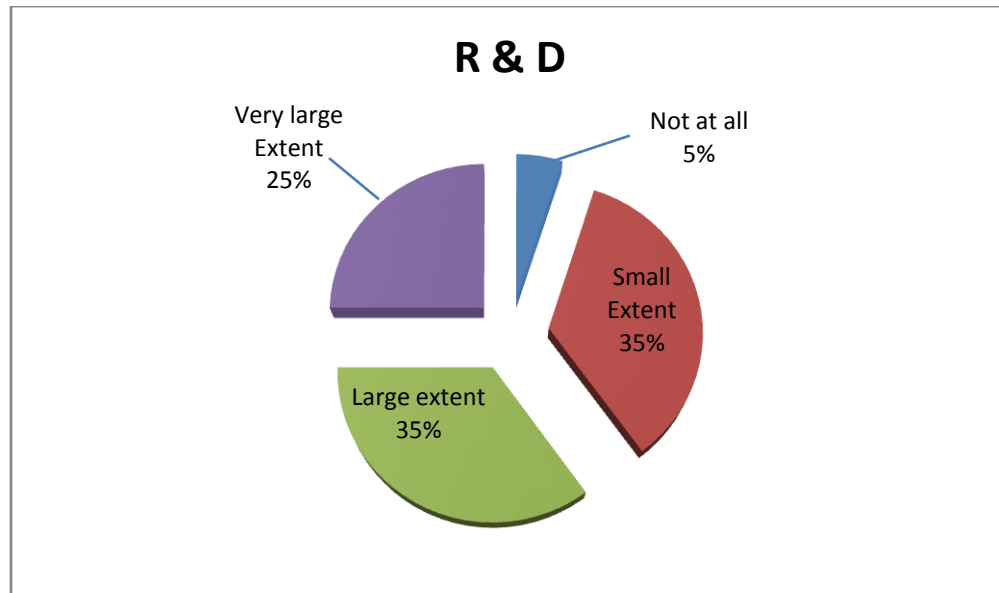


Chart 4: Stance towards Research and Development

These data as collected and analyzed, along with the discussion in the upcoming chapter will lead to answer the **research question 2** of this thesis, that is, what exactly is the level of sustainability understanding and integration in the supply chain network of the Norwegian firms.

Additionally, it will also help to point out the key barriers of the sustainability integration; cost, lack of conceptual understanding, legislation, organizational structure and so on. This calculation will show the image of the extent to which these barriers are playing role in hindering the sustainability adoption process, and may help into formulating new framework feasible for Norwegian context.

3.2 Barriers

As discussed in the introduction chapter of this research work, it has been clear that no matter how much research and experiments have been conducted adding to the understanding of the sustainability and emphasizing its importance in the competitive business environment, it is not easy to adopt the sustainability practices in a go. This adoption process comes with the cost and effort and sometimes, the level of hindrances become so influential that it puts the whole organizational values and structure at stake (Parker and Su, 2011).

To fulfill the aim of **3rd Research Question**, which is to find and discuss key hurdles of Sustainability adoption in Norwegian supply chain, this portion of the thesis has been formulated. A list of factors are

analyzed and the corresponding data from the Questback Essential have been calculated to come up with the understandable figure.

3.2.1.1 Cost in value chain

60% of the companies say the cost of implementing sustainability in the value chain has been the barrier to some extent, whereas 25% even claim that it has been hindrances in large extent. Only 15% of the companies say it has been no barrier at all. As a summary, we can understand that cost hinders sustainability integration in the value chain of more than 80 % of the companies.

3.2.1.2 Cost within the company

From the analysis of questionnaires, within companies, 25 % of participating companies has no problem with the cost, whereas 75% companies have trouble handling costs when it comes to implementing sustainability within the company.

3.2.1.3 Difficult to measure

Almost half (50%) states difficulty to measure the sustainability has been one of the key barriers to sustainability adoption.

Half companies even state that Norwegian standards do not focus on sustainability. 50% of the companies lack knowledge regarding the sustainability. Thus it has been one of the major hindrances for sustainability adoption and this fact can be used as basis to refute the claim made earlier that Norwegian and international standards do not focus on sustainability. They seem to lack understanding of the national and international standards regarding the sustainability.

3.2.1.4 Lack of sustainability understanding and no specific strategy:

More than 60% of the companies have common view that lack of understanding regarding the sustainability is hindering the adoption of sustainability in some extent. Also, half the participants (50%) state that lacking specific strategy regarding sustainability plays at least some role in hindering the integration process.

Similarly, almost same proportion (50%) of the participants conjure that lacking information regarding the customer's business is responsible for some extent of hindrances whereas 5% noting that this ignorance is playing role in greater extent.

3.2.1.5 Government rules and regulation for the procurement

Participants' response towards the questionnaires in the survey indicates that government rules and regulation is one of the key barricades when it comes to the sustainability integration in the companies' supply chain practices. It is noted that only 35 % has experienced no trouble with the rules and regulations set by the government and local authority body. Thus, 65% of the companies have suffered at least in some way while implementing the sustainability, with 30% even stating the extent to be bigger.

4 Discussions of the Empirical Calculation

In this chapter, the author tries to discuss the results as observed in the survey questionnaires. This chapter is used to explain what exactly the data collected from the response of the participating firms mean, what is the exact image of sustainability integration among the Norwegian firms, though in rough scale, as this less number of participating companies can't be accredited for representing the overall image of sustainability in Norway.

As per the Empirical calculation chapter above, it is clear that the industries that heavily participated in the survey were **Marine, Aquaculture, Furniture, oil and gas** including some others. Fifty two percentages of the firms (11 out of 21) shows large extent of inclination towards sustainability integration whereas, almost ten percentages of the firms participating showed even very large extent of inclination towards the sustainable supply chain integration in their value chain. Thus, it is clear that half the participating firms consider very seriously the sustainable supply chain integration in their value chain and take sustainability as one of the major factor that determines the performance measurement. Overall, 60 % of these firms have noted at least some level of understanding and implementing this revolutionary concept. This means 40% of the participating companies are yet to have the understanding, realization and implementation of the sustainability concept.

Although, the above number might appear satisfactory, it definitely isn't the perfect result that is expected in the present scenario. The remaining industries that are yet to fulfill the sustainability criteria have certain barriers and limitations that act as hindrances to them. This chapter will be used to discuss those problems as well. Subsequently, the recommendations and solution shall be offered in the chapter that follows this part.

From the survey, it is seen that the companies at the **local level** seem more attracted towards trust based relationship. Some of the participating companies even have reiterated the need of signing contract based relationship; nevertheless, a vast majority of companies are still reluctant to practice the signing of contract in trust based relationship. The author personally deems it significant to improve as the relationship based solely on trust might not guarantee the mutually beneficial collaboration in the long term. The exchange of information and expertise, money and technology might not be guaranteed just by formal agreement. Only the written contracts can guarantee the ground for the possible longer period of agreement, as any breach within the period by either of the collaborating firms will drag them in the legal proceedings, not beneficial for either of the parties. In the same way, the written contracts can also provide for the special modification and arrange with the advent of the time. Thus, it is really necessary to for the firms to introduce the formal signing of the contracts for the mutual collaboration.

At the national level, the companies still show tendency towards the trust based relationship but when it comes to international level, it transforms into short term relationship for technical and informational exchange.

4.1 Discussing the sustainability performance

On the performance level based on 3 BL concept of sustainability, the firms were evaluated accordingly to social performance, Environmental performance and Economic performance. In social performances, the questionnaire were prepared based on the companies' situation regarding the social procurement requirement, donation to charities; national and international, contribution towards local community, sports, etc, sales commitment to the conscious consumers and so on.

4.1.1 Social performance

The participating companies were found to be very open and promising regarding the contribution towards the society and donation to the national and international non-governmental organizations. As suggested in the empirical calculation section, about 75-80 % of the companies were found involved in the contribution to the communal sports and recreational activities and three-fourth of the them were found to be donating to the charities. Nevertheless, the percentage of not involved represents large number and need to work on those seriously. A lot remain to be done by those companies if they are to develop a positive social image, garner more consumers and increase market share in the long term.

Regarding the commitment towards the conscious consumers, the social performance has been really poor among the participating companies. It is seen that only 27-32% companies are more likely to appreciate the feedbacks and demands of the conscious consumer and integrate them in the service dispatching. Although, the questionnaire results showed only 5% companies to be totally indifferent towards the commitment, the commitment level shown by other 95% is really less. This means, those who are committed are also not very serious and perfectly considering the inputs from the consumers.

Similar is the case when it comes to companies setting and following the set social criteria before procurement. Although third fourth of the total firms said they had some social criteria set to be followed before the act of buying or selling was conducted, the extent to which they really do care is very minimal. Half of those abiding the social requirements have acknowledged to be doing in slight level. This number certainly needs to increase to improve the overall scenario of the sustainability.

4.1.2 Economical performance:

As per the empirical calculations, almost every company showed the recruitment of employees from the local community. It was seen 60% of the participating companies recruited more than half of their employees were from the local community. 40% companies showed even more positive results, as they noted more than 60 % of their employees from the local community.

Besides these, the questionnaire faced some serious limitations as there weren't many questionnaires regarding the economic performance. In compared to social and Environmental performances' 5 or 6 questions, economic aspects have only one.

4.1.3 Environmental performance:

A considerable number of questionnaires' regarding the environmental aspects was also asked to the participating companies.

From the data collected in the survey, it is seen that the responding companies have positive understanding of the sustainability when it comes to the role of the **transportations** they are using. 50% of all the companies that responded noted they were using the clean mode of transportation. Although, only 5% showed no inclination towards using any mode of clean transportation, it is not very encouraging as those remaining 95% who have utilized cleaner transportation, are doing that in lesser extent. Only the halves of those are using sustainable transportation in larger extent. Thus, the suggestion here is, although vast numbers of the companies are acquainted with the benefit and utilization of cleaner transportation, the extent of using should be upped.

In the reusing of material, the situation is even better. Except 10% of the companies who are passive regarding the reuse of the material, rest all are focused towards reusing of the material. The best thing is 65 % or more have shown really larger extent when it comes to reusing the material. This subsequently saves quite a good amount of solid and liquid wastes and hence offering good environmental performance.

To attain better scenario, the 25 % of the companies who noted smaller extent of reusing of the materials, need to increase the activity, investment and energy towards reusing.

The survey results showed that 65 % of the companies are following set environmental criteria for the procurement from their suppliers, in at least some extent. The good thing about these criteria is, it starts the sustainability right from the production plants of the suppliers. This thing makes sure the supplying companies are made well aware about the environmental performances, that they have no harsh impacts environmentally. This finally adds to the parent company's image in the sustainability market and earning loyal conscious consumers.

The result here doesn't seem really optimistic because 35 % showing indifference towards the environmentally friendly procurement is a huge number to increase for betterment. Companies who show larger extent are at 35%. If we could increase this percentage and also that of non-integrating companies (35%), then the sustainability in environmental aspect can achieve a huge boost.

In terms of Research and Developments regarding sustainable activities and integration, only the half of the participants seems investing and pouring necessary energies. Even those who are investing for these are doing in really lesser extent, not encouraging at all. This means, half of the companies are yet to spend time, money and labor on understanding, studying and working on sustainably innovative ideas. This is a demerit in itself because we know more the funds and provision for the research and development more will be the innovative and revolutionary ideas generated. This is seriously lacking now and needs to be checked.

The influence made by the international standards like ISO 9001/14001 seems really poor. The empirical data showed 35 % of the participating companies have no provision for them at all. They don't follow such standards at any extent. Similarly those who did follow, 30% said they did in only very petty extent. This is discouraging as well. The 35% saying larger extent of influence by the international standards and certifications should be increased. Increase in the following of the international standards means increase

in the steps towards numerous additional environmental criteria accepted globally, which in turn will be better for spreading better sustainable image of the company.

It is seen that the survey seriously lacks questionnaires regarding the LCA tool used by the responding firms. As we have seen in the literature section, LCA is one of the most innovative and significant tool in sustainability integration. The data related to the responding firms and companies would have displayed different image of the sustainability integration among them here. The author seriously thinks that the LCA questionnaire would have been must here.

4.2 Discussing the Barriers

From the survey, a number of reasons were found out, responsible for the implementing and sustainability integration within the companies' supply chain practices and operation. Among them, cost of implementing was one of the key reasons as it holds back 70% of the companies to put it into action. The cost here involves both the cost in the value chain and the cost within the company.

Lack of proper understanding of the sustainability concept seems another major reason acting as hindrance. 60% of the firms seem to be clearly lacking the good understanding of this concept.

Another key issue seems to be with the government legislation and regulation set for the procurement. The survey has shown that only 35% of the total responding companies have no trouble with the set laws and regulation, whereas more than 30% are likely to suffer in large excel. It seems the government seems to reconsider the rules and regulation at both local and central level to provide the companies necessary leverage to implement sustainability, in terms of cost, mobility, hiring and sourcing, availability of the areas to operate and so on.

Additionally, difficulty in measuring the sustainability performance is responsible for the hindrances in 50% of the responding companies. This difficulty makes the companies unable to know the exact performance level, risk level, actual output of the investment, customer satisfaction level, etc. The monitoring becomes vague resulting in inability to know the exact loophole to be fixed. Thus, the sustainability integration can be increased if the measuring can be made more easy, reliable and precise.

On the other hand, it is seen that the barrier factors been analyzed are considerably less (only 5 factor analyzed), it can certainly have been more. This is due to the reason that the questionnaires in the survey have been deficient. The author has noted that although the factors like **Trust among the partner firms, their stance towards short term or long term technological and information exchange** have been slightly, they haven't been analyzed in regards to what degree of hindering role they are playing. The poor performance in international business network and procurement seems unexplained.

The barrier factors analyzed here chiefly refer to the producing firms' position. In fact, the barrier to the whole supply chain can result from different stakeholders too; **suppliers' problems, consumers' failure to appreciate the sustainability, shareholders' hesitation, cost in the shipping, rules and regulation in supplying firms' country** and so on. These factors need to be effectively included in the questionnaire and analyzed for the better understanding of the overall adoption of sustainability in the supply chain

network. These factors could lead to additional information and hence point to undiscovered loopholes in the whole supply chain system to be corrected.

5 Conclusions

This research work was written in the partial fulfillment of the master's degree thesis to be offered by Department of Industrial Economics and Technology Management, NTNU. As discussed in more detail in the initial part of this work, it has been based on the 3rd and 4th work-package of the SISVI project. The thesis was formulated into three research questions and addressed subsequently by the chapters; Literature Review, Empirical Calculations and Discussion.

The **first chapter (Literature Review)** was utilized to seek the answer to first research question which required the understanding of the basic concept and present trend of the Sustainability and Supply chain Management system in the world. Looking into the available research works in renowned journals (Scienedirect, Elsevier, Journal of Logistics and supply chain, etc) contributed in understanding the essence of sustainability in Economic, social and Environmental dimension hence justifying the fact that Sustainability really has been the innovative tool to gain competitive advantages in long term.

Analyzing the literatures also led to the conclusion that Sustainable supply chain management system has broadened its focus from earlier Green supply chain management (GSCM) which focused more in Environmental criteria, to social, economical, shareholder's focus and resilience of the organization in case of global economic and financial turbulence. It has further justified the firm belief that achieving long term competitive advantages through sustainability and green supply chain systems can no longer be achieved through independent companies but in cluster and collaboration with other companies (Håkansson and Snehota, 2006).

Since the SSCM has become more upgraded version of the GSCM, it was rightful decision to use 3BL concept of sustainability as the backbone of the literature and basic the research around this topics. Keeping this fact in mind, the relevant questions adjusted to the requirement were formulated in the survey- questionnaires.

The sustainability integration and adoption framework of the research was based on the work of Rogers, 2003; SCOR model (Stuart, Parker and Xu, 2008); Seuring and Muller, 2008 with the reasoning that they were the more upgraded modern model.

On the other hand, we still faced limitations in literary review (explained in more detail in section 2.4). The major shortcomings are; although sustainability has been upgraded and made expanded into broader term, most of the analyzed literatures still has environmental dimension as the domination factor. The available literature are lacking focus especially towards the social requirements of the suppliers, strict laws regarding the following of international standards and laws and set criteria for minimum employment generation. Besides, the papers fail in recommending the actual measures to tackle the sustainability pressures triggered by different stakeholders. The measure are either weak or deficient in addressing the barriers.

Secondly, majority of the papers and empirical findings lack the theoretical background. They make it especially confusing when the papers discuss the looping supply chain, reverse logistics and utilizing the LCA. A better framework encompassing all of these terms that can provide better understanding and make adoption of sustainability easier is still lacking.

Responding to the fact that still a lot has to be done on researching Sustainability integration and better addressing the barrier, new definition of the sustainable supply chain has been proposed. It defines sustainable supply chain management as,

“The design of coordinated supply chains through the active integration of economic, environmental, and social dimensions with major inter-organizational business systems created to efficiently and effectively manage the material, information, and monetary flows regarding the procurement, production, and supplying of products or services in order to meet stakeholder demands and increase the profitability, competitiveness, and resilience of the organization over the short- and long-term.”

This definition has been formulated on the basis of earlier discussion of the various definition and focus point of the previous research works and current demand of the supply chain management in business world.

Similarly, for answering the **second research question** that is to know the exact situation of sustainability integration among Norwegian firms, a list of questionnaires were made and sent to the participating Norwegian SMEs as a part of researching survey. The response towards the question relating to all the three dimensions; social, economic and environment, and also the chief barriers playing role were recorded and analyzed to give a tentative view of the whole situation.

The survey showed that although more than 60 % of the participating firms showed very positive inclination towards the Sustainability and shared value creation, 40 % lagging behind is still a large number to improve. Trust based relationship seemed more favorable among the industries at the local and international level, meaning it needed to be made more formal and contract based. This makes the trust based relationship more prone to short lived and supply chain collaboration failure, as they could be breached anytime. This is one of the reasons that organizations still can't totally have faith in the sustainability and hence staying in the safe side by striking short term relationship with international suppliers and consumers.

Norwegian SMEs show better performance in terms of environmental sustainability. They seem more proactive in recycling, reusing of the materials, decreasing the environmental pollution by utilizing cleaner transportation. It is also seen that positive number of respondents (above 65%) are positively following the international standards, though the number can be increased. On the other hand, the Research and Development does not seem very encouraging. Only 35 % of the firm interested in R & D means a lot more fund and action need to be done in this area.

The social performances based on the survey questionnaires regarding the contribution towards the local community and charity seems positive as well (75% positive) and of course this performance can be increased as well. The main trouble in social dimension is that half of the responding enterprises showed no commitment towards the social criteria for buying. This means less attention is paid when it comes to analyzing the supply chain sustainability and social consideration for the suppliers. Whereas, when selling, the vast no. of firms (95%) are concerned in at least some extent to the demands of the conscious customers.

The results brought by the empirical calculation also can't be taken as totally effective as it still suffers some delimitation. The survey itself can't be guaranteed to garner all possible correct information as it depends upon the response of the company representative who is not always responsive. Additionally, the

questionnaires also exclude some important factors like LCA, relationship with the stakeholders, extent of exchange of the technology, information and fund flows. Additionally, the energy audits of the enterprises, carbon footprints, minimum salary distribution, tentative amount of recycling and reusing seem absent.

6 Recommendations

As fulfilling the objective of this research, the author has come up with some new ideas, tools and framework for the sustainability adoption and better performances among the Norwegian SMEs. As discussed earlier, the whole research work also faced various limitations and shortcoming during the whole process. The author uses this section to point them and offer subsequent recommendations to address them.

To remedy the irrelevancy utilized framework () as discussed in the conclusion earlier, this thesis proposes a new framework that can be more relevant for creating shared value creation through the collaborative sustainable supply chain network.

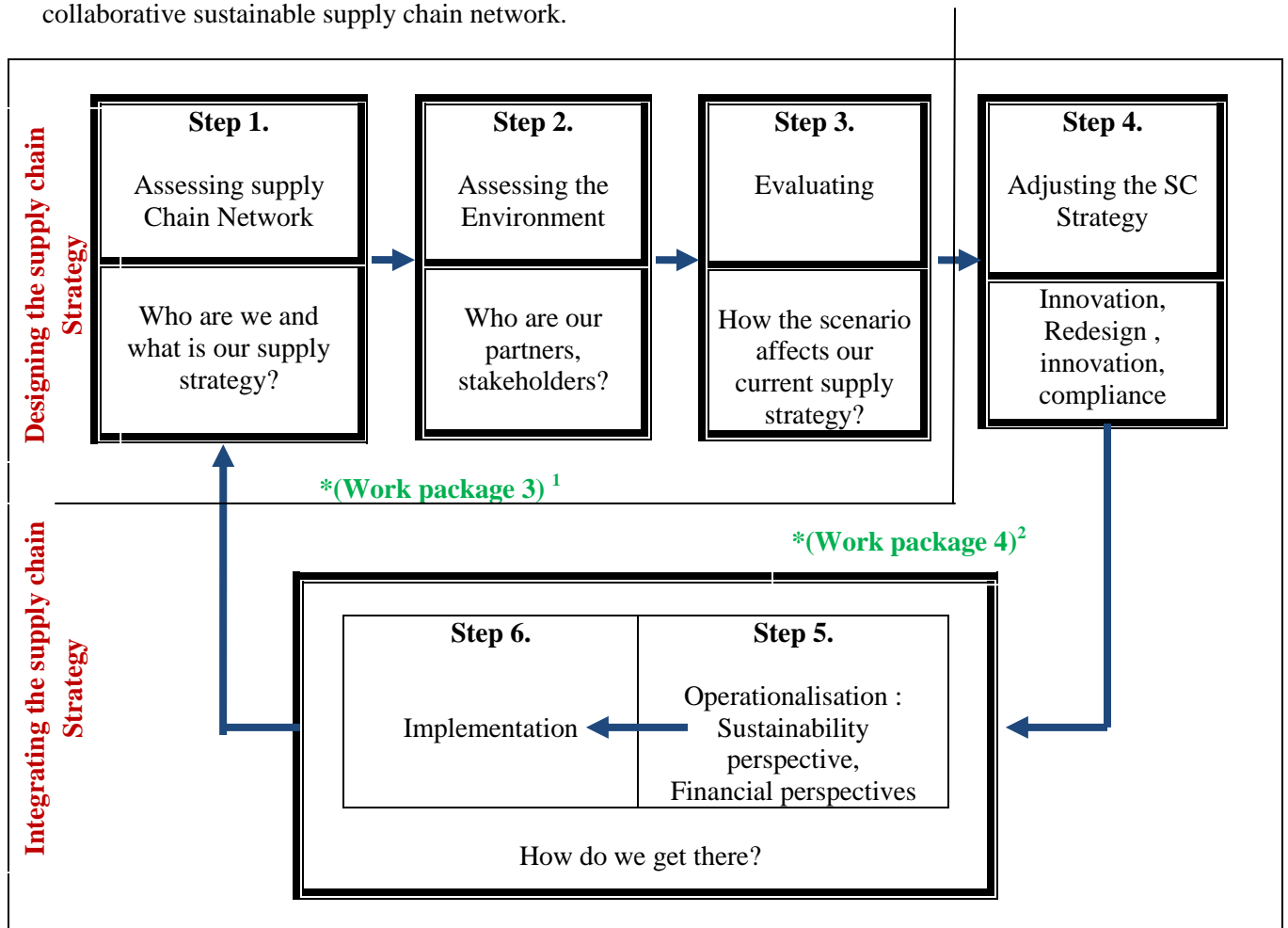


Figure 11: Suggested framework for the sustainability integration

1. This is how step 1 to step 3 relates and fulfills the objective of work-package 3 of SISVI
2. Includes the utilization of new decision support and practical innovative governance tools. Denotes the step 4 to step 6.

Step 1. Analyzing the current state of own supply chain

This step is focused on the strategies, sustainability practices existing and the related resources and potentiality in the company's own supply chain. This is helpful in Step 3 where we identify the risks and opportunities the company is facing and also to draw proper extension and re-designing of the existing supply chain strategy.

Sustainability integration is preferably a step by step adaption, instead of complete reengineering unless the whole supply chain of the company is threatened by the drastically changing business environment, Thus it is advised to have the understanding of

- Existing corporate plans and competitive strategies
- The sustainability strategies, if the corporate strategy has not included the sustainability
- The individual company specific supply chain strategy and
- The cross-company supply chain and the collaborative strategy

Step 2. Your Environment: Existing, potential and future impact stakeholders

This step is mainly focused on the changing factors in the business environment; what kind of scenarios the company will have to face in short and long term, what would be the main driver of the change possibly. It is advised to refer fig....for the better understanding of the potential stakeholders.

The major topics considered in this step are inputs of supply chain resources like fuel and energy, shareholders, and stakeholders. The following figure helps to understand the potential drivers-

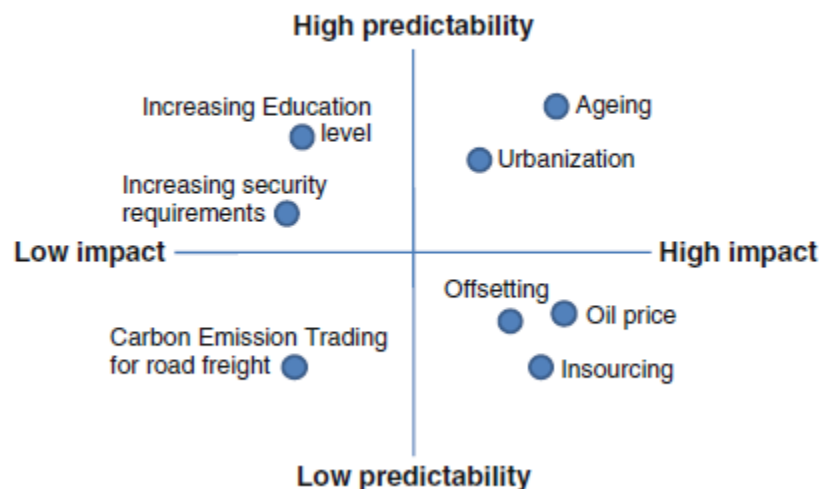


Figure 12: The potential change drivers (Source: Cetinkaya, 2011)

Step 3. Evaluating the potential risks and opportunities

Based on assessment of one's supply chain and business environment, one can be capable of identifying the potential risks and opportunities. Some of the most prevailing challenges to supply chain managers are increasing complexity of the supply chain, fast changes and uncertainty, global political and economic turmoil resulting in the oil prices, etc.

This evaluation step allows the company to assess the supply chain capability in the context of scenarios explained in step 2. For example, if the collaboration in local region leverages company to make more profit then the company should be able to estimate the decrease in the oil cost and hence reducing the transportation costs.

Step 4. Adjusting and redesigning the supply chain strategy

This step is completely based on step 3, that is threat and opportunities profile. Simply, greater the threats and opportunities, larger will be the changes to be adjusted in the existing supply chain strategies. Now, larger the gaps, more the implication of the implementing change and more drastic the strategic programs and the related action plan.

This leads to the involving innovative tools like LCA, ICT, complying with the Environmental acts and criteria and improving the productivity and efficiency. This might also lead to the action programs like

- Training driver
- Redesigning the packaging
- Energy management in the warehouses
- Route planning and optimization
- Redesigning the fleet management system

Step 5: Operationalization in terms of sustainability perspectives

Till now, strategy has been formulated and action taken but it might still result in to the imbalance between environmental, financial and social perspectives. The whole actions are analyzed to achieve the profitable financial status and with acceptable environmental impacts.

Similarly, the whole steps are analyzed to incorporate the learning effectiveness, if the steps really helped to satisfy the customer's demands and how to effectively present oneself in the views of the customers.

Step 6: Implementation

Once all the vision, mission and expectation are met in different criteria, the company should proceed to implement the whole integration framework in a loop and start the supply chain network with the collaborating partners.

Another, major shortcoming noticed was the lack of participation of the suppliers and their inclination towards all the dimensions of sustainability. Thus the research duly lacks the actual scenario of the stakeholder's sustainability performances based on different criteria like human resources, child labor, working hours, wage distribution, level of pollution, contribution to the society, etc. The research work

also fails to know the exact expectation, target and vision of the independent firms in terms of organizational growth and expectation out of the collaboration both in short and long term.

To address these communication gaps with the suppliers a list of tools has been proposed by the author in accordance with the sustainability draft as documented by different International standards, acts and United Nations.

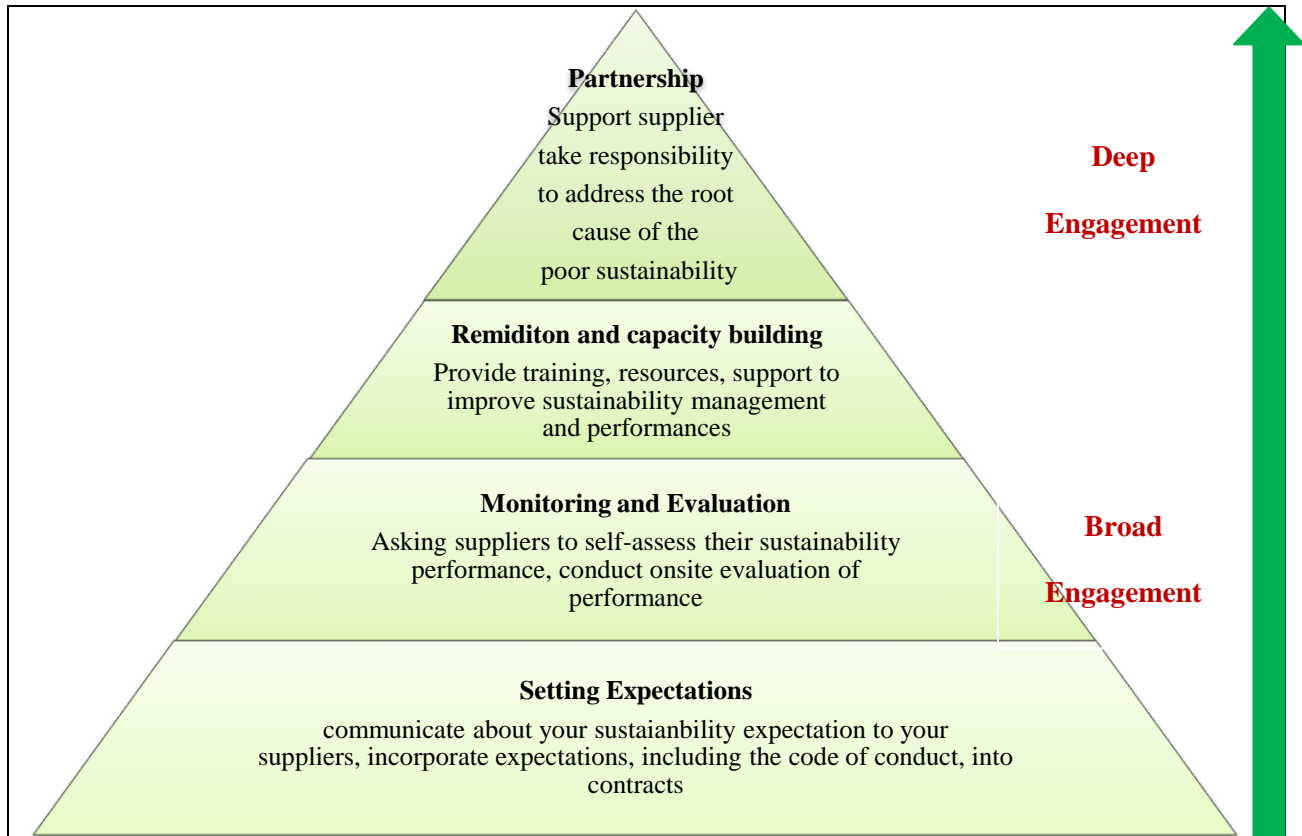


Figure 13: Tools for addressing communication between the suppliers in supply chain

In addition to these, the author recommends some more areas of whole research process to be improvised for more better and effective research output. As discussed earlier, the supply chain in this research work has been addressed in sustainable perspective. It would have been better if the articles concerning green purchasing and procurement were also referred in some number. This would have resulted in more concept and loopholes by contrasting the two different perspectives.

It has also been concluded that the literature review section also should have included the referral of the Norwegian sustainability acts and purchasing contracts for the Norwegian SMEs. Lacking this knowledge makes us ignorant if the available laws and criteria are insufficient, outdated or incapacitated.

Regarding the questionnaires, significant questions related to social dimensions and economic perspectives seem lacking. For example, the questionnaires do not exact the figures of the revenues, job creation, donations and amount of energy utilized and pollution created. These questions need to be included. More specifically, the suppliers and their supply chain performances on the basis of environment, economy and social dimensions need to be included. Similarly, LCA and reverse Engineering seems completely lacking in the questionnaire. This once added will provide far better view

from the environmental performances of the participating firms. Above all, the Norwegian firms should broaden their horizon and spend more time and funds on researching the potentiality of outsourcing, increasing the market share, better responding to the consumers and innovative ICT.

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