LUND UNIVERSITY
School of Economics and Management

Analysis of practices and organizational awareness of sustainability – the case of Thule AB

A Corporate wide analysis and investigation on the existing and upcoming sustainable practices, general awareness on sustainability among employees and Carbon footprint Calculation of a bike rack.

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Foreword

This thesis has been written as a part of the degree project course in the Masters program "Sustainable Business Leadership" at the School of Economics and Management, Lund University.

The course was based on the methodology of action learning and self-managed learning. The students were all assigned to an in-company project, having a role as consultants. This project constituted the main part of the course. As a minor part the students were responsible for organizing several learning events addressing relevant issues related to the in-company projects. The students continuously documented their learning in learning journals and participated in tutorials on these journals.

The assessments of the students were done partly on the written thesis, partly on the consultancy process and report to the client company, partly on performance in learning events and partly on ability to document and discuss the students' individual learning and development.

Acknowledgements

We take this privilege to express our profound gratitude to THULE AB for giving us an opportunity to work on this project. This was a rewarding experience for us and we hope that our project work and results would help Thule in some way or other.

There are some key people who helped and supported us throughout this project. They have also provided many critical inputs and data, without which this project could not have been completed. We take this opportunity to express our gratitude to our supervisor's Prof. Stein Kleppestø and Prof. Christine Blomqvist. Special thanks to Patrick Monahan (Pat), Vice President Operations, Vehicle Accessories North America, Thule Inc. for his indispensable support and kind cooperation throughout this project. We would also like to thank our classmates and opponents for their help and feedback.

Lund, 1st of June 2010.

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Abstract

Aim

The aim of this degree project is to carry out the corporate wide analysis and investigation to identify the existing and upcoming sustainable practices in Thule AB, general awareness and perception on sustainability among employees and to calculate carbon footprint of a bike rack, a Thule product produced at Seymour plant, USA.

Approach

We embarked on this project by dividing it into two different tasks.

1) Corporate wide analysis and investigation of all processes and systems to identify sustainable practices in Thule and an investigation on the awareness & perception on sustainability among its employees

2) Calculating the carbon footprint of a bike rack, a Thule product produced at Seymour plant, USA.

Methodology

The first task is a combination of qualitative analysis to a large extent and some quantitative analysis. Online Questionnaires were made and sent out to appropriate people to get the inputs for the analysis. There were both closed ended and open ended questions. This received data has been analyzed and represented in charts for lucid comprehension. Wherever possible the charts have also been represented in terms of business areas and country wise in addition to the overall representation. We have also included our remarks and observations wherever necessary.

The second task, the calculation of a carbon footprint envelops both qualitative and quantitative approach. An existing method PAS 2050 has been identified and worked out to use it for the calculation of carbon footprint of bike rack. Then the data required has been identified and the appropriate questionnaires were made. These questionnaires were then sent to the client (Thule AB) to obtain the data from the client. After a back and forth consultation sufficient data was acquired to embark on the calculation process. Through the calculation process some approximations and assumptions had to be made to overcome data constraints, the reason and basis of such approximations and assumptions was explained clearly. As a result of the calculation process we arrived at an estimate of the carbon footprint of a bike rack.

Results

All the sustainable practices and awareness & perceptions have been identified through the practices and awareness questionnaires respectively have been compiled, analyzed and presented in charts and tables. The carbon footprint of a bike rack is estimated to be 32.889 kg of Co2 equivalent.

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1. Introduction

This chapter aims to give the reader an understanding and perspective of the concept of sustainability and its three different dimensions. This is followed by a brief discussion relating THULE and sustainability. The background gives an initial vision of the project which is then narrowed down to our two research questions.

1.1 What is Sustainability?

Today the business sector is increasingly expected to respond to the demands of society for improved environmental, societal and ethical performance. The global sustainability debate has evolved to the point where business must consider the impacts of products and services throughout the life-cycles and supply chains[1].

One of the most frequently quoted definition of sustainability is derived from the 'Our *Common Future'* book, which was produced by the World Commission on Environment and Development (WCED), chaired by Norwegian Prime Minister Gro Harlem Brundtland in 1987: "*Humanity has the ability to make development sustainable – to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs.''*[2]

The core mainstream idea of sustainability[3] is seen as having three overlapping and mutually dependent[4] dimensions: economic, environmental and social.

Economic

For businesses, sustainability should be about understanding the fundamental changes in the long term and looking at them as opportunities. Companies that adopt a strategy which embraces the three above mentioned dimensions are very likely to gain competitive advantage in the long run.[5]

Environmental

Companies should redesign the way they operate so that the damage done to the environment is as minimal as possible. Sustainability is about learning to value, maintain and develop our environmental asset so that we can live off its income and not its capital. There should be a

[1] Charter, Martin and Tischner, Ursula, '*Sustainable Solutions : Developing Products and Services for the Future*', Greenleaf Publishing 2001
[2] World Commission on Environment Development, '*Our Common Future*' , New York : Oxford University Press, 1987
[3] Adams, W.M, "*The Future of Sustainability :Re-thinking Environment and Development in the Twenty-first Century*", ICUN, The World Conservation Union
[4] Dillard, Jesse, Dujon Veronica, King, C, Mary, "*Understanding the Social Dimension of Sustainability*", Routledge Publishing, (2009), ISBN10 :0-203-89297-6, Google Book Search, Retrieved on 1st June 2010
[5] Willums, Jan-Olaf, The World Business Council for Sustainable Development, '*The Sustainable Business Challenge : A briefing for tomorrow's business leaders*', Greenleaf Publishing, 1998

shift from seeing environmental responsibilities only for technical departments or experts to seeing these issues as company wide responsibilities.[6]

Social

Philip Kotler defines Corporate Social Responsibility as making decisions in business related to "ethical values, legal requirements, as well as respect for people, communities and the environment[7]". The basic ethical or social responsibility of any firm is to make an effort to compensate for the negative impact it has created to the communities in which it operates or to the society on the whole. It is in the long-term well being of the company to adhere to a fair level of social sustainability. Social sustainability if often regarded as corporate social responsibility (CSR). Research has shown that if CSR is carried out properly it also brings financial benefit to the firms in the long-run[8].

1.2 THULE and Sustainability

Corporate Sustainability can be seen as a transfer of the overall idea of sustainable development to a business level[9]. It can thus be defined analogously to the definition of WCED ''as meeting the needs of a firm's direct and indirect stakeholders […] without compromising its ability to meet the needs of future stakeholders as well''[10].

Corporate sustainability means adding the environmental and the social aspects to the set of business objectives. This requires overcoming conflicts of goals between economic, environmental and social issues in the long run, thus combining economic success with conserving the biophysical environment and social responsible actions. Due to short-term orientation in business activities, businesses might find that the objectives are conflicting. When goal conflicts are changed into goal congruencies a win-win situation between the dimensions of sustainability is realized. As a result the overall performance of a corporation is not only determined by financial results but also its environmental and social performance.[11]

For THULE: The business sector is beginning to realize that financial and social benefits will arise from incorporating practices of sustainability. Energy efficiency, recycling and maximizing use of raw materials can all deliver profitable returns, as can clean, efficient production processes and innovative 'sustainable' products.

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[6] Willums, Jan-Olaf, The World Business Council for Sustainable Development, '*The Sustainable Business Challenge : A briefing for tomorrow's business leaders*', Greenleaf Publishing, 1998

[7] Kotler, Phillip & Lee, Nancy, "*Corporate Social Responsibility: Doing the most good for Your Company*", Pg4, Wiley & Sons, 2005

[8] Berger et al, 2007, "*Mainstreaming Corporate Social Responsibility: Developing Markets for Virtue*", California Management Review, VOL. 49, NO. 4, (132-157)

[9] Zink J, Klaus, Steimle Ulrich, Fisher Klaus, '*Human Factors, Business Excellence and Corporate Sustainability : Differing Perspectives, Joint Objectives'* , 2008

[10] Dyllick T, Hockerts K , '*Beyond the Business Case for Corporate Sustainability. Business Strategy and the Environment* 11:130-141', 2002

[11] Stimle U, Zink KJ, '*Sustainable Development and Human Factors.' International Encyclopaedia of Ergonomics and Human Factors*, 2nd edn, Taylor & Francis, pp2258-3363, (2006)

Thule AB is a multinational company with operations in various countries. Thule is the world leader in sports and utility transportation. Thule delivers safe, easy and stylish solutions for active families, professionals and other outdoor enthusiasts to transport their gear. It offers load carriers for vehicles such as rooftop boxes, roof rails and bike carriers. Plus, the company offers snow chains, trailers, towing systems, organization solutions and accessories for RVs as well.

1.3 Background Work

The ever changing market dynamics and the current business environment have prompted Thule to show more interest in sustainability aspects. At this stage Thule is not fully aware to what extent sustainable practices are employed in its business and how it has to tread towards becoming a sustainable company. Currently their main focus is on environmental sustainability. In this project we attempted to help Thule understand its current situation concerning various aspects of sustainability. The results of this project can also aid Thule in making decisions on treading towards sustainability.[12]

Thule has approximately 3,100 employees at over 30 production and sales locations in North America, Europe and Asia. Net sales for 2008 amounted to SEK 6.2 billion (approx 620 M Euro or 800 MUSD).

Based from the company presentation and THULE's website we were able to gather information about some initiatives related to sustainability and their Business Areas

Initiatives related to sustainability:

- 2008 - (August) Installed 318-kilowatt solar array on the roof of Thule's Connecticut facility. [13]
- 2007 - (June) Thule employees spent a day cleaning up the Housatonic River in Stratford, Connecticut.

Thule AB has five Business Areas.

- Vehicle Accessories Europe/Asia (VAEA)
  Headquarters: Malmö, Sweden

- Vehicle Accessories North America (VANA)
  Headquarters: Seymour, Connecticut, USA

- Trailers
  Headquarters: Malmö, Sweden

- Towing Systems Europe/Asia (TSEA)
  Headquarters: Staphorst, Netherlands

[12] THULE Sweden Official Website http://www.thule.com/en/US/About%20Thule/Company%20Facts/Our%20Structure.aspx, Retrieved 1st June 2010
[13] Ibid.,

- Organization Solutions
  Headquarters: Longmont, Colorado, USA

Throughout this project we will be using the following abbreviations for the Business Areas in our charts and tables.

Business Area	**Abbreviation**
Malmo Corporate Headquarters	HQ
Thule Towing Systems	Towing
Trailers	Trailers
Vehicles Accessories Europe/Asia	VAEA
Vehicle Accessories North America	VANA

1.4 Problem Discussion

For THULE to engage in sustainability abilities it has to first know where it stands as a company in terms of sustainability practices. To do so, the organization needs data from all its plants and business areas to have a clear about the ongoing and planned initiative and determine if any of them are related to sustainable practices.

With this project the aim is to carry out a corporate wide analysis on THULE's plants to see how their activities are related to sustainability. The organization also wants to know how well aware its employees are regarding the concept of sustainability.

Engaging in sustainability would mean that THULE would have to ensure minimum environmental damage in its production processes. As a starting point, THULE requires the carbon footprint calculation of one of its products.

1.5 Focus and delimitations

For the first task we made two questionnaires, one to collect the information on all processes and systems related to sustainability in all plants of Thule and the second questionnaire to investigate the level of awareness of sustainability in the company. These questionnaires consist of both closed-end and open-ended questions. Most of them are qualitative questions with some exceptions. We represented the collected data in the form of charts by Business areas, country and on the whole. This way it is easily comprehensible and these representations would aid THULE to make decisions regarding the aspects of sustainability. We forward our questionnaires to THULE who in turn distributed it among its employees. We did not receive questionnaires from the Organization Solutions business area and out of total 70 respondents for the awareness questionnaire 35 of them were from the VANA business area. We have done our best to work with data we had at hand and we hope to be able to present a fair analysis for our project

For the second task we chose PAS2050 method to calculate product carbon footprint. PAS 2050 is a publicly available specification for assessing product life cycle GHG emissions,

prepared by BSI British Standards and co-sponsored by the Carbon Trust and the Department for Environment, Food and Rural Affairs (Defra), UK. We studied the method carefully and tried our best to adapt it to Thule's products and ecosystem. After working through the process we could identify the proper set of data that is required. We made a questionnaire based on the required data that would aid in the calculation of product carbon footprint. At some points approximations & assumptions had to be made due to the data constraints. Wherever possible, we have mentioned why they are made and how they are made. In spite of these shortcomings we hope that our result is a nearest approximate that could be reached for the given conditions.

2. What is currently being done at THULE concerning sustainability?

This chapter aims to look at the first research task of this project, which is about the ongoing practices at THULE and how they are related to sustainability. We present the research methodology of the Practices and Awareness Questionnaires.

2.1 Practices and Awareness

Assessing one's environmental and socioeconomic footprint is the first step for a company in trying to embrace sustainability. The materials, energy and human resource input involved with every step of the organizations workflow needs to be indentified[14]. The Practices questionnaire will try to assess the impacts generated throughout the value chain of THULE plants, from the raw material purchased to the way to the disposal of waste materials.

To make the move towards sustainability, everyone associated with the organization should have a clear definition of sustainability and the goals of the company for trying to be more sustainable. As a first step, to see what the level of awareness is about sustainability among its employees, we have formulated an Awareness Questionnaire.

2.2 Methodology

THULE had suggested that we make use of questionnaires for the data collection therefore already supplying us with a coherent methodology to go about the task at hand.

Below we have provided a step by step approach that was followed when preparing the 2 questionnaires. The same framework applies to the both of them, since they are similar in format, question types and only differ in content.

2.2.1 Steps in Process of the Research Questionnaires

Step 1.
The first step was to formulate our hypothesis: To determine what is THULE already doing with respect to sustainability and finding the level of awareness about sustainability among the THULE employees. Since it had been suggested to us by THULE to carry out those interviews by questionnaire, we proposed to make online questionnaires which would ease distribution and data collection.

Step 2.
The second step was figuring out how the data would be recorded. The use of online questionnaires, made it possible for the data to be collected in real time. This data was then exported from the online questionnaires' website database and put on Microsoft Excel sheets for analysis.

[14] Doppelt, Bob, "*Leading Change Towards Sustainability : A Chang e-Management Guide for Business, Government and Civil Society*", Chapter 7, GreenLeaf Publishing, (2003)

Step 3.
Deciding the target population was the next logical step. For the practices questionnaire, the questionnaire was targeted to the plants managers in the different business areas in the different countries. The awareness questionnaire was targeted at THULE employees from all the various Business Areas and all its departments within.

Step 4
Test interviews were made after which small corrections and clarifications were made. Next step was to make sure that the questionnaire had been forwarded to the different plants in the different business areas.

Step 5
Final step was to extract the collected data from the online questionnaires' website into MS Excel Sheets for statistical analysis. Most results are presented in form tables and charts to facilitate understanding and readability. To ensure data consistency, we always checked whether the exported data matched those on the website.

2.3 The Data Type

The data captured from the Practices and Awareness questionnaires will be a mixture of qualitative and quantitative data.

The qualitative data from the questionnaires will come from open ended questions where the opinions and views of the respondents are being asked. The quantitative data will come from the questions based on the likert[15] scale and multiple choice questions. This quantitative data will then be analyzed using statistical methods and presented in form of charts and tables.

Our objective was to guide the respondents in some questions by given them options through likert scales and also get data in form of narratives for the questions for which we could not anticipate the type of response. This would be our qualitative data that we are presenting verbatim most of the time.

Different types of questions have been used in the questionnaires so that data can be successfully extracted from the respondents. We have made use of likert scales, narrative questions, contingency questions, closed ended multiple choice questions and also open ended questions.

2.4 Advantage and Disadvantage of Questionnaires

These questionnaires were an advantage since they could be easily forwarded by email. Online questionnaires are also a very inexpensive way of reaching out to the respondents. Questionnaires in general[16], avoid interviewer bias, guiding and cues that might have an

[15] Neuman Lawrence, W. "Basics of Social Research : Qualitative and Quantitative Approaches", Second Edition, Pearson Education Inc, Pg129
[16] University of Tennessee, Knoxville, Course IS 540: Research Methods, given by William C. Robinson <http://web.utk.edu/~wrobinso/540_lec_qaire.html>, accessed on 25th May 2010

impact on the validity and reliability of the data being collected. Another advantage of the questionnaires is that they would give our respondents time to gather and consult sources needed to respond well, for example , the practices questionnaires requires the measurement of waste and water used.

One disadvantage of the questionnaires is that some motivation is required from the respondents and also in general there is often a strong tendency for people to give answers that are socially desirable. Another issue that can arise is whether or not, the respondent knows enough to give a meaningful answer. To tackle these issues we tried to make our questions as clear and as simple as possible.

2.5 Validity and Reliability

We have tried to ensure that the results and conclusion made from the data captured in our Practices and Awareness questionnaires have a high level of validity and reliability. A measure shows validity if it actually measures what it is intended to[17]. Since our project work consists of qualitative research we wanted our data to have a high level of authenticity[18]; i.e., fair, honest and balanced answers from the respondents. To ensure the validity of the practices questionnaires we tailored the questions in such a way that the responses would indicate whether the different activities and processes of THULE fall within the three dimensions of sustainability or not.

Reliability refers to the consistency or the dependability of the data captured. Reliability for our questionnaires was ensured by the fact that all the respondents, for either the Practices or the Awareness, were presented with the same standardized set of questions and that they were answered in the exact same way. The reliability was also enhanced due to the fact that the questionnaires were sent to the different business areas in different countries and from the responses we could see a certain pattern, thus ensuring the consistency of the capture information.

2.6 Reflections and Criticisms

The motivation of the respondents may influence the level of accuracy of our study, since their personal beliefs, ambitions and willingness to answer will influence the outcome.

For our awareness questionnaires, the number of responses from the various business areas has been inconsistent. We failed to receive any responses from the Organization Solution Business Area. From the TRAILERS business area there were only 7 respondents whereas in Vehicle Accessories North America (VANA) we received 35 responses. The reliability of the responses from VANA would be higher and thus a better generalization could be made than the TRAILERS business area. This issue was out of our hands, since THULE took the responsibility of choosing, forwarding and motivating the respondents to fill in the questionnaires.

[17] Venderstoep Scott, & Johnston Diedre, "*Research Methods for Everyday life: Blending Qualitative and Quantitative Approaches*" Pg 59

[18] Neuman Lawrence, W. "Basics of Social Research : Qualitative and Quantitative Approaches", Second Edition, Pearson Education Inc

3. Empirical Study and Analysis of Results from Questionnaires

In this section we aim to present and analyze our empirical results from both questionnaires. The Practices Questionnaire is discussed first, followed by the Awareness Questionnaire.

3.1 The Practices Questionnaire

The main aim of the Practices Questionnaire was to capture data about the ongoing as well as planned practices and activities at THULE and determine whether these practices are related to sustainability.

The intention of the questionnaire is gather data from the various THULE plants about:

- Any recent activities concerning sustainability
- their existing environmental policy(if any)
- incentives/barriers for THULE to embrace sustainability
- programs for resource efficiency, waste management
- any community development activities

An example of the questionnaire that we put together can be found in the Appendix.

3.1.1 Sample Selection

We suggested to THULE that this questionnaire needs to be filled by plant managers of their five different business areas. THULE then forwarded the questionnaires to the plant managers and the 7 respondents of this questionnaire are shown in the table below.

	Designation	***Business Area***	***City***	***Country***
1	Vice President Operations	Towing System EA	Staphorst	Netherlands
2	Managing Director	VAEA	Huta	Poland
3	Vice President Operation	VAEA	Malmo	Sweden
4	Vice President Operation	VANA	Seymour	USA
5		VAEA	SaoPaulo/Itepuva	Brazil
6		VAEA	Mene	Belgium
7		VAEA	Neumark	Germany

Table 1: Respondents of the Practices Questionnaire

From the table above we can observe than only 3 out the 5 business areas have responded to the Practices Questionnaire. The analysis of the 7 respondents will thus be made by Country.

3.1.2 Analysis of Questionnaires

We will present the analysis of each question from the Practices Questionnaire, with a chart or table summarizing the answers followed by a small discussion.

3.1.2.1 Recent Sustainability Activities

Question: What are the recent sustainability activities that have been adopted by your plant?

This question was included in the Carbon Footprint Questionnaire (See Appendix) that was sent out to the THULE plants. The results for this question will be presented here first since it shows all the different sustainability practices by the different THULE plants.

Business Area	**Location/Product**	**Recent Sustainability Activities**
VAEA	Neumarkt, Germany Roof Boxes	1. Reduction of electrical energy by installing new compressor station with the automatic management of each compressor. Started (06/2010) 2. DIN ISO 14001 environmental certification. Started 01/2010 3. Improved maintenance for the checking of liquids using indicators
VANA	Seymour, USA Car Racks, Bike racks, Boat racks	1. 355 KW Solar Array installed in 2008 2. White paper reduction team started in 2009 3. White paper recycling started in 2005 4. Paper cup reduction effort planned for 2010-06-01 5. Annual River Clean Up day
VAEA	Hillerstorp, Sweden	1. Recycling of waste from : paper, corrugation, trash, wood, metal scrap, aluminium scrap, stainless steel, brass, plastic coating, plastic film, electrical scrap, 2. Whole plant supplied by wind power 2009

	Car Racks, Accessories and Sheet metal components	3. Gas heating installed (previous electric) (2007) 4. All product boxes optimized to minimize transportation losses (box size, pallet height etc, 2009) 5. Material supply (milk run) from subcontractors outsourced and optimized. Old truck replaced by new with exhaust emission control 2009
VAEA	Huta Szklana Poland Bike Carrier	1. ISO 14000 2. Waste segregation 3. Energy reduction 4. Replacement surface treatment system
Towing Systems	Staphorst, Hoogeven, Netherlands Tow bars and repair sets	1. In general: every quarter a meeting with Environment Coordinator in plant. Staff to quarterly report including monitoring used energy per produced tow bar (hitch) 2. 5S is a part of our quality ISO TS 16948 and ISO 14001
VAEA	Molteno, Italy Snow chains, hardware & security chains	1. 200KW Solar array installation within end of 2010-06-01 2. Permit application based on the IPPC directive (Integrated Pollution Prevention & Control) 3. Goal 2011 : ISO 14000 Ambiental Certification

Table 2 : Summary of Sustainability Practices by Plants

From the data collected from these different plants above, the most effort is seen to be made in the energy aspect and waste recycling. Installations of solar panels, use of electricity generated from wind and other energy reduction initiatives reflect that. Almost no activities are seen which can be classified into the social dimension of sustainability, except the "Annual River Cleaning" initiative from the Seymour plant.

3.1.2.2 Incentive to engage in sustainability

"What do you think might be the incentive for Thule to engage in sustainability? (1 – represents low, 5 – represents high)"

With this question we aim to find out what the plant managers think might be the advantage(s) for THULE to engage in sustainability practices. We made a likert scale question providing the respondent with 6 options as shown below.

Key

1. Lowering overhead costs.
2. Anticipating and responding to change.
3. Making a contribution to sustainability.
4. Meeting the needs of our client group more effectively.
5. Contributing to securing funding.
6. Improving our department's profile.

Result

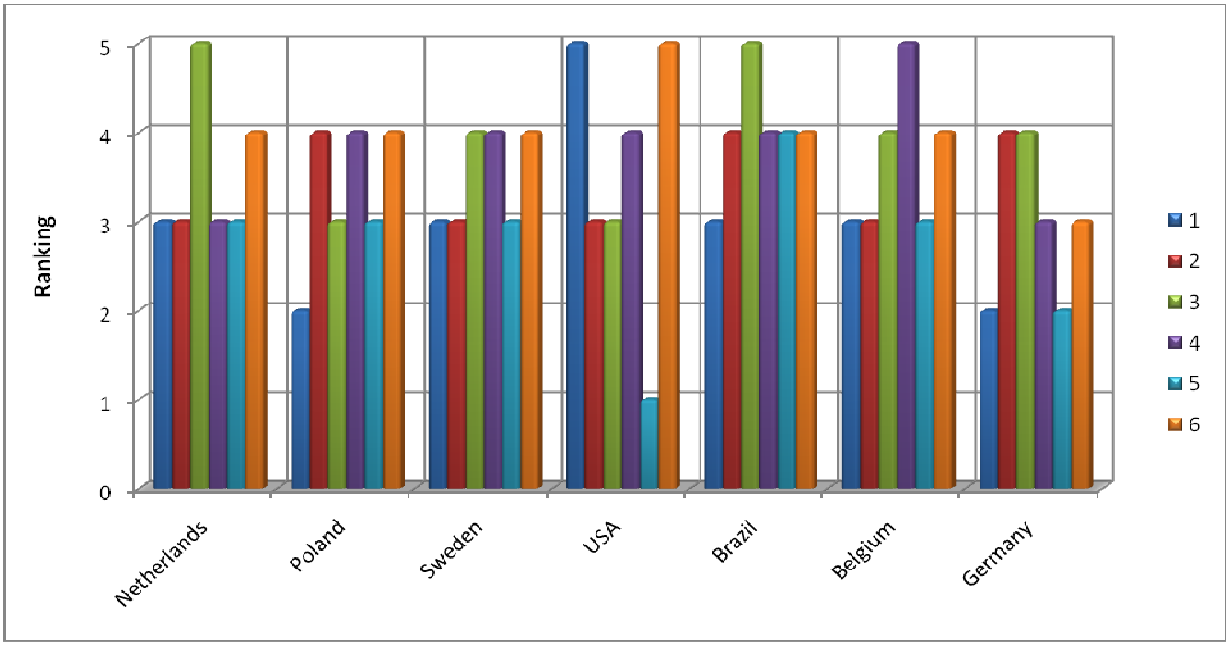


Figure 1: Incentive to engage in sustainability – Country wise

Analysis

From the figure above, we observe that the 3rd option, 'Making a Contribution to Sustainability' is the most popular incentive that the respondents chose, showing strong willingness to indulge in sustainability practices. The next two most popular answers are options 4 and 6.

The Seymour plant seems to have identified that engaging in sustainability activities such as reduction of resources (water, energy, paper as shown in sections 3.1.2.5, 3.1.2.8, 3.1.2.15 and 3.2.3.6) and waste would have the benefit of lowering their overhead costs.

3.1.2.3 Barriers for engaging in sustainability

Q.What do you see as the barriers to improving your organization's engagement in sustainability? Please indicate which barriers are relevant. *(Please tick all that apply)*

1. Not enough time
2. Not enough information.
3. Too much information
4. Have no control over building/building management
5. Compliance fatigue.
6. Does not seem relevant to our work
7. No-one in organization responsible for this area
8. Cannot see benefits
9. Other

	Netherlands	Poland	Sweden	USA	Brazil	Belgium	Germany	%
1			✓		✓	✓	✓	57%
2		✓	✓	✓				43%
3								-
4				✓				14%
5			✓					14%
6								-
7		✓		✓		✓		43%
8				✓				14%
9	*						**	29%

Table 3: Barriers for engaging in Sustainability

Percentages are based on the total number of countries.
.*Netherlands' answer; There are no barriers
**Germany's answer; the current matrix organisation in the BA. It is difficult to manage an organisation in a matrix management system.

Analysis

Most interesting fact observed from the results is the response from Netherlands, who say there are no barriers to sustainability. This implies that the plant in Netherlands have all the necessary knowledge and resources required to engage in sustainability.

Biggest barrier assumed by the managers is that there is not enough time to engage in sustainability activities. The two next biggest obstacles are lack of information and no one in charge in that area. When embracing sustainability communicating what is being tried to achieve[19] and how to achieve them are essential. Getting the right people in the key positions and creating a sustainability department who overlooks all the sustainability initiatives is also of prime importance.

[19] Doppelt, Bob, "*Leading Change Towards Sustainability : A Chang e-Management Guide for Business, Government and Civil Society*", Pg 112, GreenLeaf Publishing, (2003)

3.1.2.4 Environmental Policy

An environmental policy is "a set of principles and intentions used to guide decision making about human management of environmental capital and environmental services"[20]

An environmental policy for THULE would mean that it would have programs in place for managing raw material efficiency, energy consumption and waste management. This question aims to find out if such an environmental policy already exists at THULE or its plant.

Q. "Does your plant (or Thule) have an environmental policy statement?"

Options:

1. We are developing an environmental policy statement
2. Our environmental policy statement consists of a commitment to promote environmental stewardship
3. We have formed a committee to ensure the success of our environmental policy
4. Our environmental policy statement describes how our company explores opportunities to work with communities, governments and non-governmental organizations to help articulate, teach and advance the principles of sustainability.
5. Other

Results

	Netherlands	Poland	Sweden	USA	Brazil	Belgium	Germany	%
1	✓			✓	✓	✓	✓	71%
2	✓							14%
3	✓						✓	29%
4								-
5		*						14%

Table 4. Environmental Policy summary

**Poland's answer; Going to apply for ISO 140001*

Analysis

We saw from Question 3, Netherlands said that it had no barriers that were hindering their engagement in sustainability practices. So it is not surprising to find that they already have an environmental policy which promotes environmental stewardship together with the appropriate team to ensure its success. From the energy efficiency and waste management activities mentioned in the results from question 1 and also in section 1, it can be seen that USA and Germany and Sweden also (even though they did not answer) have an environmental policy.

[20] Roberts Jane, "*Environmental Policy*", Pg 2, Routledge, 2004

3.1.2.5 Resource Efficiency

The objective of this question is to find out any existing programs within the plant which promotes resource efficiency.

"Q What programs do you have in place, or planned for promoting resource efficiency? (i.e. an environmental or waste audit? (Please check the items that apply)"

1. We recycle wastes and practice energy reduction when possible
2. We are developing a recycling system
3. We utilize a formal energy management system
4. We are a member of various environmental organizations
5. We have performed an environmental or waste audit
6. Other

Results

	Netherlands	Poland	Sweden	USA	Brazil	Belgium	Germany	%
1	✓	✓		✓		✓	✓	57%
2				✓	✓		✓	43%
3	✓							14%
4								-
5	✓	✓					✓	29%
6	*		**					29%

Table 5. Existence of an Environmental Policy

**Netherlands' Answer; recycling system is outsourced*

***Sweden's Answer; We are working towards ISO14000 Certification in all sites. Sustainability is a corner stone to the certification process.*

Analysis

Out of all the plants, Netherlands seems to be taking the lead in sustainability practices with Germany following closely behind. Most of the plants already have waste management and energy reduction programs. All plants, if not practicing waste management at the moment, are in the process of developing a recycling system.

The ISO14000 standard is a series that address Environmental Management which is accredited to organizations who "minimize harmful effects on the activities caused by its activities, and to achieve continual improvement of its environmental performance"[21].

[21] International Organization for Standardization website <http://www.iso.org/iso/iso_catalogue/management_standards/iso_9000_iso_14000.htm> accessed on 30th May 2010

3.1.2.6 Environmental Burden

This question is aimed at finding in which area most effort has been carried out concerning environmental issues.

"Q.In which parts has your department already tried to decrease the environmental burden? *(Please check the items that apply.)"*

1. Conserve energy use (electricity and heat)
2. Decrease chemicals use and emission
3. GHG (green house gas) emissions
4. Using eco-friendly material
5. Processes
6. Waste
7. Recycling
8. Transportation (logistics)

Results

	Netherlands	Poland	Sweden	USA	Brazil	Belgium	Germany	%
1	✓		✓	✓	✓		✓	71%
2	✓					✓		14%
3								-
4	✓						✓	14%
5	✓	✓	✓		✓		✓	71%
6	✓	✓	✓			✓		57%
7	✓	✓	✓	✓	✓	✓	✓	100%
8		✓	✓	✓				43%

Table 6. Areas in which the environmental burden has been decreased

Analysis

Again leading the charts, we find Netherlands, which have tried to minimize the environmental impact from nearly all the areas. Almost all the plants, as shown in the previous questions as well, have energy conservation practices and all plants practice waste recycling. An area where improvement can be made is in the use of eco-friendly material whether it is in the office or in the manufacturing processes.

3.1.2.7 Life Cycle assessment

With this question, we want to see if any third party testing organization such as the International Organization for Standardization[22] or the American National Standards Institute[23], conduct a Life Cycle assessment of THULE products to assess their impact on the environment. Life cycle assessment "studies the environmental aspects and potential impacts throughout a product's life (i.e. cradle to grave) from raw material acquisition throughout production use and disposal"[24]

Q. Life cycle assessment (LCA) considers a product from cradle to grave. Has an environmental life-cycle assessment of the product that you are providing been conducted by a certified testing organization? *(Please check the item that applies.)*

1. Yes, an environmental life-cycle assessment of the product that we are providing has been conducted by a certified testing organization
2. No, an environmental life-cycle assessment of the product that we are providing has NOT been conducted by a certified testing organization
3. No, we don't use life-cycle assessment at all
4. I don't know

Result

	Netherlands	Poland	Sweden	USA	Brazil	Belgium	Germany	%
1								-
2					✓	✓	✓	43%
3	✓		✓			✓		43%
4		✓		✓				29%

Table 7. LCA assessment by certitified testing organization

Analysis

No plants seems to practice any life cycle assessment of their product by a certified testing organization. This might something for THULE to look into since a Life Cycle Assessment would help the in the efficient use of resources throughout the manufacturing process

[22]International Organization for Standardization website <http://www.iso.org/iso/iso_catalogue/management_standards/iso_9000_iso_14000.htm> accessed on 30th May 2010

[23]American Nation Standards Institute http://www.ansi.org/, Accessed on 30th May 2010

[24] Hendrickson Chris, Lave B Lester, Matthews Scott H, "Environmental Life Cycle Assessment of Goods and Services :Ain Input-Output Approach",Pg3-4, Resources for the Future, 2006

3.1.2.8 Raw Material Efficiency

The objective of this question is to look at the measures taken by the plants to promote resource efficiency.

Q. Do you promote resource (raw material, energy) efficiency?
If YES: What kind of activities or management system do you use for promoting resource efficiency?

Results

Netherlands	Especially in lasercutting we optimized better than average our scrap
Poland	Weekly reject follow up meeting
Sweden	As stated above I am driving ISO 14000 Certification in all Sites.
USA	Financial system promotes scrap and energy use reduction.
Brazil	Yes. Sheet size reduction. Scrap reduction. Reduction of the Peak Energy.
Belgium	Recycling of disapproved alu (aluminium) profiles in other usable lengths
Germany	Automatically Electrical energy saving management in case of the compressor station

Table 8. Measures to promote raw material efficiency

If NO, please explain why
There was no "no" answer.

Analysis
From the responses above, it is seen that all the plants have taken some approaches to promote resource efficiency.

3.1.2.9 Sustainable Packaging/Shipping

THULE being a world leader[25] in sports and utility transportation, shipping forms a considerate amount of their operations. This questions aims to look at their shipping and packaging materials

Q. What type of sustainable packaging/shipping materials do you use? *(Please check the items that apply.)*

1. Our packaging/shipping materials are recyclable
2. Our packaging/shipping materials are reusable
3. Our packaging/shipping materials are bio-degradable
4. Our packaging materials are not sustainable
5. Other

[25]Official THULE website http://www.thule.com/en/US/About%20Thule/Company%20Facts/Our%20Structure.aspx, accessed on 30th May 2010.

Results

	Netherlands	Poland	Sweden	USA	Brazil	Belgium	Germany	%
1	✓	✓	✓	✓	✓	✓	✓	100%
2	✓		✓		✓	✓		57%
3								-
4			✓					14%
5				*			**	29%

Table 9. Packaging/shipping material type

**USA's answer; they have a high % of recycled content*
***Germany's answer; PE-Films; PE-Bags and cartons*

Analysis

All plants appear to be using recyclable material and almost of them are able to reuse the same materials after recycling.

3.1.2.10 Question 10: Green Transportation

The burning of fuel in transportation vehicles is one of the largest sources of green house gas emissions. This question aims to look at what is being at the THULE plants to reduce the emissions from transportation.

Q. "*Does your plant do anything to minimize the environmental costs associated with energy, GHG emissions related to transportation? If yes, Please describe shortly how and what methods are used.*"

Results

	Netherlands	Poland	Sweden	USA	Brazil	Belgium	Germany	%
I don't know								-
No		✗	✗		✗	✗	✗	71%
Yes	*			**				29%

Table 10. Activities to reduce GHG emissions from Transportation

**Netherlands' Answer; In case of costs management we optimize the transportation including routing milk runs. We are sure we can improve further*
***USA's Answer; Maximization of truck loads (Only full truck shipments)*

Analysis

From the results, it can be inferred that most of the plants do not have a green transportation plan.

3.1.2.11 Solid Waste and Water (Measurement and Reduction Targets)

Questions 11, 12 deal with the amount of solid waste measured for the previous year and any reduction targets set.
Questions 13, 14 deal with the amount of water used, measured for the previous, and any reduction targets set.

The results from these questions have been summarized in the table below

Results

Country	Item	Measured	Reduction Targets
Netherlands	Solid Wastes : Paper/corrugation Metal Scrap Wood Trash Water	 69,000kg 675,000kg 4700kg 42,000kg 4900m3	We are collecting now a lot of data (like we did in previous years with energy. As soon as a correlation has been found in data, we start with KPI's 2) Light weight constructions are strategic. This has an impact on reduced waste. Yes. We see a relation between the amount of employees (especially temps in seasonal pattern). Second issues are that we made automatization on our degreasing unit which consumes water. When no product is available, water consumption is zero no instead of continuing the installation
Poland	Solid Waste : 0.3% of purchased production material value. Mainly plastics, aluminium, packaging and steel tubes Water		0.4% NO
Sweden			
USA	Solid wastes : Corrugation	 510,00lbs	No targets set

	Trash Wood Water not used in production process	93,600lbs 268,000lbs 236,000gallons	 No targets set
Brazil	Very low, not measured Water	 400m3/year	Not yet No. There are not in our targets due to low consumption
Germany	Various waste Water	83 to/a 650m3	No Not yet.
Belgium	Alu Extrusions PVC Laminated Fabric Water	26 tons 4000m2 No	Alu 3.5% bought RM No

Table 11. Solid waste and water (measurement and reduction targets)

Analysis

From the above results, we what are the measurement practices in place for the different plants. Quoting an adage “What gets measured, gets done”, if the plants are able to measure the amount of waste produced or the amount of resource used, reduction targets could then be set.

3.1.2.12 Sustainable Purchasing

Sustainable purchasing is a the act of buying goods and services in a way that gives "preference to suppliers that generate positive social, environmental and economic outcomes and that integrates sustainability considerations into product selection so that impacts on society and the environment are minimized throughout the full life cycle of the product"[26]

With this question we aim to find out if THULE has any purchasing guidelines for its suppliers

Q. "Do you have any purchasing guidelines for your direct suppliers that address issues such as environmental compliance?"

Results

Country	**Do you have any purchasing guidelines for your direct suppliers that address issues such as environmental compliance?**
Netherlands	Especially on IMDS we have
Poland	is covered by Code of Conduct
Sweden	*
USA	We have guidelines in our corporate governance document
Brazil	No
Germany	Yes
Belgium	No

Table 12. Purchasing guidelines

*No answer from Sweden

Analysis

For THULE, buying sustainably would mean to know about the energy, material and emission footprints of their suppliers. For their raw material they could focus on who made it, how it was made and under what working conditions.[27]

[26] The Sustainability Purchasing Network, www.buysmartbc.com, accessed on 30th May 2010
[27] Ibid

3.1.2.13 Social Compliance

Policies at the workplace and practices help shape the corporate culture and act as a guide for the relationship between employers and employees and among employees.[28] Corporations need to understand and recognize the fact that proactive, dependable and responsible workplace practices help attract, train and sustain dedicated and productive employees, gain consumer and brand loyalty and goodwill with the public and investors, thus ensuring corporate success.[29]

Results

Country	Do you have a process for managing social compliance?
Netherlands	Not structural organized yet
Poland	Following local legislation
Sweden	*
USA	We have guidelines in our corporate governance document, and perform audits
Brazil	No
Germany	Yes, for customers
Belgium	Yes

Table 13: Managing Social Compliance

* *No answer for Sweden*

Analysis

Most of the plants seem to have some form of social compliance practices.

3.1.2.14: Community Development Activities

Corporate Social Responsibility encompasses social compliance as well as "working with the local community, and society at large to improve their quality of life". With this question we aim to find any social initiatives taken by THULE.

Results

Country	*Q. Do you invest in community development activities in the markets you source from and/or operate within?*
Netherlands	No
Poland	I don't know
Sweden	
USA	We conduct river cleanup days where many employees spend a day cleaning up trash from local rivers.
Brazil	No. Not directly.
Germany	Not yet
Belgium	No

Table 14. Community Development Activities

[28] Social Compliance, http://www.socialcompliance.org/vision.htm, accessed on 31st May 2010
[29] Ibid

Analysis

The third dimension of sustainability is often eclipsed by environmental and economic sustainability.[30]. The importance credited to economic activities lead to an all too-exclusive focus on the production and consumption of good and services[31]. The only activity, which falls into the category of social sustainability, is the annual river cleaning day by the employees at the US plant.

3.1.2.15 Question 18: Possibilities where THULE can perform better in terms of sustainability.

This question was asked to the plants managers, being in charge of operations, they would be able to spot the areas in which THULE could perform better in relation to sustainability.

Results

Country	***Please describe any possibilities that you can see where Thule can perform better in terms of Sustainability (Social or Environmental aspects). It can be any thing like minimizing the waste, optimal use of resources, energy conservation etc.***
Netherlands	ISO 14001 is not a demand in the organization. Our plant has and we see the benefits of it.
Poland	green philosophy, recycled packaging, less printed labels, recycled material use, standardization
Sweden	
USA	The first step is measuring where we are today and understanding where we need to improve. Then set goals to improve to continue the journey.
Brazil	Thule Brazil is a very small company with 13 employees. We already use recyclable materials. There is a very low waste. The only thing we are planning is Implementation of the Waste separation.
Germany	Improvements in isolation of the roof, the building; installation of solar cell, Usage of rain water, investments in environmental projects/management systems to reduce waste, water, etc
Belgium	Develop new products only with recyclable RM, recycle own sold products

Table 15. Possibilities where THULE can perform better in terms of sustainability.

[30] Dillard, Jesse, Dujon Veronica, King, C, Mary, "*Understanding the Social Dimension of Sustainability*", Routledge Publishing, (2009), ISBN10 :0-203-89297-6, Google Book Search, Retrieved on 1st June 2010
[31] Ibid

Analysis

Netherlands have adopted the ISO 14001, although it is not demanded by THULE. According to them, complying with these standards would benefit the whole organization. The rest of the responses indicate the improvements can be made regarding efficient use of resources.

3.1.3 Conclusions of the Practices Questionnaire.

Out of the 7 plants that have answered this questionnaire we observe that the Netherlands plant is doing the most in terms of sustainability. The Netherlands plant seem to be have the knowledge about the issues that need to be dealt with and also give the impression that they are working in achieving sustainable practices. The rest of the plants have recycling and waste management activities in place. Awareness and training programs with issues regarding sustainability will help raise the issue's profile among the employees and give them a better understanding on what needs to be done for further improvement. THULE seems to have initiated some practices related to sustainability, mostly in its production of goods. These activities are mostly concerned with the environmental dimension and maybe some more effort if possible could be put in societal aspect.

The most important thing that can come out of this questionnaire is the fact that the plants can have idea where they stand and what they need to do.

3.2 The Awareness Questionnaire

The questions in the awareness questionnaire investigate THULE's employees about their level of awareness about the concept of sustainability and also ways in which they think THULE could enhance their activities in order to align them with sustainability principles.

An example of this questionnaire can also be found in the Appendix

3.2.1 Sample Selection

Once prepared, our awareness questionnaire was sent to THULE who then forwarded it to its employees. A total of 70 employees have answered the awareness questionnaires. Below we represent the classification of respondents by country and by business areas.

Country Name	No of Responses
Canada	2
Denmark	7
France	4
Italy	2
Netherlands	3
Poland	1
Sweden	15
UK	3
USA	33
Total	**70**

Table 16. Awareness questionnaire responses

From the table above and the chart below we can see that almost half of the responses have come from VANA Business Area, USA. There is not enough respondents from each country to be able to classify and represent the data country wise and this would affect the reliability of the results considerably.

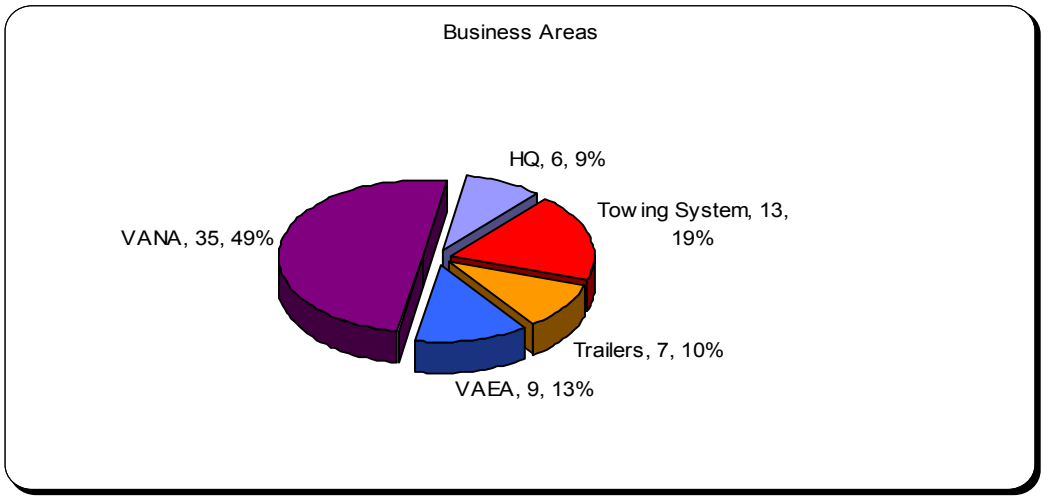


Figure 2. Representation of responses by Business Area (%)

3.2.2 Reliability and Validity

We have chosen the represent our data for the total of 70 employees, calling that a general result and presenting results from each different business areas.

Our 'general' results will suffer from reliability since most respondents are from USA On the other hand, when analyzing the results by Business Area, the reliability for VANA will be stronger because of the larger number of respondents

It should also be pointed that THULE informed us that a total of 150 requests had been made to fill questionnaire. Due to limited time and other constraints, THULE could not to motivate the remaining 80 respondents to answer these questionnaires.

3.2.3 Analysis of Results

Most of the results in this section will be represented in the form of bar charts to help readability. We are presenting the charts for THULE in general first followed by the charts representing the answers by Business Areas.

Abbreviations used have been defined in section 1.3

3.2.3.1 Personal Definition of Sustainability

With this question, we aim to see what do the THULE employees understand by the word sustainability. To guide the respondents we have provided a likert scale with the general perception of sustainability as well indicators from its three dimensions.

Q.What does the word sustainability mean to you personally? (Tick all that apply)

Results

THULE in General

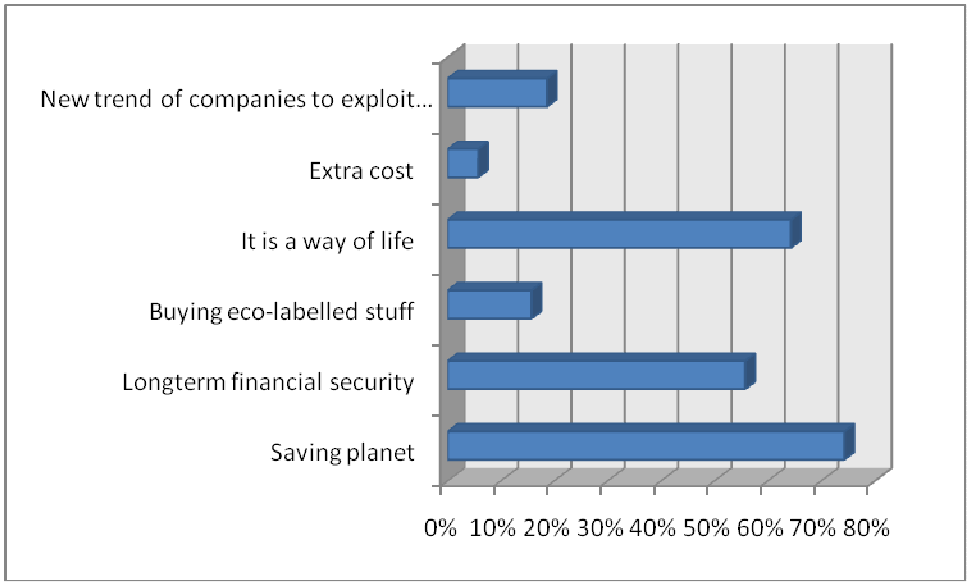


Figure 3. Personal definition of Sustainability in General

By Business Areas

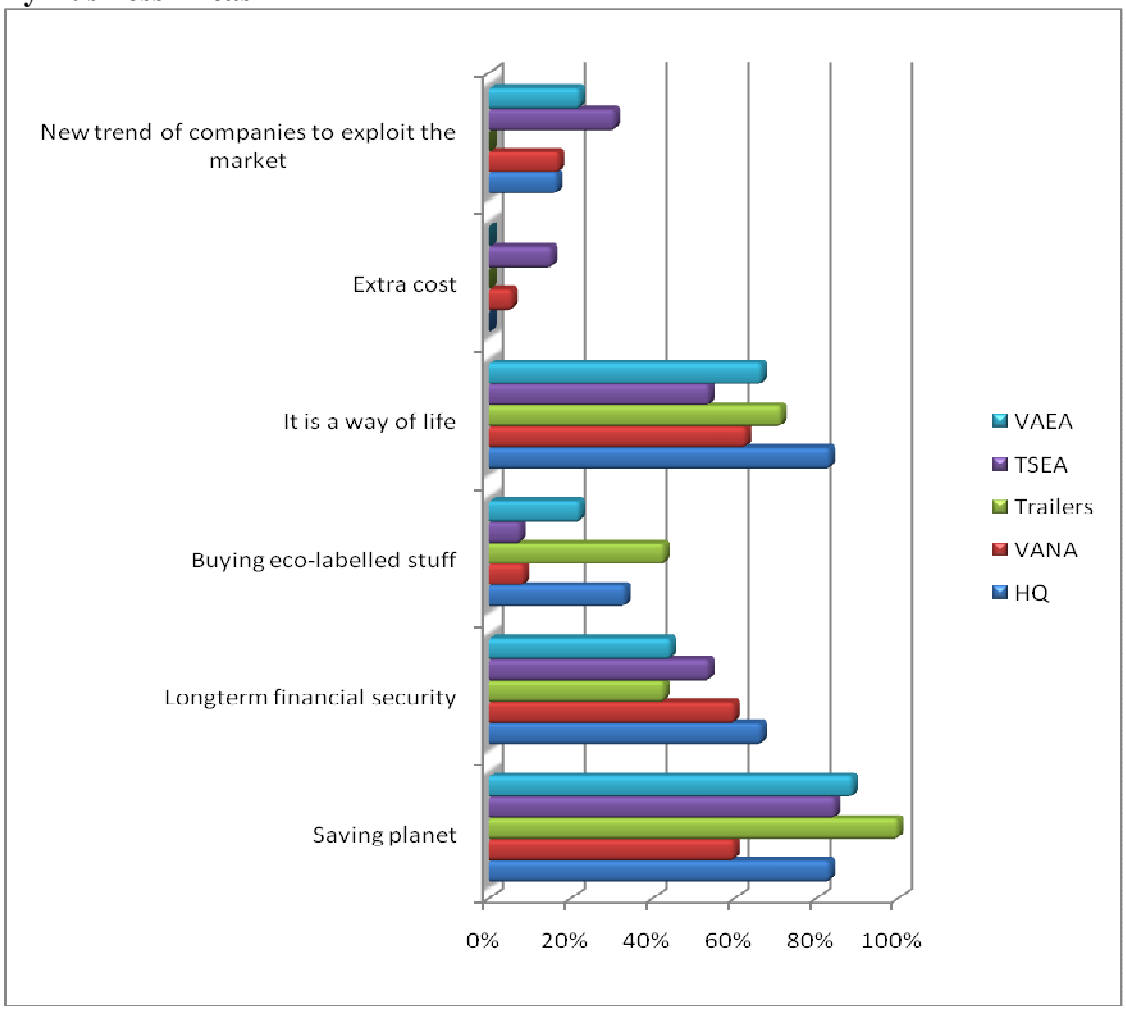


Figure 4. Personal definition of Sustainability by Business Areas

Analysis

From the results we find that the general understanding sustainability is that it is something to do with saving the planet, and rightly so. The word to sustain as defined by the Collins English dictionary[32] refers to to maintain or continue for a period of time. Sustainability is also often percieved as an environmental approach.[33]Thus the general response of associating Sustainability with 'Saving the Planet' and also as 'a way of life'

[32] Collins English Dictionary, http://www.collinslanguage.com/results.aspx, Retrieved on 1st June 2010
[33]MIT Sloan, Management Review, Interview with Peter Senge, Senior Lecturer in Behavioural and Policy Sciences at MIT Sloan School of Management http://sloanreview.mit.edu/beyond-green/sustainability-its-not-what-you-think-it-is/, Retrieved on 2nd June 2010

3.2.3.2 Definition of Sustainability in Business

With this question, we aim to understand what the THULE employees mean by sustainability in business.

Q. What does 'Sustainability' (in Business) mean to you ?

Results :

THULE in General

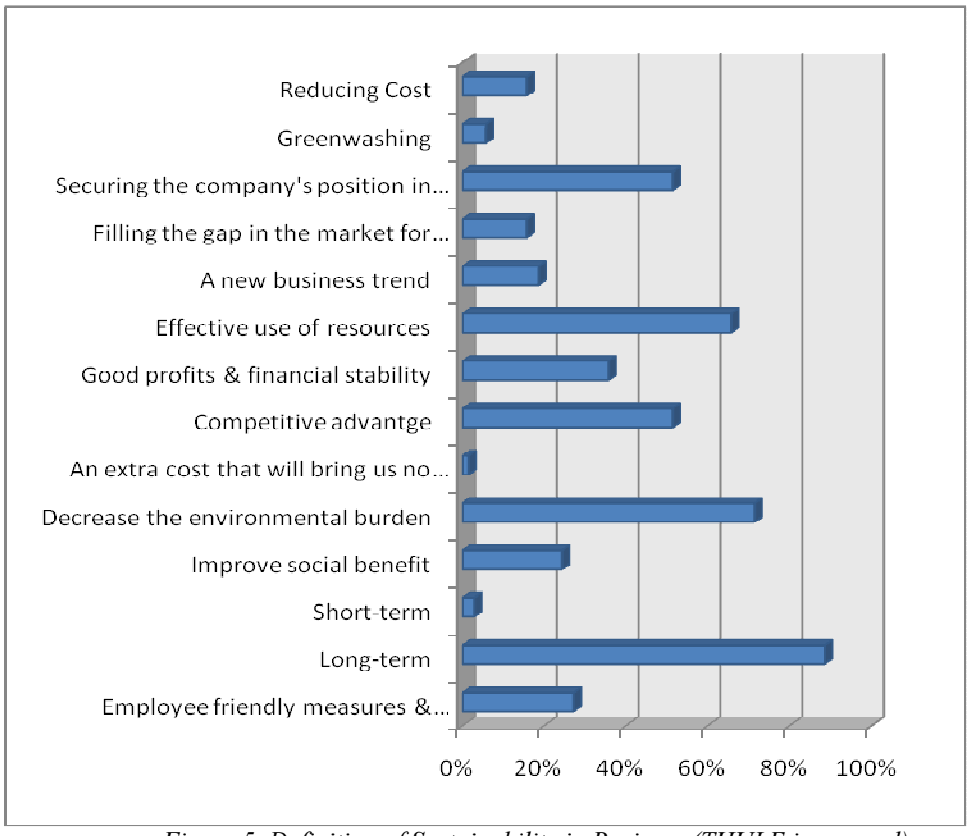


Figure 5. Definition of Sustainability in Business (THULE in general)

Analysis

From the results we observe the same trend from the 1st question concerning the most popular answer. The most popular answers are long-term, decrease the environmental burden, effective use of resource followed by securing the company's position in the market. The 2 dimensions of sustainability, environmental and economic have correctly been indentified but the employees but again we find that improving the social benefit is not being strong associated with sustainability.

By Business Areas

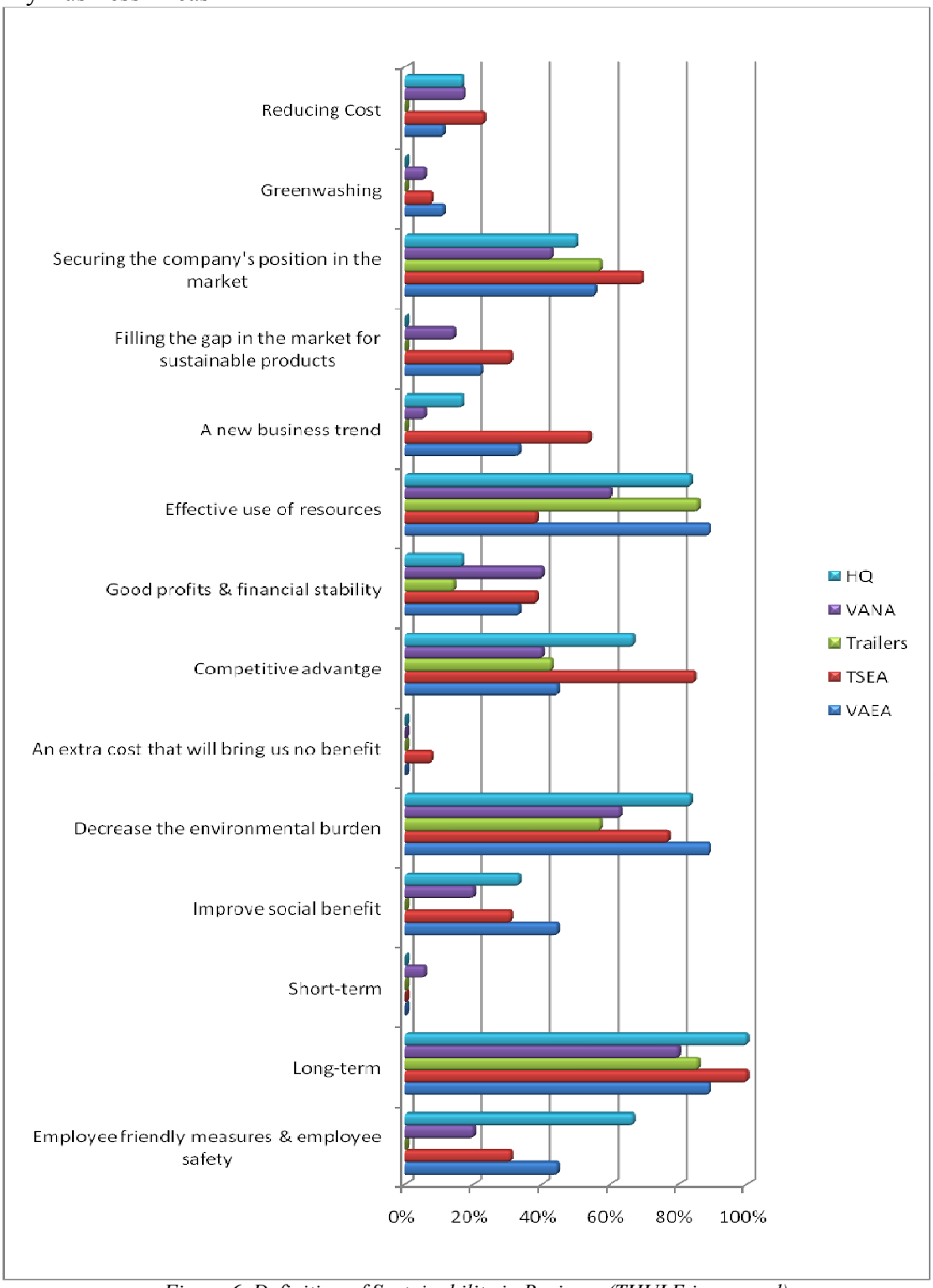


Figure 6. Definition of Sustainability in Business (THULE in general)

3.2.3.3 Sustainability Focus for THULE

This question aims at capturing the dimensions of sustainability on which THULE should focus on according to its employees.

Q. Sustainability in Business encompasses economic, social and environmental aspects. According to you, what would be the order of preference you recommend Thule to focus on.(Rank the following from 1-high to 3-low)

Results

THULE in general

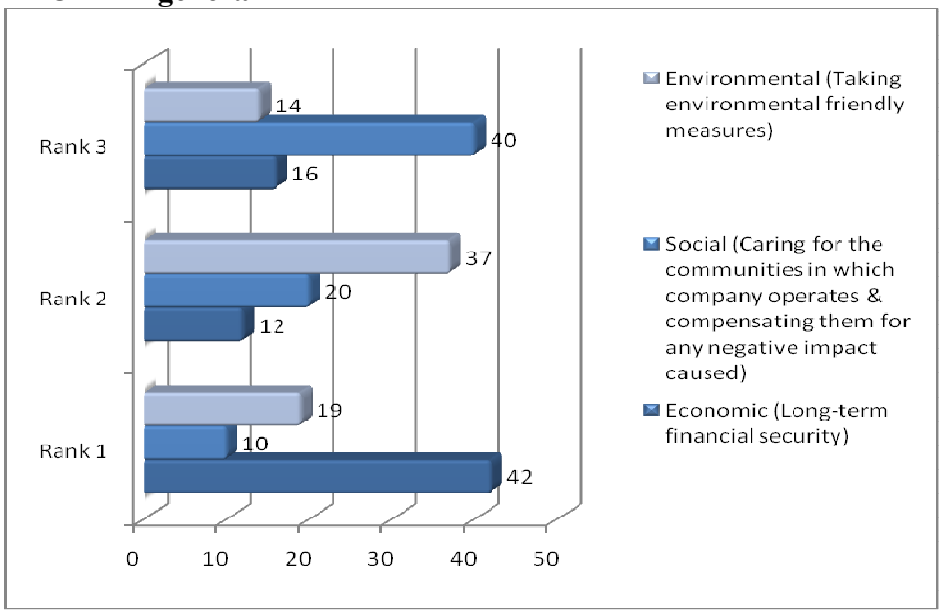


Figure 7. Sustainability Focus for THULE in general
x-axis shows number of responses and y axis represents the 3 dimensions of sustainability

By Business Area

To analyze the response from each business area, three charts have been made. Each represents the responses for each dimension by business area.

Economic (Long-term financial security)

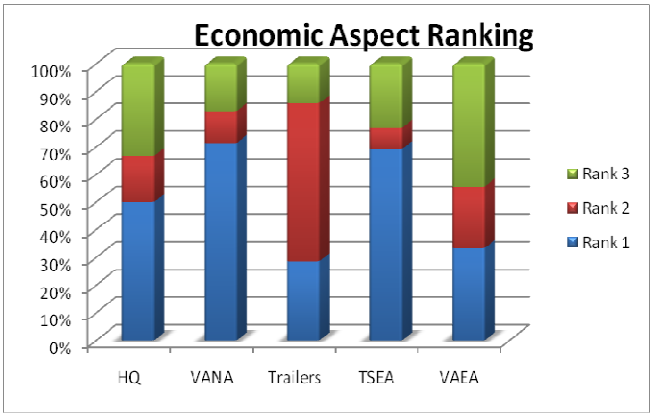


Figure 8. Economic focus by Business Area

Social (Caring for the communities in which company operates & compensating them for any negative impact caused)

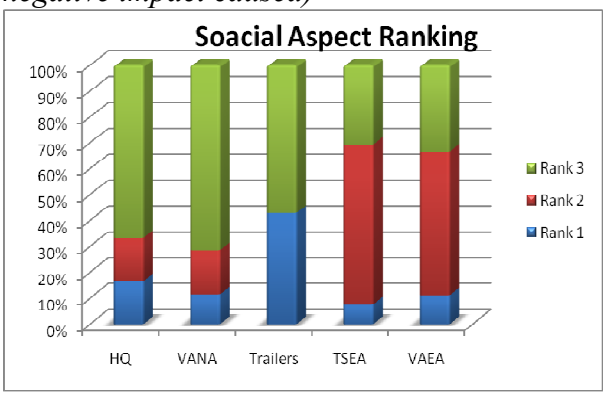


Figure 9. Social Dimension by Business Area

Environmental (Taking environmental friendly measures)

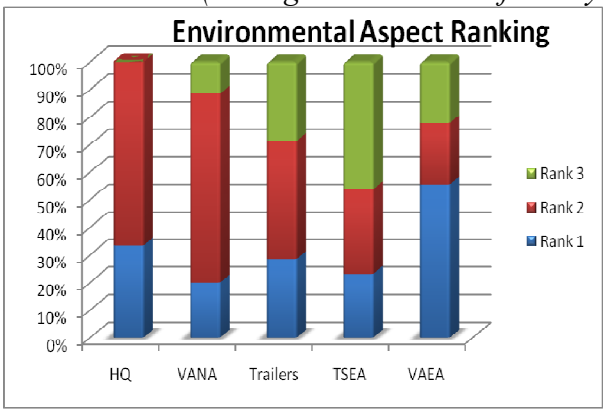


Figure 10 Environmental dimensions by Business Area

From the responses we see that the THULE employees think that the focus should be mainly on the Economic and Environmental aspect of their business.

3.2.3.4 Where the focus currently is.

With this question we want to find out in which aspect of sustainability does the THULE employees think the company is doing well. They were asked to rate from 1 to 5 (1 meaning poor to 5 meaning extremely well)

Q. According to you how well is Thule currently performing in the following aspects of sustainability?

Results

THULE in general

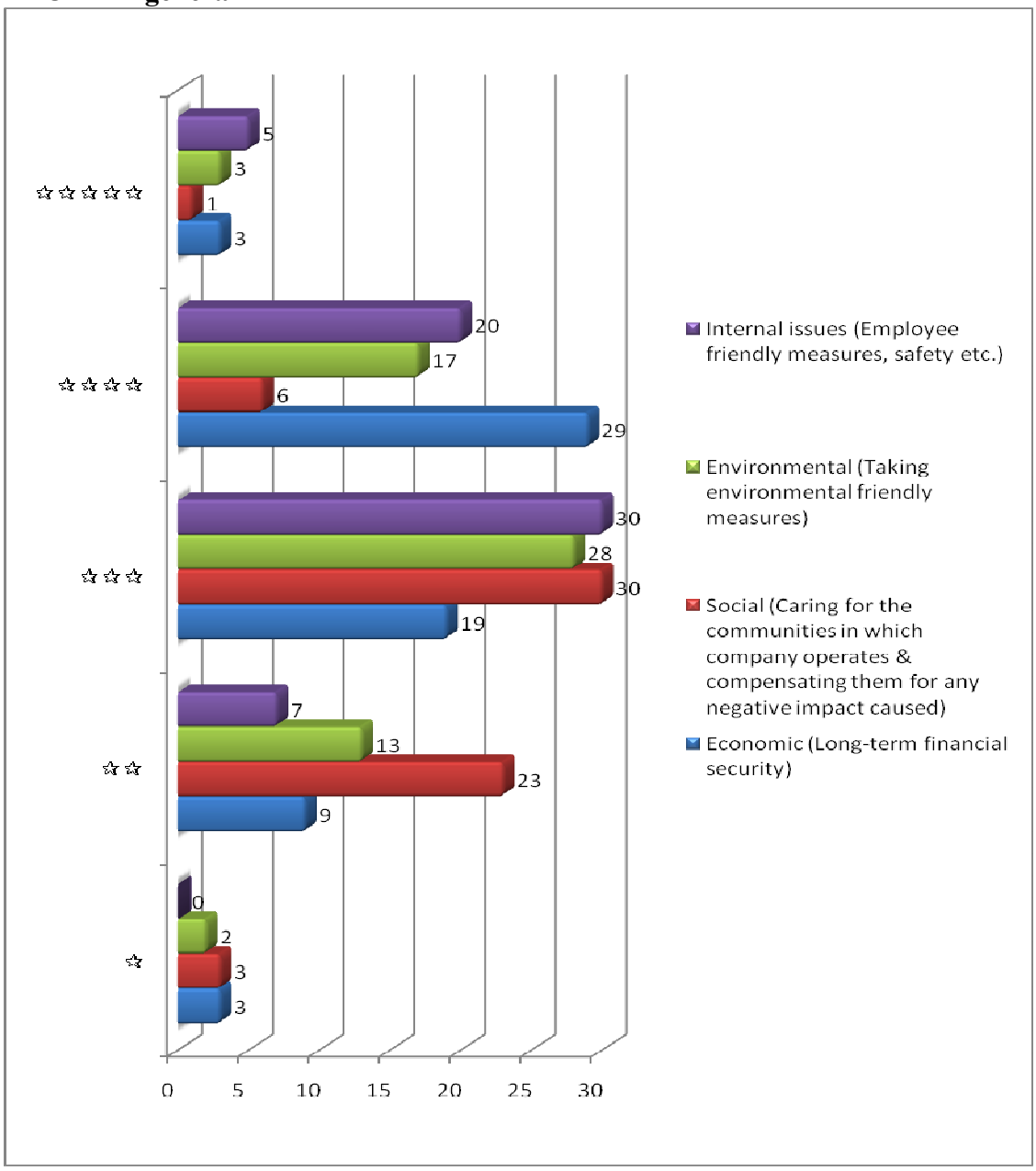


Figure 11. Current Focus in General

Analysis

From the general result we find that in general the perception just enough focus is being given to the Environmental, Social and Internal issues. More focus seemed to be on the Economic issues. The area that most employees think that THULE could do more is in the Social dimension

Results by Business Areas

Economic

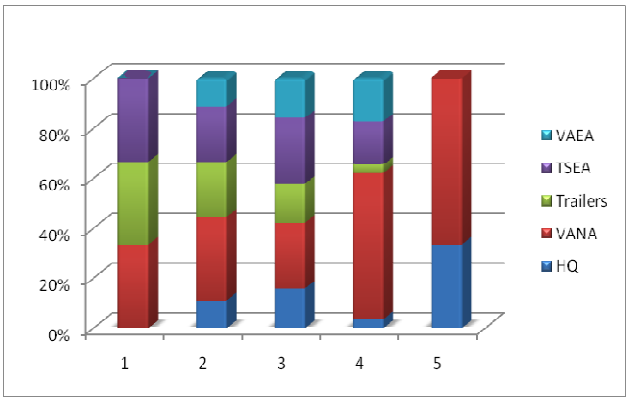


Figure 12. Current focus on Economic issues

Social

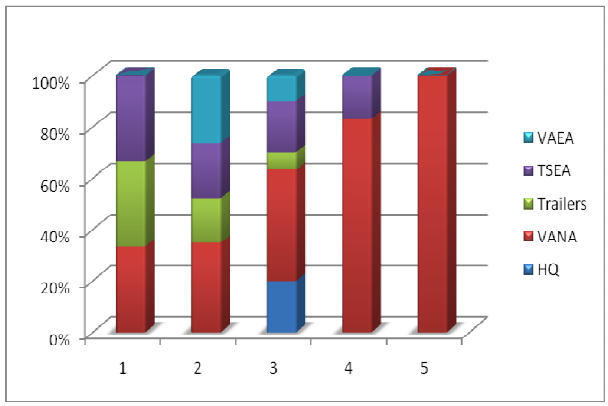


Figure 13. Current focus on Social Issues

Environmental

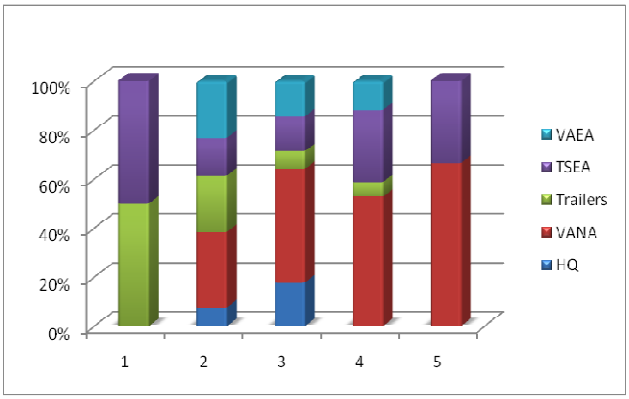


Figure 14. Current focus on Environmental issues

Internal issues

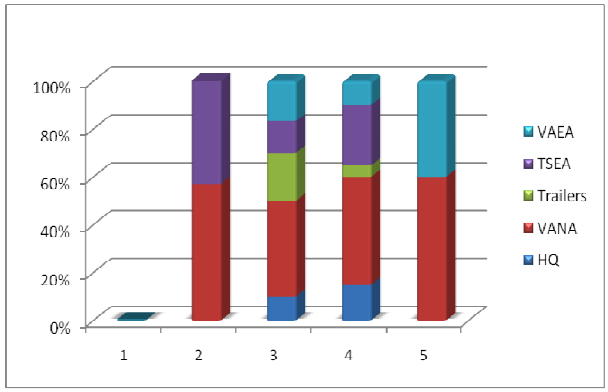


Figure 15 current focus on internal issues

Analysis

Most striking observations from these 4 charts are that VANA is doing the most concerning social issues and that the HQ in Sweden feel that not much is being done concerning the internal issues of the organization

3.2.3.5 Motivation for Sustainability

The aim of this question is to try to locate the factors what would encourage and enable THULE employees to indulge in sustainable practices

Q. What would make you put more attention to the sustainability aspects? (Tick all that apply)

Results

THULE in general

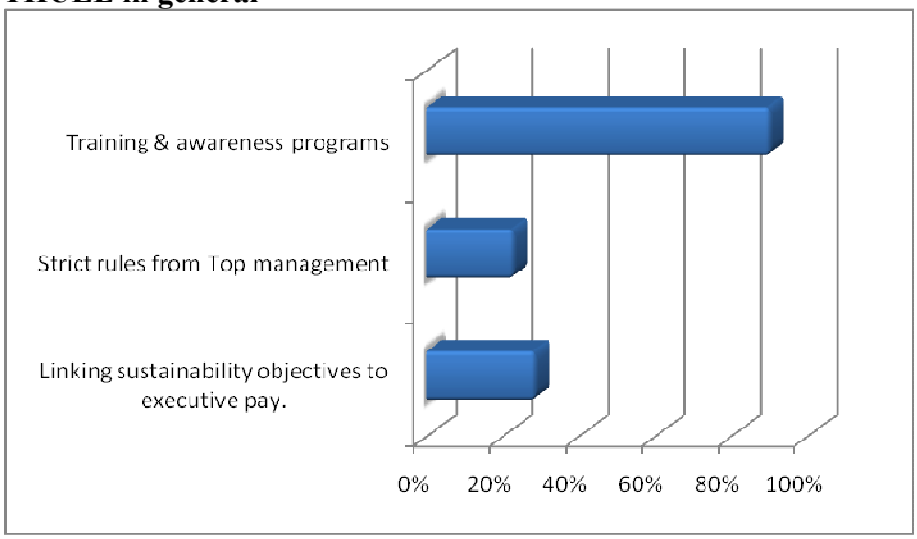


Figure 16. Motivation for sustainability for THULE in general

By Business Area

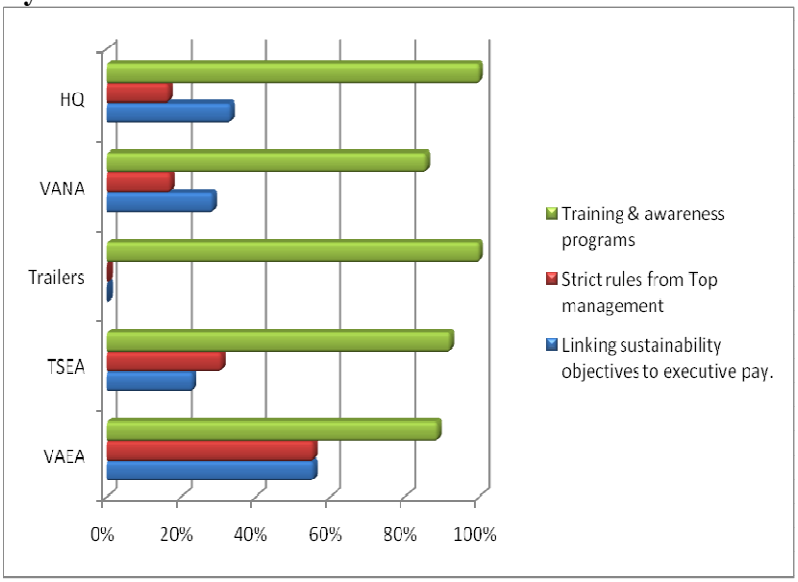


Figure 17. Motivation for sustainability by Business Areas

Analysis

By far, the most popular response to this question was that Training and Awareness programs would be the best way to promote sustainability within the organization. In his book[34], Bob Doppelt mentions that for successful engagement in sustainability an organization must tirelessly be communicating the need, vision and strategies for achieving sustainability. Lack of effective communication on new concepts will hinder the move towards a more sustainable organization.

[34] Doppelt, Bob, "*Leading Change Towards Sustainability : A Chang e-Management Guide for Business, Government and Civil Society*", Chapter 10, Pg 173, GreenLeaf Publishing, (2003)

3.2.3.6 Existing sustainability practices at work

The objective of this question was to find out if THULE employees were already implementing sustainability practices in their daily work. We left the question open-ended so that they could narrate their activities in detail.

To ease readability, we have tried to summarize the sustainability practices in 9 different categories that would be suitable for THULE :

Category	Description
1. Efficient Use of Energy	Energy conservation measures, innovative use of techonology, energy efficient appliances and devices, etc
2. Efficient Use of Raw Material	Ensure minimum generation during production process, use less items such as paper
3. Waste Management	Programs to recycle the different wastes generated
4. Transport	Green Travel Plans, Innovative use of technology to decrease travel
5. Sustainable Purchasing/Procurement	Buying materials which are environmental friendly, buying from suppliers with a certain level of ethics
6. Efficient Packaging	Use recyclable material, full use of space, less material
7. Economic/Financial Stability	Sustainable budgeting, avoiding unnecessary expenses
8. Local Environment(Internal issues, workplace)	Ergonomics, Employee safety, Social Interaction.
9. Corporate Social Responsibility (CSR)	Community activities, maintaining good relationship with all stakeholders(e.g good customer relationships),

Table 17. Categories for sustainability developed for THULE

The results from the question are presented according to these categories, with an indication of the ID and Business area of the response. The responses are taken verbatim from the questionnaire and have been put in between inverted commas and in italics font.

All the results in full details are provided in the Appendix

Q. Are you taking sustainability aspects into account in your daily work? If so, in what type of work tasks?

Result According to Category

- Efficient use of energy

1. "*I'm trying to minimize the costs and negative environmental impact of my daily work. Reducing the use of electricity waste etc*"". (Corporate, Malmo, Response ID1822486)

2. "*Try to reduce the consumption of energy paper etc. Encourage my colleagues to think green*"" (Trailers, Denmark, Response ID1823110)

3. "*……. sending electronic documents, auto shutoffs for lights*" (VANA, USA, Response ID1777100)

4. "Yes. *... Have installed occupancy sensors in offices and restrooms…*''(VANA USA, ID1849370)"

- Efficient use of raw materials

1. "*Trying not to use too much of paper and other stuff in the office*." (Malmo, HQ, Response ID1822392)

2. "*Trying to print as few paper copies as possible*."" (Malmo, HQ, ID1823446)

3. "*Yes normal issues like no environmental issues…, reduction of material content & waste transport*"(Towing, Netherlands, Response ID 1825258)

4. "*Reduction of weight product + packaging*" (Towing Systems, France, ID1826427)

5. "*Avoid paper copies at all costs. Use reusable cups rather than plastic bottles or paper cups.''.* (VANA, USA, ID1776815)

6.'' *When possible always trying not to waste to reuse to recycle in an effort not only to keep Thule costs down but also to help the environment*.'' (VANA, USA, ID1776874)

- Waste Management

1. "*We are continuously improving the reduction of process scrap High focus on recycling all materials coming into the building; currently 85-90%.*" (VAEA, UK, ID1823541)

2. "[...] *Waste management Lean Manufacturing"* (VANA, USA, ID1776859)

3. "*reduce - reuse - recycle mindset*". (VANA, USA, ID1781957)

4. "*recycling all office materials*." (VANA, USA, ID1789633)

5. "*Reducing the use of [...] waste etc*." (HQ, Sweden, ID1822486)

- Transport

1. "*reduction of CO2 emissions by consolidation transport and reducing the transport network*". (HQ, Sweden, ID1823513)

2. "*I choose bike and train as means of transportation rather than going by car or by air [...]."* (VAEA, Sweden, ID1824022)

3. "Trying *to be smarter about travel plans - using more online meeting providers*." (VANA, USA, ID1802012)

4. "*Conference call vs meeting [...] bike to work at times [...]*." (VANA, USA, ID1777838)

- Sustainable Purchasing

1. "*Environment friendly designs* [...]." (THULE Towing systems, Sweden, ID1844935)

2. "*Use reusable cups rather than plastic bottles or paper cups*." (VANA, USA, ID1776815)

3. "*RECYCLABLES SUCH AS CARDBOARD STRETCH WRAP AND OFFICE PAPER." (*VANA, USA, ID1798657)

- Efficient Packaging

1. "[...] *cooperate with customers to reduce freight weight etc*." (Towing, NL, ID1824972)

2. *"[...] reduction of material content & waste transport*." (Towing, Netherlands, ID1825258)

3. "*Reduction of weight product + packaging*." (Towing System, France, ID1826427)

4. "*Yes - We try to limit use of packing materials*." (Trailers, Denmark, ID1823176)

5. "*We also return used corrugate*." (VANA, USA, ID1849370)

- Economical/Financial Stability

1. "*Yes especially in new developments Capex. Meetings with project teams etc*." (Towing Systems, Netherlands, ID1797435)

2. "*Yes. Cash flow improvement*." (VANA, USA, ID1776854)

3. "*Best and fastest to market utilizing best practices of material choices and ingenuity to increase market share*." (VANA, USA, ID1789138)

- Local Environment

1. "[...] *good ergonomics for customers and employees*." (Thule Towing system, Sweden, ID 1844935)

2. "*Encourage my colleagues to think green*." (TRAILERS, Denmark, ID1823110)

3. "*Focus on well-being of my employees both short term and long term." (Trailers, Denmark*, ID1823021)

4. "*Environmental aspects and safety for employees*." (VAEA, Italy, ID1828899)

- CSR

1. " [...] *We are also working an a long term relation with our customers*." (Thule Towing System, Sweden,ID1844935)

2. "*offering a solution which brings customer uses confident and reliable in time*". (Towing, France, ID1823276)

3. "[...] *no child labour* [...]." (Towing, Netherlands, ID1825258)

4. "*Support local companies with business when possible*." (VANA, USA, ID1776815)

5. "[...] *Strong customer service world class products employee relations*". (VANA, USA, ID1777371)

- No Sustainability Activities

1. "*No*" (HQ, Sweden, ID1823544)

2. "*No*" (Thule Towing System, Poland, ID1827092)

3. "*NO*" (VANA, USA, ID1776758)

4. "*No not really*" (Trailers, Sweden, ID1840749)

5. "*No*" (VAEA, Sweden, ID1822440)

Analysis of Results

As observed from the various accounts, there seem we observe practices which fall in all the 9 categories. Some respondents have also said that they have no sustainability activities in their daily tasks even though other employees from same business area have described sustainability activities in their daily tasks. We think that this might be attributed due to lack of communication from the departments in the same business areas or lack of knowledge about what exactly are sustainability practices. Another reason could be that the respondents who said no did not really want to fill in this question/questionnaire.

3.2.3.7 Possibilities to perform better in terms of Sustainability.

The THULE employees were also asked about the possibilities where THULE could perform better in terms of sustainability

Here also the comments from the employees are presented using the same methodology as mentioned in section 3.2.3.6

On top of the 9 categories, we have also presented some of the general comments put forward by the employees.

Q. Please describe any possibilities that you can see where Thule can perform better in terms of Sustainability (Social or Environmental aspects). It can be any thing like minimizing the waste, optimal use of resources, energy conservation etc.

Results

General Comments

1. "*Almost in all aspects*'' (HQ, Sweden, ID1822392)

2. ‘*'make this an agenda point for senior management*" (HQ, Sweden, ID 1822486)

3. "*Thule needs to implement environmental and social accountability analysis in all sourcing, production and acquisition decisions. Too much is unexplored at this point in time*.""(HQ, Sweden, ID1822486)

4. "*Create a sharp "green" profile and culture. The active lifestyle which is our core value is strongly connected to nature and out door life. (it will give us brand recognition as well). Show environmental (and ethically) responsibility in all business aspects from sourcing to distribution*." (Trailers, Denmark, ID1823110)

5. ‘*'Thule could improve how they utilize existing competences within the group across BA's. Especially when closing down organizations in one end and strengthen in another end*.'' (Towing Systems, Sweden, ID 1827342)

6. "*We can start to talk about the matter more. Clearly define what we will focus on when it comes to sustainability during the coming years. I think we should focus on all of the above*

suggested areas (Economic, Social, Environmental and Internal Issues)."(VAEA, Sweden, ID1823252)

7. "Sharing successes from other BA's, best practice sharing..."(VANA, USA, ID1777838)

- Efficient use of energy

1. "*Switch off the lights in offices…*''(HQ, Sweden, ID 1827759)

2. "*Energy consumption specification for our products as well as specified in what type of energy that has been used*."(Towing Systems, Sweden, ID 1844935)

3. "*Focus on saving energy from production, heating and lightening…..*''(Towing, Denmark, ID 1822995)

4.*" - ease the usage of Scanners (would ease the electronic archiving)*
-encourage the video conferences vs. travels,
- reduce heating/ air conditioning when offices are not utilized (holidays, week- ends)
-turn off all computers, copiers, printers before leaving
-put this into the Purchase requirement we expect from our Suppliers
- utilize the roofs of the factories for Electrical power (or selling Green Electricity to the local Electric Company) " (Towing Systems Europe/Asia, France, ID 1825983)
5. "*Change our very old thermoforming oven to new, more efficient, design potentially saving 40% in energy. Utilising more renewable energy sources*" (VAEA, UK, ID 1823541)

6. "*Very happy to see the recent installation of solar panels - given our location on the top of a windy hill - it would be great to see a wind turbine...*" (VANA, USA, 1802012)

7. "*Our CT office installed solar panels on their roof to generate electrify and reduce reliance on the electric company. The opportunity is for other sites to rely more heavily on the sun for energy needs*." (VANA, USA, ID1849370)

Efficient use of raw material.

1. "*Better planning and quality control at the beginning of the product development and production cycle. No up front quality control visibly in place at this time*.""(VANA, Canada, ID1780081)

2." *Engineering end of life plans into each of our products. Eliminating of all PVC or other harmful materials from our products*" (VANA, USA, ID 1789633)

3. "*Eliminate use of plastic K-cups in coffee machine. Distribute re-usable coffee mugs and charge $0.25 for disposable cups*" (VANA, USA, ID 1792060)

4. "*Remove carpeting in all buildings to cut down on chemical cleaning and allergens; install environmentally-friendly solid surface flooring; work to provide more natural light to cut down on electrical needs; keep vents clean for employee well-being…*" (VANA, USA, ID1776885)

- Waste Management

1."…*recycle waste in the kitchen*"(HQ, Sweden, ID 1827759)

2. "Waste *reduction, product development is the big potential…*"(HQ, Sweden, ID 1823544)"

3." *Thule can take direction on product recycling materials, for example by Thule box production*."(Towing Systems, Poland, ID 1827092)

4." *Recycling of used products/material*" (VAEA, Sweden, ID1824022)"

5." *Where possible, I'd like to see a higher utilization of recycled materials (like we currently use in our cargo boxes*)." (VANA, USA, ID1802012)

6. "*Reducing our waste. From the production floor to becoming a more paperless company*."(VANA, USA, ID 1789138)"

7. *"…implement a week-long program to weigh garbage per department with a goal to reduce waste as the week progresses*" (VANA, USA, ID 1776885)

8. "*Better communication between purchasing and product development would result fewer scrapped parts each year as products are changed or discontinued*." (VANA, USA, ID 1777091)

- Transport

1." *Company cars and company bikes available at Thule offices, making it easy to take your bike to the office even if you have to use a car during your working day and making it easy to use a bike for shorter trips during your working day even if you have to use the car to get to work*"(VAEA, Sweden, ID1824022)

2. "Encourage *alternative transportation and carpooling with incentive*" (VANA, USA, ID1792060)

3. "*provide employee incentives to ride their bike to work*"(VANA, USA, ID1776885)

- Sustainable Procurement/Purchasing

1." I *think Thule should define an environment policy towards our suppliers*. "

2. "*Set requirements on SUPPLIERS for Sustainable actions and reaching certain objectives."(*VAEA, Sweden, ID1840980)

3. "*Focus on local suppliers for components*" (VANA, USA, ID 1776815)

4. "*KEEP GOING ON A UPWARD TREND ON SUSTAINABILITY IN TERMS OF SUPPLIERS*"(VANA, USA, ID 1776821)

- Efficient Packaging

1." *Recycling (re-use) of packing materials*."(Trailers, Denmark, ID1823176)

- Local Environment/Social Workplace

1." *Communication of present activities*"(Towing Systems, Netherlands, ID1825258)

2. "*Continue with environmental awareness and perhaps publicize efforts more within each location to gain 100% support and understanding from all employees which will spill into their lives and their communities outside of Thule*."(VANA, USA, ID 1776874)

3. "*keep vents clean for employee well-being*"(VANA, USA, ID 1776885)

4. "*COMPOSTING BINS IN CAFETERIA'S, RECYLCING BINS IN ALL OFFICES AND CUBICLES, COMMUNITY GARDEN PLOTS WHERE EMPLOYEE KEEPS HALF AND THE OTHER HALF DONATED (WHERE THERE IS ENOUGH LAND*)."(VANA, USA, ID1776912)

- Corporate Social Responsibility

1. *"...show additional fuel consumption on car when roof box is in use to make customer aware and only use when necessary.."(*VAEA, Sweden, ID 1845214)

2. "*Aligning ourselves as a corporation with one or two social causes. for example: feeding hungry, habitat for humanity, cancer research, etc*." (VANA, USA, ID 1789633)

3. "*Increase community involvement with sponsorships*" (VANA, USA, ID 1792060)

4. "*Social and environmental opportunities - more volunteer work with connection to environment*" (VANA, USA, ID 1798258)

5.” *More community outreach. Becoming a better neighbor in the city of Seymour and the surrounding area*.”(VANA, USA, ID 1776758)

6. “*Create more jobs in our community by manufacturing and assembling more in house.*”(VANA, USA, ID 1776815)

Analysis of Results

Some THULE employees are very aware about sustainability issues and have very clear ideas about how the company can move in that direction. Some of them also appear familiar with all the three dimensions of sustainability and from their responses they show a willingness to engage in those activities. The employees had suggestions for every different category and with the right support, a bunch of these ideas could be implemented in near future.

3.2.3.8 General Level of Awareness about sustainability

As a last question we asked the THULE employees what they thought their level of awareness about sustainability was.

Q. On the scale of 1 to 5, how do you rate your awareness of sustainability? (1 meaning not aware to 5 very aware)

Results

THULE in general

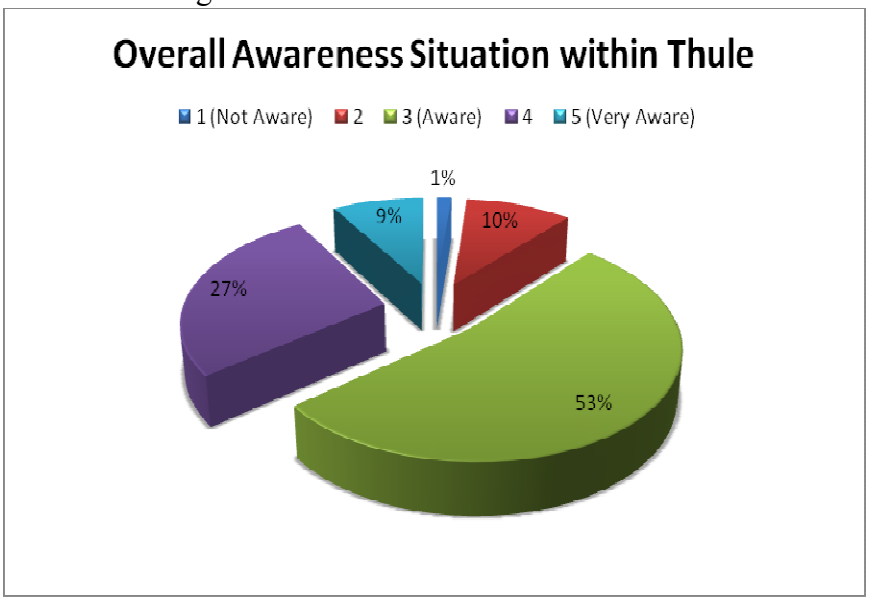


Figure 18. Level of awareness for THULE employees in general

Level of Awareness by Business Area

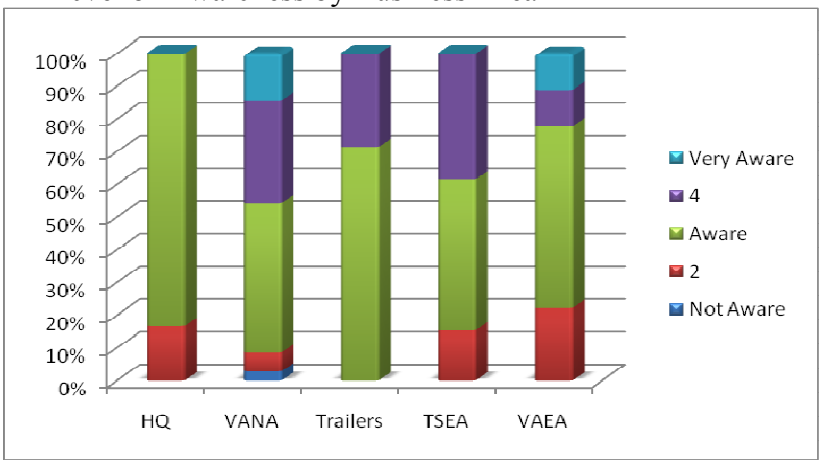


Figure 19. Level of awareness by Business Areas

Analysis of Results

More than half of the THULE employees say that they are aware about sustainability. Taking into consideration the previous answers, this level of sustainability is justified since most of

them associate sustainability with improving practices so that damage on the environment is minimized.

The reliability of this answer again is affected due to the fact that the VANA employees constitute half of the answers. So it is no surprise that VANA would have the highest level of awareness among the other business areas.

3.3 Conclusion from the Awareness Questionnaires.

From all the questions and responses, there appears to be a certain level of awareness among the THULE employees. Their level of awareness though seems to limit the concept of sustainability with its environmental dimension mostly. Some of the employees also demonstrate an ability to relate sustainability to their daily work and even suggest ways in which the sustainability approaches could be adopted at personal level as well at organizational level. We conclude that with awareness and training programs, THULE employees would be even more familiar with the concept of sustainability and thus be ready engage in more sustainable practices.

5. Carbon Footprint Calculation

In this chapter, we will present the framework and a method for calculating the carbon footprint of a Bike Rack, a THULE product. In following sections we present an introduction, methodology and calculation of the product carbon footprint.

5.1 Introduction to Carbon foot print

A 'carbon footprint' measures the total greenhouse gas emissions caused directly and indirectly by a person, organization, event or product.[35]

The main types of carbon foot print are organizational carbon footprint and product carbon footprint. Throughout this project our focus is only on product carbon footprint.

5.1.1 Product Carbon footprint

Emissions over the whole life of a product or service, from the extraction of raw materials and manufacturing right through to its use and final reuse, recycling or disposal.[36]

Therefore Carbon footprint is a cradle to grave approach. In most cases, in addition to carbon dioxide, many other Green House Gases (GHG) are released into the environment during various activities. These GHG emissions are converted into the carbon dioxide equivalents (CO2e) by multiplying with their respective 100 year Global Warming Potentials (GWP). Carbon dioxide equivalent (CO2e) allows the different greenhouse gases to be compared on a like-for-like basis relative to one unit of CO2. This way the carbon footprint of any activity can be represented in terms of carbon dioxide emissions.

Calculation of a product carbon foot print requires unusual amount of data. Even the type of data that is required is not retained in most companies, it often requires product specific data through out and beyond the value chain. It can be calculated better by working on-site with active interaction with the client. In most cases approximations and logical assumptions are made to overcome the data constraints. The degree of this approximations and logical assumptions depend on various factors such as data availability, ecosystem etc. Therefore the carbon foot print calculation can be regarded as an estimate rather than exact. Wherever in this project an approximation or assumption is made, we had put our best effort to explain why it is made and how it is made.

[35] http://www.carbontrust.co.uk/cut-carbon-reduce-costs/calculate/carbon-footprinting/pages/carbon-footprinting.aspx, retrieved on May 28th 2010
[36] Ibid.,

5.1.2 Benefits from measuring a product carbon footprint

Measuring a product carbon footprint can result in various benefits to organization. Some of benefits are listed below[37].

Attracting customers

Customers are becoming increasingly aware of the environmental impact of the goods and services they use. This is clearly evident from the fact that the demand for eco-friendly products has been on the rise over the past few years. Demonstrating a lower carbon footprint of products than the competitor products might result in a competitive advantage.

Brand identity

Reporting product carbon footprint or getting a certification shows that an organization is environmentally and socially responsible organization. This improves its brand image and brand value.

Leadership

Reporting the products carbon footprint will support your corporate responsibility endeavors and improve your reputation. This can result in leadership advantage in market and industry. It helps to develop better relationships with your supply chain as they tend to relate themselves to your organization due to its reputation.

Cost savings

Ascertaining emissions at each stage of a product gives greater insight into all the processes and aides in identifying the areas where GHG emissions can be reduced. This often results in cost savings in terms of transport, energy, material usage, wastes, packaging etc.

Emission savings & integrating it into decision making

Looking at the whole supply chain will help you reduce your emissions from factors such as suppliers, choice of materials, production processes, product designs and modes of transport etc.

5.2. Methodology to calculate product carbon footprint

We chose PAS 2050 method to calculate product carbon footprint. PAS 2050 is a Publicly Available Specification for assessing product life cycle GHG emissions, prepared by BSI British Standards and co-sponsored by the Carbon Trust and the Department for Environment, Food and Rural Affairs (DEFRA), UK. PAS 2050 has been specially designed

[37] http://www.carbontrust.co.uk/cut-carbon-reduce-costs/calculate/carbon-footprinting/pages/product-carbon-footprint.aspx retrieved May 29, 2010

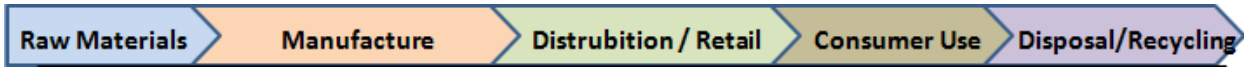
to aid companies in the calculation of their product / service carbon footprint and help them reduce the GHG emissions. This method calculates the GHG emissions of a product across its entire life cycle – from raw materials to all stages of its production, distribution, use and its disposal / recycling. Reasons for choosing PAS 2050 are that it is a reliable and most popular method to calculate product carbon footprint. In addition to this, comprehensive information about PAS 2050 is available on internet, most importantly a 'Guide to PAS 2050' and 'PAS 2050:2008 Specification for the assessment of the life cycle greenhouse gas emissions of goods and services'.

According to PAS 2050 there are 5 steps to calculate carbon footprint of a product. Here we attempted to summarize these steps briefly.

Step 1: Building a process map

Build process map of product's life cycle, from raw materials to disposal, including all material, energy, transport, usage, recycling and waste flows. The goal is to identify all materials, activities and processes that contribute to the chosen product's life cycle. This process map is a valuable tool and acts as a graphical reference to guide in the collection of data and footprint calculation. To develop a process map start by breaking the product's functional units into its constituents (e.g. raw materials, packaging) by mass. This can be achieved by available data, consultation, observation and understanding.

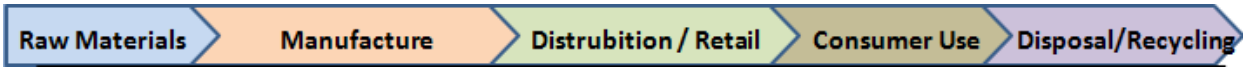
For a B2C business model the life cycle of a product that has to be considered for the process map consists of five stages as shown below. For a B2B product the last two stages, consumer use and disposal/recycling must be excluded. B2B product carbon footprints stop at the point at which the product is delivered to another manufacturer, consistent with the 'cradle-to-gate' approach



Process map stages for business-to-consumer good

Step 2: Checking boundaries and prioritization

After making the process map, relevant boundaries for the carbon footprint analysis must be determined. The system boundary defines the scope for the product carbon footprint, i.e. which life cycle stages, inputs and outputs should be included in the assessment.[38]



Raw Materials	Manufacture	Distrubition / Retail	Consumer Use	Disposal/Recycling
-All inputs used at all stages in the lifecycle - Procedures related to raw materials: Mining/Extraction, Pre-processing, packaging, storing, transport	-All activities from collection of raw materials to distribution: All production processes, Transport, Storage, Packaging, and site related emissions -Material produced: Wastes, By-products	-All steps in transport and related storage	-Direct energy required during usage phase	-Steps in disposal -Energy required in disposal/recycling process - Direct emissions due to disposal / recycling

Common materials / activities to include within product's lifecycle boundary

Step 3: Collecting data

Two types of data are required for the calculation of a carbon footprint: Activity data and emission factors. Activity data refers to all the material and energy amounts (mass/volume/kWh/km) involved in the product's life cycle such as material inputs and outputs, energy used, transport, etc. Emission factors provide the links that convert these quantities into the resulting GHG emissions: the amount of greenhouse gases emitted per 'unit' of activity (e.g. kg GHG per kg input or per kWh energy used).

Step 4: Calculating the footprint

The carbon footprint or total GHG emissions of an entity is calculated by summing all the materials, energy and wastes across all activities in a product's life cycle multiplied by their corresponding emission factors.

Carbon footprint of a given activity = Activity data (mass/volume/kWh/km) X

Emission factor (CO_2 e per unit)

[38] Guide to PAS 2050, File accessed from www.carbontrust.co.uk

Carbon emissions from all constituent activities are summed up to get the total GHG emissions or carbon footprint of an entity.

Step 5: Checking uncertainty (optional)

The objective of this step is to measure and minimize uncertainty in the footprint result and to improve the confidence in footprint comparisons and any decisions that are made based on the footprint. Uncertainty can be reduced by replacing secondary data with good quality primary activity data, using more specific, more recent and more reliable data and also by trying to use a realistic model. PAS 2050 does not explicitly require uncertainty analysis[39] therefore this is an optional step.

5.3. Carbon footprint of bike rack

We estimated the carbon footprint of a bike rack (ROADWAY 4 BIKE 2" & 1.2, Item # 914), a product of Thule AB, Vehicle Accessories North America according to PAS2050. This product is manufactured at Seymour plant, USA. The other products that are produced in this plant include car racks and boat racks. In most cases, the method PAS2050 with all the prescribed steps cannot be used as it is, because of the data constraints that arise in practice. It has been adapted to this case and some approximations & assumptions had to be made to overcome the data constraints. Wherever an approximation or assumption is made, we had put our best efforts to explain why it is made and how it is made. However we hope that this is the best possible estimate that can be reached for the given conditions. Here we represented the whole process of calculation in few steps.

Process map of bike rack

This process map has been developed based on the data received, consultation and constant updating process until we got complete understanding of lifecycle of the product (Bike rack). All the materials, activities and processes that contribute to the chosen product's life cycle have been identified and represented. This acted as a graphical reference throughout our calculation process.

[39] Ibid.,

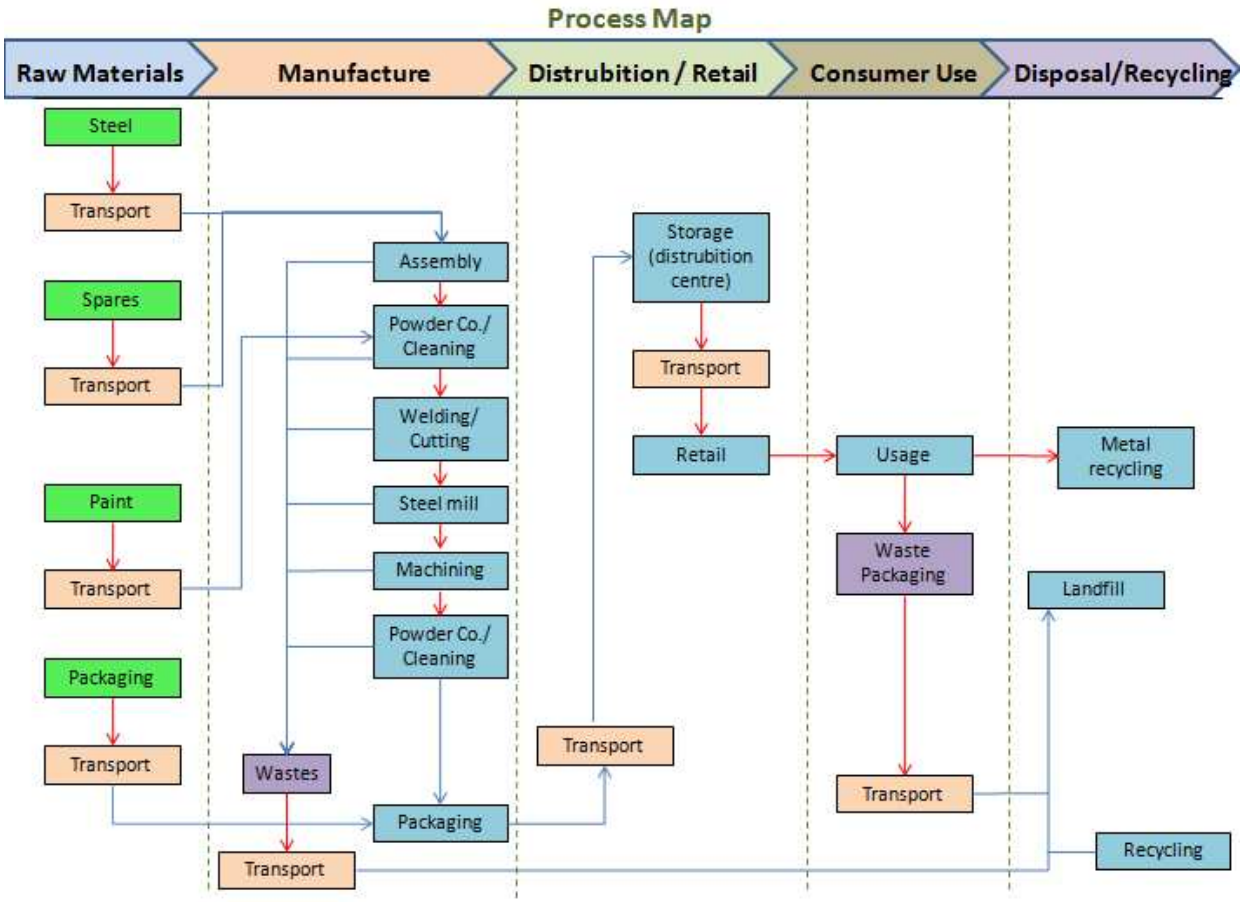


Figure 20. Process map for Bike rack

Checking boundaries and prioritization

In this step we could identify what needs to be taken into account and what can be excluded for the given case. PAS 2050 allows the exclusion of any single source resulting in less than 1% of total emissions. A firsthand idea on the kind of data required has been conceived in this step. We had setup boundaries where to start and end the calculation.

Collecting data

It was an arduous task to identify and collect all the data that is required. Based on our data requirements we made a questionnaire and sent it to the plant. After a back and forth process of consultation we got enough data to start the calculation process. A large part of data we got from the client (Thule) can be found in the appendix. The data is in the form of an excel sheet, this is the data that was used for the calculation.

A large part of data such as emission factors are UK specific data. They differ little bit from country to country because the industry practices and energy sources are different in different countries. In our case we are calculating for a product made in US. We had a free and relatively easy access to UK specific data and also observed that the difference between these data sets is very less and it does not make much difference to the final result. It is assumed that they would also average out in the process of whole calculation.

Calculating the footprint

Our attempts to calculate it according to the rulebook and the corresponding templates we made for this purpose can be found in the appendix section. Understanding the deviation of practical situation from theory we adapted the process of calculation for this case. In the following sections the emissions arising from different activities have been grouped into categories to tackle them effectively as well as for lucid representation.

Carbon emissions from materials

Carbon emissions of different materials that are used in the making of one unit of Bike rack are estimated below. The types of materials that go into it are found to be steel, plastic, aluminum, paper, corrugate, nylon strap. All the materials used are assumed to be recycled materials while choosing the emission factors. For virgin materials the emission factors are fairly higher.

The emission factors of materials that are listed here are their respective life cycle emission factors. Life cycle emission factor covers the stages extraction, primary processing, transportation, manufacturing, transport, reuse/recycling/landfill except product/material use. Some other emissions also add up as the raw steel is turned into spares. This part is omitted as we have no data concerning the upstream process from material steel to spares. Therefore we are associating the emission factor of material steel to spares made of steel. The same has been done with respect to the emission factors of plastic and aluminum. The emission factor of nylon strap could not been found, therefore it has not been taken into account. However we assume that it would not influence the final result much as its corresponding activity (weight) data is very low.

In the following table the Co_2 equivalent emissions of all constituent materials is calculated by multiplying their respective weights with corresponding emission factors.

Co_2 emissions of material = Weight of the material (Kg) * Emission factor

Material	Weight (Kg)	Emission factor (kg of Co2/ton of material)	Total kg of Co2 equivalent
Steel	11.54	1800[1]	20.77
Plastic	2.05	1600[1]	3.28
Aluminum	0.59	1005[2]	0.59
Paper	0.004	950[1]	0.0038
Corrugate	1.33	950[1]	1.264
Nylon strap	0.097	–	–
Total Co2 equivalent emissions from materials per unit product			**25.90**

Therefore a total Co_2 equivalent emission from all material constituents of a unit of bike rack is **25.90 kg**.

Carbon emissions from transport

For calculating the carbon emissions of transport the amount of fuel consumed is required (or) the type of vehicle and distance travelled is required so that based on its mileage we can calculate the amount of fuel consumed. We also need to know the payload carried by the vehicle to find the factor of carbon emissions contribution by the weight in question.

In our case we know the type of vehicle, distance travelled and the average payload carried by the truck. Carbon emissions from all kinds of transport involved are calculated below. Based on the data received, 48foot trucks are used with an average payload of 15000 pounds (~6.8 ton) for inbound transport and 20000 pounds (~9 ton) for outbound transport.

From Annex 7 Freight transport, for an articulated truck with a payload of around 6 ton the kg Co2 equivalent per ton.km is 0.14138.[40]

Total ton.km travelled * Kg Co_2 equivalent per ton.km = Total kg of Co_2 equivalent

Total ton.km travelled = (Quantity per assembly * weight in ton) * Distance in km

The mode of transport in some of the cases is mentioned as boat. We have no data concerning the type of boat. Wherever the mode of transport is boat, the country of origin is mentioned as Taiwan. As it is intercontinental shipping we assumed it to be 'Large bulk carrier' and the corresponding kg Co2 equivalent per ton.km is found to be 0.00706 in Annex 7 Freight transport. [41]

Carbon emissions from inbound transport

The items that involve transport have been identified from the data sheet (in appendix) and listed here in the first column of the table. These are the items that are transported from suppliers to the plant. The second column 'Total ton km travelled' has been calculated by using the above stated formula.

Item #	Total ton km travelled	Kg Co2 Equivalent per ton km	Total Kg of Co2 Equivalent
7533727	0.35	0.14138	0.049483
853518498	0.122	0.14138	0.017248
8537161	0.112	0.14138	0.015835
8537096	0.254	0.14138	0.035911
853518498	0.488	0.14138	0.068993

[40] http://www.defra.gov.uk/environment/business/reporting/conversion-factors.htm retrieved May 20, 2010.

[41] Ibid.,

7533741	0.510	0.14138	0.072104
853518498	0.244	0.14138	0.034497
853521202	3.914	0.14138	0.553361
8537093	8.758	0.00706	0.061831
853709302	8.758	0.00706	0.061831
8535829	0.052	0.14138	0.007352
7533535	0.059	0.14138	0.008341
8535753	0.0002	0.14138	0.000028
8532181	0.0015	0.14138	0.000212
853147704	0.002	0.14138	0.00028
8535567	0.0010	0.14138	0.000141
753203007	1.890	0.00706	0.013343
5155154	0.00003	0.14138	0.000004
7533748	0.056	0.14138	0.007917
8537094	11.120	0.00706	0.078507
853709404	11.120	0.00706	0.078507
7533747	0.037	0.14138	0.005231
853595302	0.019	0.14138	0.002686
951122411	0.002	0.14138	0.000283
853701202	0.022	0.14138	0.003110
853578702	0.0003	0.14138	0.000042
853558402	0.004	0.14138	0.000566
8537292	11.540	0.00706	0.081472
500009907	0.00003	0.14138	0.000004
5005662	0.043	0.14138	0.006079
5005658	0.017	0.14138	0.002403
5005659	0.017	0.14138	0.002403
5005660	0.017	0.14138	0.002403
Total kg of Co2 equivalent per unit			**1.272416**

So the emission contributed by transport per unit is **1.27 kg** of Co2 equivalent.

Carbon emissions from outbound transport

The finished goods are transported from plant to the customers. The locations of various customers are different from each other. Therefore the average distance from plant to customers is approximated to be 1300 miles (~2092.14 km) based on the data received, 48foot trucks are used with an average payload of 20000 pounds (~9 ton) for outbound transport

The total ton.km in this process = weight of bike rack (in tons) * km travelled
= 0.0154 * 2092.14 = 32.21

Total kg of Co2 equivalent from outbound transport per unit is 32.21 * 0.14138 = **4.55 kg**

Carbon emissions from transport of various wastes generated during the production process

The average distance from the source of these wastes to their respective destinations is 50 miles (80.46 km). Total annual quantity of all types of wastes generated is 395.34 tons. Based on the data received, 48foot trucks are used with an average payload of 20000 pounds (~9 ton) for outbound transport. Therefore 44 times the truck has to travel 80.46km to transport the wastes to their respective destinations. Total ton.km in this process is 9*44*80.46 = 31862.16

Total kg of Co2 equivalent is 31862.16 * 0.14138 = 4504.67 kg

Dividing the above result with the annual unit volume produced in the plant will give us the contribution of emissions by the wastes transport of each product. It is calculated to be **0.005kg**

Carbon emissions during the production process

According to the rulebook, carbon emissions for each process step is calculated individually so that if higher emissions are observed in any of the steps corrective measures can be taken in that step to reduce the emissions. But such a calculation is almost impossible to make as the energy consumed for each process step is difficult to ascertain.

The next best alternative is to calculate the carbon emissions from the product specific energy data, which means the total energy consumed by the finished product all through the various stages of its production process. The carbon emissions can be correctly measured but it is not possible to estimate the emissions in each step and take corrective measures.

In our case only the annual energy consumption of the plant and annual unit volume of production are available. Dividing the annual energy consumption by annual unit volume give the energy consumed in the making of single unit. Even though different types of products (in our case car racks, bike racks, boat racks) in the plant consume energy in different proportions during the production process, the energy consumption of each unit is approximated to be same.

Water supply also has a carbon emission factor. From the data it can be inferred that in the Seymour plant water is used for sanitary purposes and not for production purpose. Therefore the GHG emissions of water supply can be excluded in this case. These emissions need to be taken into account while calculating organizational carbon footprint.

From Annex 3 – Electricity factors, kg Co2 equivalent per kWh of electricity consumed is found to be 0.54667. [42]

3, 55,000 kWh of power is generated onsite by means of solar, the carbon emissions from this renewable energy is zero.

From Annex 1- Fuel conversion factors, kg Co2 equivalent per liter of Propane (LPG) consumed is found to be 1.4968. The kg Co2 equivalent per liter of diesel consumed is found to be 2.6694.

Type	Annual usage	Unit	kg Co2 equivalent per unit	Total Kg of Co2 equivalent
Electricity	1145600	kWh	0.54667	626265.15
LPG (Propane)	123025.8828	Liter	1.4968	184145.14
Diesel	946.3529	Liter	2.6694	2526.19
Solar power	355000	kWh	0	0
Total annual kg of Co2 equivalent emissions				812936.48

By dividing the 'Total annual kg of Co2 equivalent emissions' by the annual unit volume produced in the plant we get emissions per unit.

Annual unit volume produced in the plant is 786000. Therefore the emissions from production process per unit are **1.034 kg**.

Carbon emissions from the wastes generated

Ideally, carbon emissions from the wastes generated at each process step is calculated individually so that if higher emissions are observed in any of the steps corrective measures can be taken in that step to reduce the emissions. But such a calculation is almost impossible to make as the wastes generated at each process step is difficult to ascertain.

Product specific types and the corresponding amounts of wastes data are not available. In our case only the annual wastes generated by the plant and annual unit volume of production are available. By dividing the 'Total annual kg of Co2 equivalent emissions from all types of wastes' by the annual unit volume produced in the plant we get emissions contributed by the wastes of single unit. Even though different types of products (in our case car racks, bike racks, boat racks) in the plant generate wastes in different proportions during the production process, the generation of wastes by each unit is approximated to be same.

[42] http://www.defra.gov.uk/environment/business/reporting/conversion-factors.htm retrieved May 20, 2010.

According to the data received, wood and corrugate go to recyclers and trash to landfill or cogeneration. It was found that corrugate recycling is generally a closed loop recycling. [43]The wood recycling is also assumed to be closed loop recycling. These aspects were considered while choosing the emission factors. As trash is said to be destined to land fill or cogeneration, this trash must be combustible to be used for cogeneration. Therefore the emission factor of Misc combustibles is taken.

Annex 9 – other UK factor conversion tables

Type of waste	Process	Annual quantity generated (tons)	Net Co2 equivalent emitted per ton of waste	Annual Co2 equivalent emitted per type of waste (kg)
Corrugate	Recycling	231.33	237	54825.21
Wood	Recycling	42.45	250	10612.5
Trash	Landfill/Cogeneration	121.56	305	37075.8
Total annual Co2 equivalent emitted by all types of wastes				**102513.51**

Annual unit volume produced in the plant is 786000. Therefore the emissions from wastes, per unit are **0.13 kg**.

Carbon emissions from other sources

During customer use the carbon emissions of the Bike rack are zero, as it consumes no direct energy. Even if the operation or application of a product causes either increase or decrease (e.g. due to aerodynamic pull) in the GHG emissions arising from the use phase of another product, this change shall be excluded from the assessment of the life cycle GHG emissions of the product being assessed.[44]

In the disposal phase, energy is consumed to recycle the discarded product. Emissions arising from recycling the discarded product have already been included in the emission factors of respective materials in the section 'Carbon emissions from material'. The emission factors that are listed there are their respective Life cycle emission factors.

[43] http://www.severnside.com/about-us/recycling-loop/ retrieved May 30, 2010

[44] Section 6.4.8.4 in PAS 2050:2008 Specification for the assessment of the life cycle greenhouse gas emissions of goods and services, File accessed from www.carbontrust.co.uk

Total carbon emissions per unit of bike rack

Therefore total Co2 equivalent emissions by a unit of bike rack are the sum of Co2 equivalent emissions from all the above sources: materials, inbound transport, outbound transport, wastes transport, production processes and wastes generated

25.90 + 1.27 + 4.55 + 0.005 + 1.034 + 0.13 = 32.889 kg of Co2 equivalent / unit of bike rack

Conclusion

Our task for this project was to act as sustainability consultants for THULE. We embarked on this project by gathering information required for building our practices and awareness questionnaire. We had to make sure to choose the right type of questions so that the data captured would be valid and reliable. Our data gathering, though a bit slow at the start, went well, thanks to the cooperation of THULE.

The data captured through the Practices questionnaires illustrate that some of the THULE plants are already engaging in sustainable practices. Most of these efforts are seen to be directed towards efficient use of energy and waste management. The societal aspect of sustainability has proven to be the area where the least is being done.

From the Awareness questionnaire, we observed that 50% of the THULE employees demonstrated a fair understanding of what the concept of sustainability is about. Most of the employees associated the word sustainability mostly with its environmental aspect. The THULE employees suggested that better awareness and training programs would provide them with the knowledge required to engage in more sustainable practices.

Part of our consultancy task, required us to calculate the carbon footprint of a THULE product. This work required a lot of research and understanding about the methods and tools required for the carbon footprint calculation of a product. We hope that our work will provide THULE with a baseline for moving forward in the sustainability direction.

Future work

Practices questionnaire
In this project, the sustainable practices at various plants have been identified, compiled, analyzed and represented in the form of charts & tables. This refined data can aid Thule to understand to what extent it has been following sustainable practices and what more can be done.

Awareness questionnaire
From the analysis, charts & tables represented in this project, the awareness level & perception of Thule employees on sustainability can be inferred. This inference would probably aid Thule in understanding and decision making concerning various aspects of sustainability and its effect on its employees.

Carbon footprint calculation of bike rack
From the calculation the carbon emissions from various sources all through the life cycle of a bike rack are clearly evident. Based on this emissions data, identify if any appropriate measures can be taken to decrease the carbon emissions at any of the stages.

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27. calculation: 420 kg of Co2 / ton + 102 kg of CO / ton + 0.9 kg of NO2 / ton, GWP of CO is 3 and NO2 is 310. Therefore total Co2 equivalent is 420 + 3*102 + 310*0.9 = 1005 kg of Co2 eq/ton

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APPENDIX

Awareness Questionnaires Results

1825258	Towing	Nederlands	Yes normal issue s like no environmental issue s no child labour reduction of material content & waste transport
1845214	VAEA	Sweden	Employee safety waist recycling
1826427	Towing system	France	Reduction of weight product + packaging
1828046	Towing system france	FRANCE	Integrating sustainable development in the etablishment of new process
1823106	TOWING SYSTEMS	United Kingdom	We need to be more proactive when it comes to Marketing activities within the Towing Systems BA through the use of the internet and getting closer to the consumer.He must make the brand decision which currently is not the case.
1827342	Towing Systems	Sweden	Finding long term solutions and promote light weight development.
1847106	Towing Systems	United Kingdom	
1797435	Towing Systems EA	Netherlands	Yes especially in new developments Capex. Meetings with projectteams etc.
1825983	Towing Systems Europe Asia	France	#NAME?
1822423	trailerS	Denmark	
1823021	Trailers	Denmark	Focus on well-being of my employess both short term and long term.
1823110	TRAILERS	Denmark	Try to reduce the consumption of energy paper etc. Encourage my colleagues to think green .
1823339	trailers	Denmark	
1825187	Trailers	Denmark	
1840749	Trailers	Sweden	No not really
1823176	Trailers	Denmark	Yes - We try to limit use of packing materials..
1822440	VAEA	Sweden	No
1823252	VAEA	Sweden	
1823541	VAEA	UK	We are continuously improving the reduction of process scrap High focus on recycling all materials coming into the building; currently 85-90%
1824022	VAEA	Sweden	I choose bike and train as means of transportation rather than going by car or by air. No printing unless necessary.
1828899	VAEA	Italy	Environmental aspects and safety for employees
1840980	VAEA	Sweden	
	VAEA (out of 4)	TRAILERS(out of 4)	
1802012	VANA	USA	Trying to be smarter about travel plans - using more online meeting providers.
1776859	VANA	USA	Envionmental concerns - waste management Lean Manufacuring
1776743	VANA	USA	
1776758	VANA	USA	NO
1776767	VANA	USA	
1776815	VANA	USA	Avoid paper copies at all costs. Use reusable cups rather than plastic bottles or papercups. Use vendors that have a sustainability focus as well. Support local companies with business when possible.

1776821	VANA	USA	PAPER RECYCLING BEVERAGE CONTAINER RECYCLING
1776854	VANA	USA	Yes. Cashflow improvement.
1776874	VANA	USA	When possible always trying not to waste to reuse to recycle in an effort not only to keep Thule costs down but also to help the environment.
1776885	VANA	USA	Yes. Make sure all printing is done on FSC certified paper.
1776912	VANA	USA	
1776947	VANA	USA	
1777054	VANA	USA	Aiming for 100% accuracy in data entry trying not to waste paper. Recycling where possible.
1777069	VANA	USA	Doing my job as efficiently and affectively as possibly
1777091	VANA	USA	I look for long term solutions to manufacturing issues. This includes type of equipment purchased repair procedures and steady repeatable manufacturing processes.
1777100	VANA	USA	recycling paper printing less and sending electronic documents auto shutoffs for lights
1777371	vana	us	Lean mfg Strong customer service world class products employee relations
1777578	VANA	Canada	
1777737	VANA	USA	
1777838	VANA	USA	Confrence call vs meeting recycling bike to work at times listening to new ideas...
1780081	VANA	Canada	Customer service. Recycle destroyed product
1781957	VANA	USA	reduce - reuse - recycle mindset
1789138	VANA	USA	Best and fastest to market utilizing best practices of material choices and ingenuity to increase market share.
1789396	VANA	USA	Recycling
1789580	VANA	USA	
1789633	VANA	USA	recycling all office materials
1789683	VANA	USA	5S
1789881	VANA	US	reduce use of resources and recycling
1790093	VANA	United States	
1792060	VANA	USA	
1798657	Vana	USA	RECYCLABLES SUCH AS CARDBOARD STRETCH WRAP AND OFFICE PAPER.
1798258	VANA	USA	We are not focused against sustainability
1849370	VANA	USA	Yes. We are recycling paper have installed occupancy sensors in offices and restrooms return regrinded plastic for re-use. We also return used corrugate.
1789177	VANA product dev	USA	Yes. In reusing existing parts whenever possible.
1789614	VANA Quality	USA	Ensuring parts needed for manufacturing of product meets specification. Ensuring that all product going to our consumers is of the highest quality and free from defects.

Notes:	Bill Level	Item #		Make or Buy	Supplier	Qty Per Assembly		Possible to estimate carbon footprint from estimated process norms			Size or weight to use in calculating transportation footprint			Can be estimated using Source location	
									Source						
Assembly	Bill Level	Item	Description	M/B	Supplier	ExtQty	Raw Material	MFG Process Description	Country	Region	Weight each	Unit	Primary Transportation mode from supplier	Travel Distance	Unit
914	0	914	ROADWAY 4 BIKE 2" & 1.2	Make	internal process	1		Assembly			34	Lbs			
914	0.1	7533727	Coated stinger assembly	Make	SUPERIOR PO	1	Paint	Powder coat, Cleaning	USA	NJ	7	Lbs	truck	70	miles
914	..2	753372750	Uncoated stinger assembly	Make	internal process	1		Welding			7	Lbs			
914	...3	8537095	Cut and pierced steel tube	Make	internal process	1		Pierce			5	Lbs			
914	4	853709597	Cut tube	Make	internal process	1		Cutting			5	Lbs			
914	5	853518498	Steel tube	Buy	LOCK LOINT	0.05	Steel	Steel mill	USA	IN	5	Lbs	Truck	672	miles
914	...3	8537161	Steel bar	Buy	INDUSTRIAL	1	Steel	Machining	USA	NJ	2	Lbs	Truck	77	miles
914	0.1	8537096	UPRIGHT TUBE COATED	Make	SUPERIOR PO	1	Paint	Powder coat, Cleaning	USA	NJ	5	Lbs	truck	70	miles
914	..2	853709650	UPRIGHT CUT PIERCED UNC	Make	internal process	1		Pierce			5	Lbs			
914	...3	853709697	UPRIGHT TUBE CUT 724MM	Make	internal process	1		Cutting			5	Lbs			
914	4	853518498	TUBE 50.7 SQUARE 3.00MM	Buy	LOCK LOINT	0.2	Steel	Steel mill	USA	IN	5	Lbs	Truck	672	miles
914	0.1	7533741	BIKE ARM PIVOT ASSY 4BI	Make	SUPERIOR PO	1	Paint	Powder coat, Cleaning	USA	NJ	10	Lbs	truck	70	miles
914	..2	753374150	BIKE ARM PIVOT ASSY 4BI	Make	internal process	1		Welding			10	Lbs			
914	...3	8535202	2" SQUARE TUBE CUT AND	Make	internal process	1		Pierce			5	Lbs			
914	4	853520297	RAW CUT TO 350MM 13.78"	Make	internal process	1		Cutting			5	Lbs			
914	5	853518498	TUBE 50.7 SQUARE 3.00MM	Buy	LOCK LOINT	0.1	Steel	Steel mill	USA	IN	5	Lbs	Truck	672	miles
914	...3	8535212 02	TUBE 1" OD X 11GA 640.	Buy	LOCK LOINT	2	Steel	Steel mill	USA	IN	4	Lbs	Truck	672	miles
914	...3	8537093	TOP PLATE RIGHT	Buy	WELLTECH EN	1	Steel	stamping	Taiwan		1	Lbs	Boat	12,000	miles
914	...3	853709302	TOP PLATE LEFT	Buy	WELLTECH EN	1	Steel	stamping	Taiwan		1	Lbs	Boat	12,000	miles
914	0.1	8535829	CRADLE MAIN BODY 2005	Buy	HI-TECH MOL	8	plastic	injection molding	USA	MA	0.15	Lbs	Truck	60	miles
914	0.1	7533535	CRADLE STRAP ASSY 2005	Buy	HI-TECH MOL	8	plastic	injection molding	USA	MA	0.17	Lbs	Truck	60	miles
914	0.1	8535753	SCREW 8-32 THREAD FORMI	Buy	INDUSTRIAL	2	Steel	Machining	USA	NJ	0.003	Lbs	Truck	77	miles
914	0.1	8532181	END CAP NO LOGO	Buy	HI-TECH MOL	2	plastic	injection molding	USA	MA	0.018	Lbs	Truck	60	miles
914	0.1	8531477 04	TUBE CAP HITCHING POST	Buy	NIAGRA PLAS	2	plastic	injection molding	USA	NY	0.005	Lbs	Truck	327	miles
914	0.1	8535567	SQUARE TUBE CAP, BIKE A	Buy	HI-TECH MOL	2	plastic	injection molding	USA	MA	0.036	Lbs	Truck	60	miles
914	0.1	7532030 07	STRAP ASSY 3.1M W/BUCKL	Buy	WELLTECH EN	1	nylon strap	sew	Taiwan		0.216	Lbs	Boat	12,000	miles
914	0.1	5155154	HITCH DECAL	Buy	ROBINSON TA	1	paper	printing	USA	CT	0.003	Lbs	Truck	20	miles
914	0.1	7533748	HDWR BAG 912 914	Buy	INDUSTRIAL	1	plastic	blown film	USA	NJ	1	Lbs	Truck	77	miles
914	0.1	8537094	BOTTOM PLATE RIGHT	Buy	WELLTECH EN	1	Steel	stamping	Taiwan		1.272	Lbs	Boat	12,000	miles
914	0.1	853709404	BOTTOM PLATE LEFT	Buy	WELLTECH EN	1	Steel	stamping	Taiwan		1.272	Lbs	Boat	12,000	miles
914	0.1	7533747	END CAP ASSY HITCH	Buy	HI-TECH MOL	2	plastic	injection molding	USA	MA	0.428	Lbs	Truck	60	miles
914	0.1	8535953 02	TRIGGER PIN 4 BAR LINAG	Buy	INDUSTRIAL	2	Steel	stamping	USA	NJ	0.176	Lbs	Truck	77	miles
914	0.1	9511224 11	WASHER 12 MM ID 24 MM O	Buy	INDUSTRIAL	4	Steel	stamping	USA	NJ	0.013	Lbs	Truck	77	miles
914	0.1	8537012 02	HEX BOLT 1/2 UNC-13 3 1	Buy	INDUSTRIAL	2	Steel	Machining	USA	NJ	0.201	Lbs	Truck	77	miles

914	0.1	8535787702	M6X16 FLAT HEAD SOCKET	Buy	INDUSTRIAL	1	Steel	Machining	USA	NJ	0.008	Lbs	Truck	77	miles
914	0.1	853558402	1/2-13 LOCK NUT	Buy	INDUSTRIAL	2	Steel	Machining	USA	NJ	0.044	Lbs	Truck	77	miles
914	0.1	8537292	ADAPTOR SLEEVE	Buy	WELLTECH EN	1	Aluminum	Extrusion	Taiwan		1.319	Lbs	Boat	12,000	miles
914	0.1	500009907	WARRANTY CARD LTW	Buy	ROBINSON TA	1	paper	printing	USA	CT	0.004	Lbs	Truck	20	miles
914	0.1	5015569	INSTR 912 914	Buy	internal process	1	paper	printing			0.004	Lbs			
914	0.1	5005662	CTN TOP 914	Buy	SMURFIT-STO	1	Corrugate	Corrugator	USA	MA	1.325	Lbs	Truck	45	miles
914	0.1	5005658	CTN INSERT 1 HITCH	Buy	SMURFIT-STO	1	Corrugate	Corrugator	USA	MA	0.537	Lbs	Truck	45	miles
914	0.1	5005659	CTN INSERT 2 HITCH	Buy	SMURFIT-STO	1	Corrugate	Corrugator	USA	MA	0.537	Lbs	Truck	45	miles
914	0.1	5005660	CTN BOTTOM HITCH	Buy	SMURFIT-STO	1	Corrugate	Corrugator	USA	MA	0.537	Lbs	Truck	45	miles

Baseline Plant Information (2009)	
BA	VANA
Location	Seymour CT USA
Location Use	MFG, Distribution and VANA sales, engineering and Corporate Offices
Average # of employees	150
Products produced	Car Racks, Bike racks, Boat racks
Annual unit volume	786000

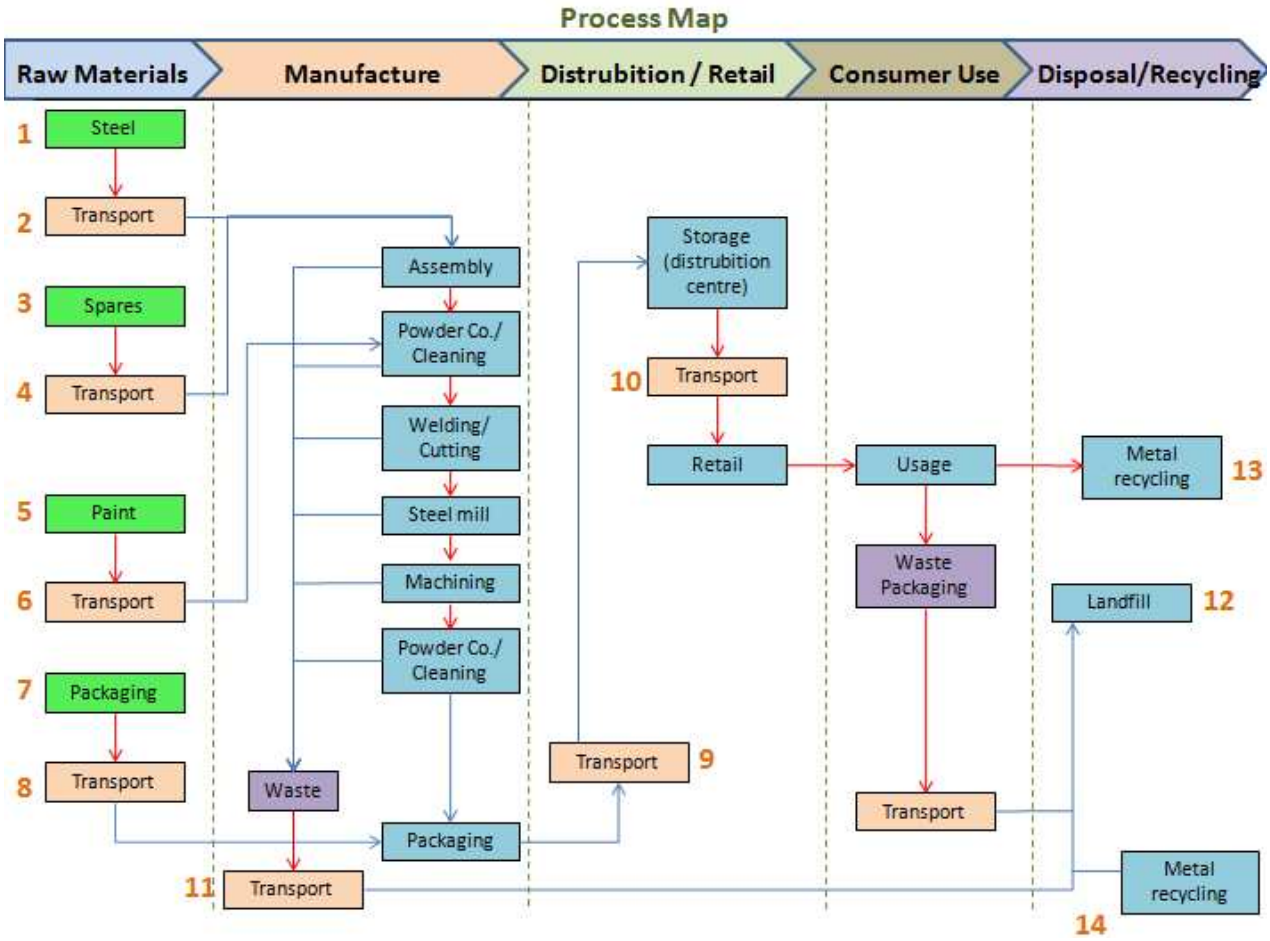
Resource usage				
Type	**Purpose**	**Annual Usage**	**Unit**	**Cost (USD)**
Electric	Light, heat, IT, MFG Process	1,145,600	KWh	208,000
Natural Gas or Propane	Heat	32,500	Gallons	51,000
Diesel	Fire pump	250	Gallons	750
Water	Sanitary	236,000	Gallons	5,777
Other	None			

Energy Produced		
Type	**Quantity**	**Unit**
Solar	355,000	KWh

Waste Generated			
Type	**Primary Source**	**Qty**	**Unit**
Production waste water	None		
Corrugation	In-bound Packaging	510,000	Lbs
Trash	Various	93,600	Lbs
Wood	In-bound Packaging	268,000	Lbs
Airborne	None		
Other	None		

Recent sustainability activities
355 KW solar array installed in 2008
White paper reduction team started in 2009
White paper recycling started in 2005
Paper cup reduction effort planned for 2010
Annual River cleanup day

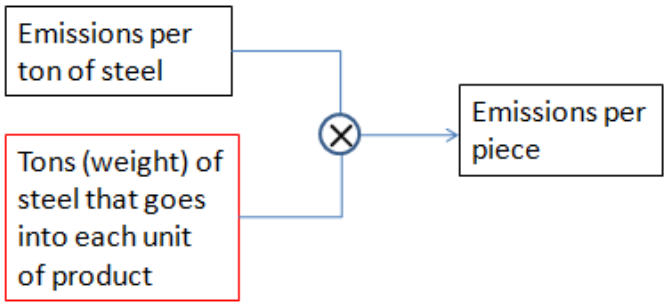
Process map of bike rack



Instructions:

- If you can't answer (or If you don't have the data) questions concerning boxes, 2,4,6,8,9,10,11 then please mention the total amount of fuel used for all kinds of transport.
It can be the amount of total fuel used per year or per month, also mention the total number of units manufactured in the plant per month or per year so that we can approximate per unit.
- If you can not asnwer questions concerning box 12, please mention the total wastes generated per year (or per month) and also their types. Also, mention the total number of units manufactured in the plant per month or per year so that we can approximate per unit.
- Red rectangles indicate the data that is expected from you.
- The box numbers which are there on the top-right correspond to the numbers on the process map.
- Please answer all the questions in each box.

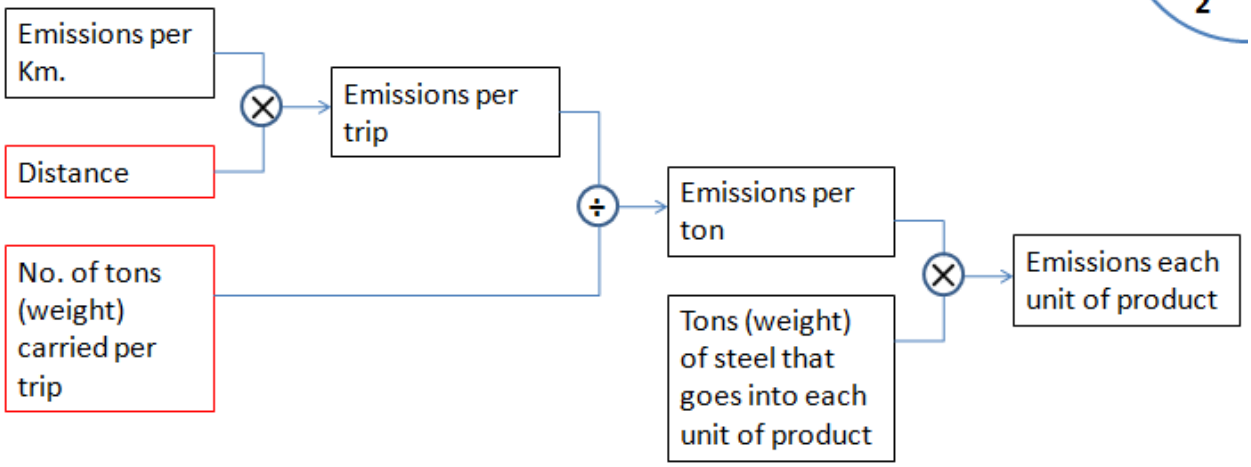
Box 1



Q) Please describe what kind of steel is used? (please be as clear as possible)

Q) Weight of this steel that goes into the making of one unit of product

Box 2

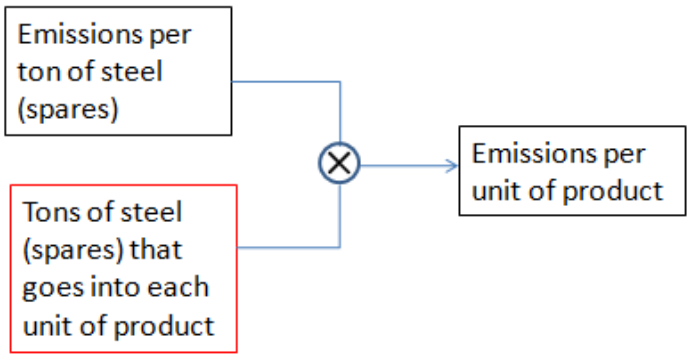


Q) Distance between suplier (of steel) and production unit

Q) Amount and type of fuel used (or) vehicle type

Q) No. of tons carried per trip

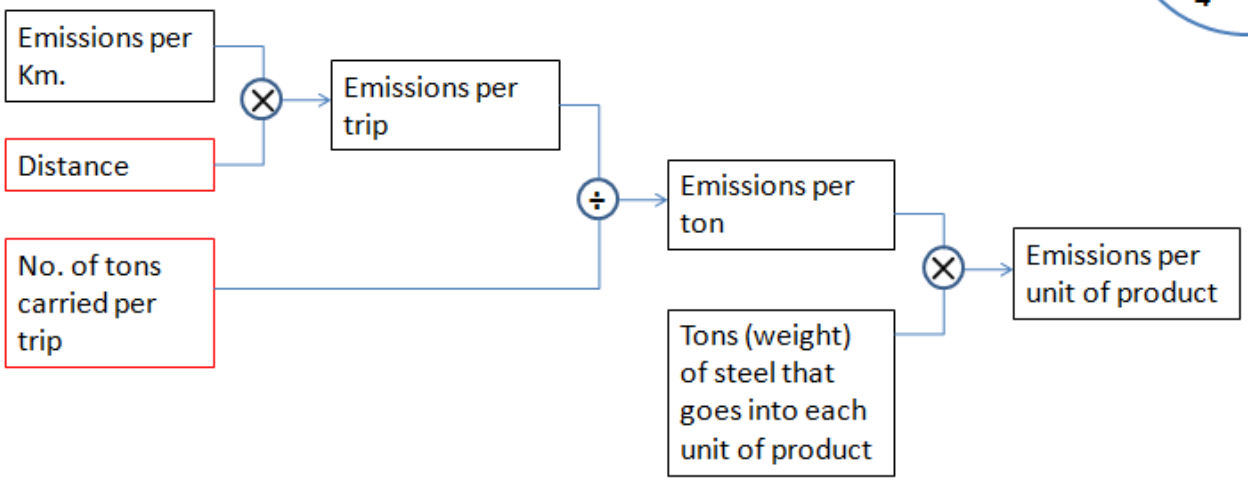
Box 3



Q) Describe what kind of steel the spares are made of?

Q) Weight of this steel that goes into the making of one unit of product.

Box 4

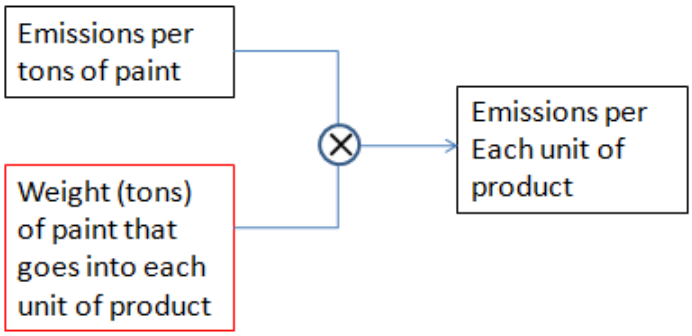


Q) Distance between suplier (of spares) and production unit

Q) Amount and type of fuel used (or) vehicle type

Q) No. of tons carried per trip

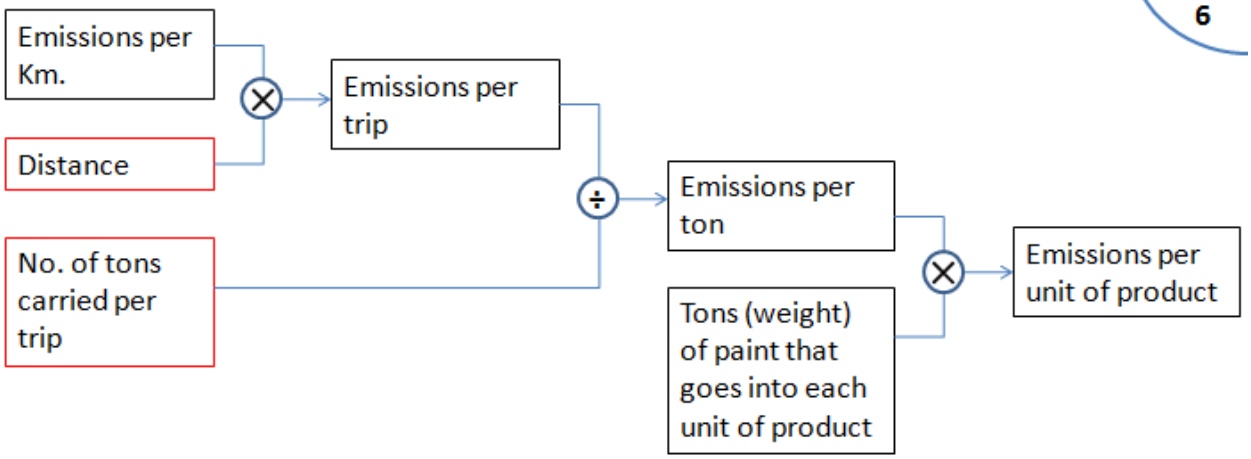
Box 5



Q) Describe what kind of paint (material)

Q) Weight of paint that goes into each unit of product

Box 6

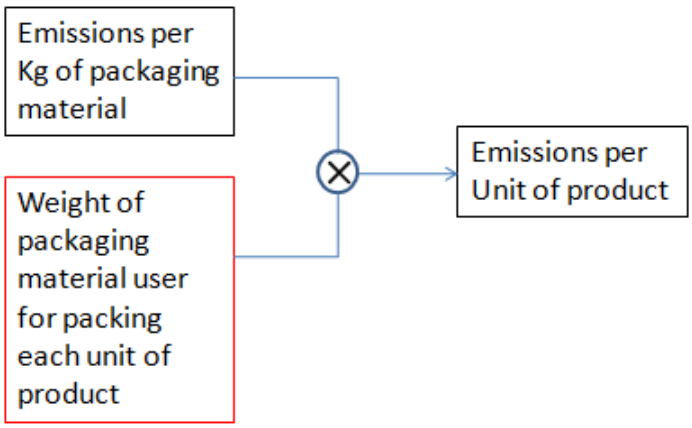


Q) Distance between suplier (of paint) and production unit

Q) Amount and type of fuel used (or) vehicle type

Q) No. of tons carried per trip

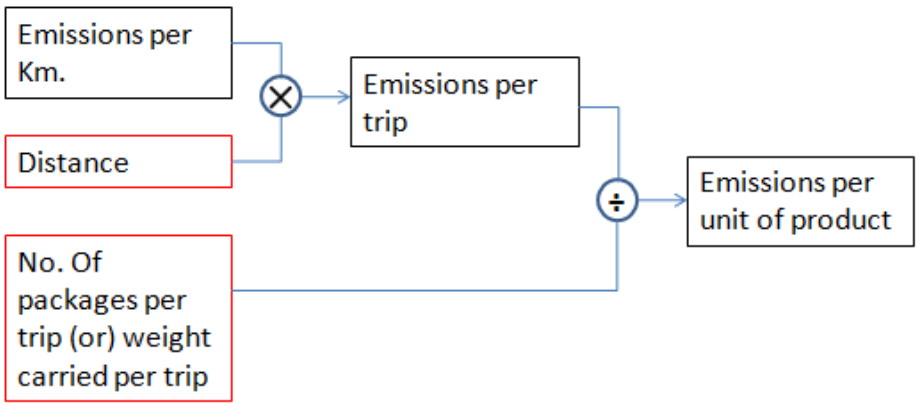
Box 7



Q) Describe the kaind of packaging material used

Q) Weight of packaging material user for packing each unit of product

Box 8

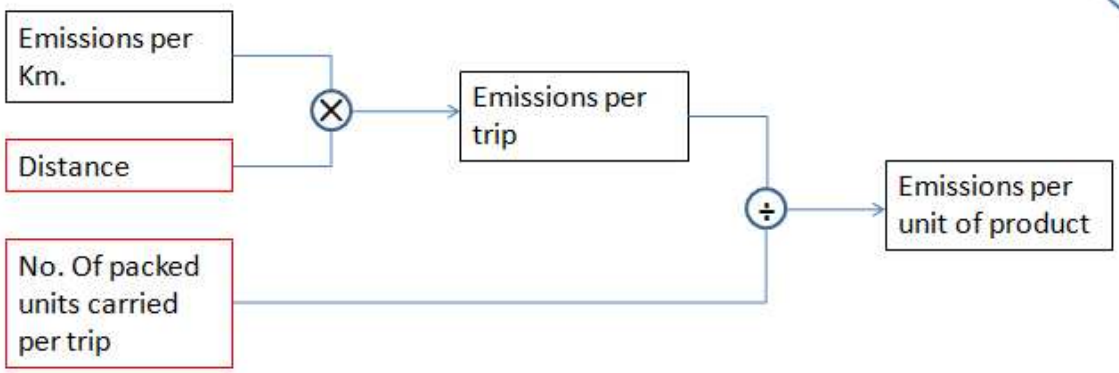


Q) Distance between suplier (of packaging material) and production unit

Q) Amount and type of fuel used (or) vehicle type

Q) No. of tons carried per trip (or) No. Of packages per trip

Box 9

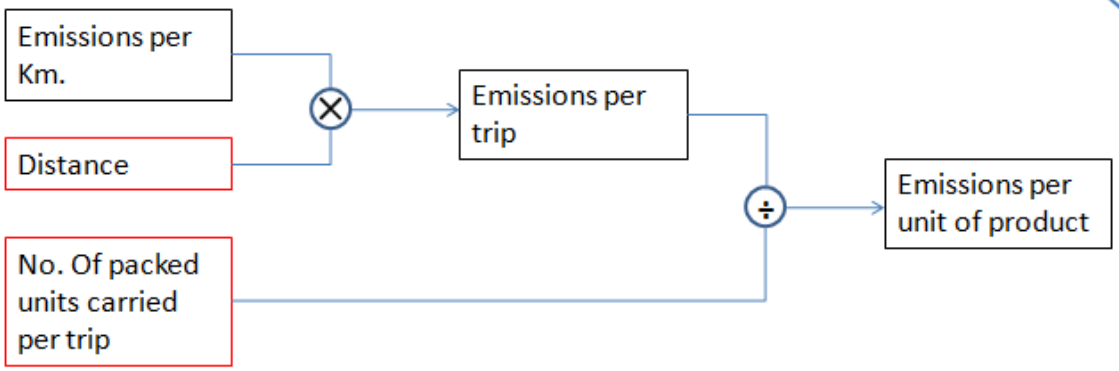


Q) Distance between production plant to storage (distribution centre)

Q) Amount and type of fuel used (or) vehicle type

Q) No. of packed units per trip (or) No. of tons carried per trip

Box 10

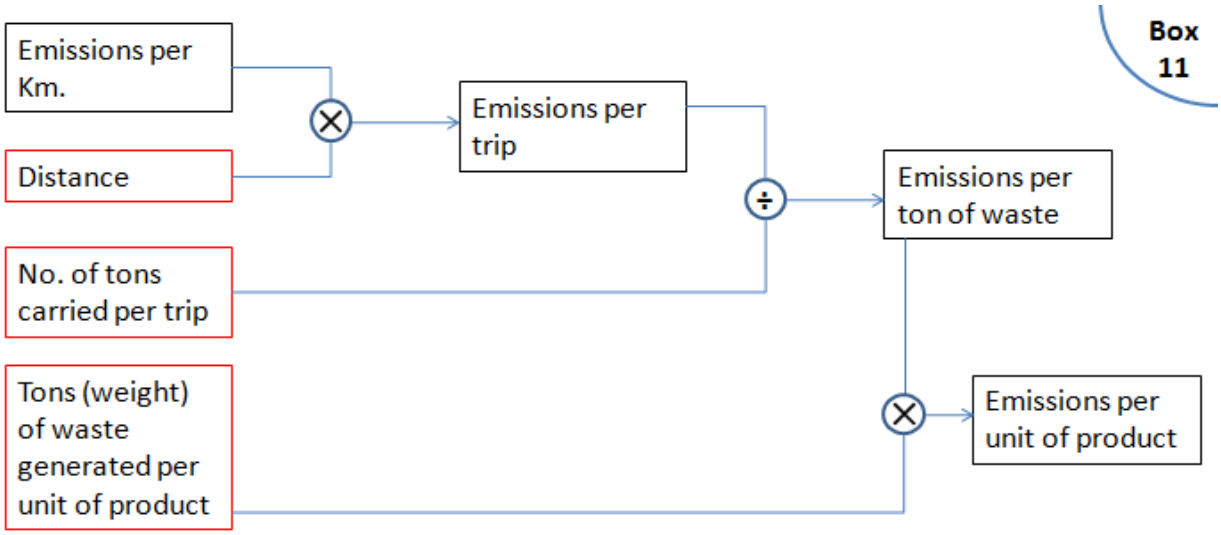


Q) Average distance between storage (distribution centre) and retailer

Q) Amount and type of fuel used (or) vehicle type

Q) No. of packed units per trip (or) No. of tons carried per trip

Box 11



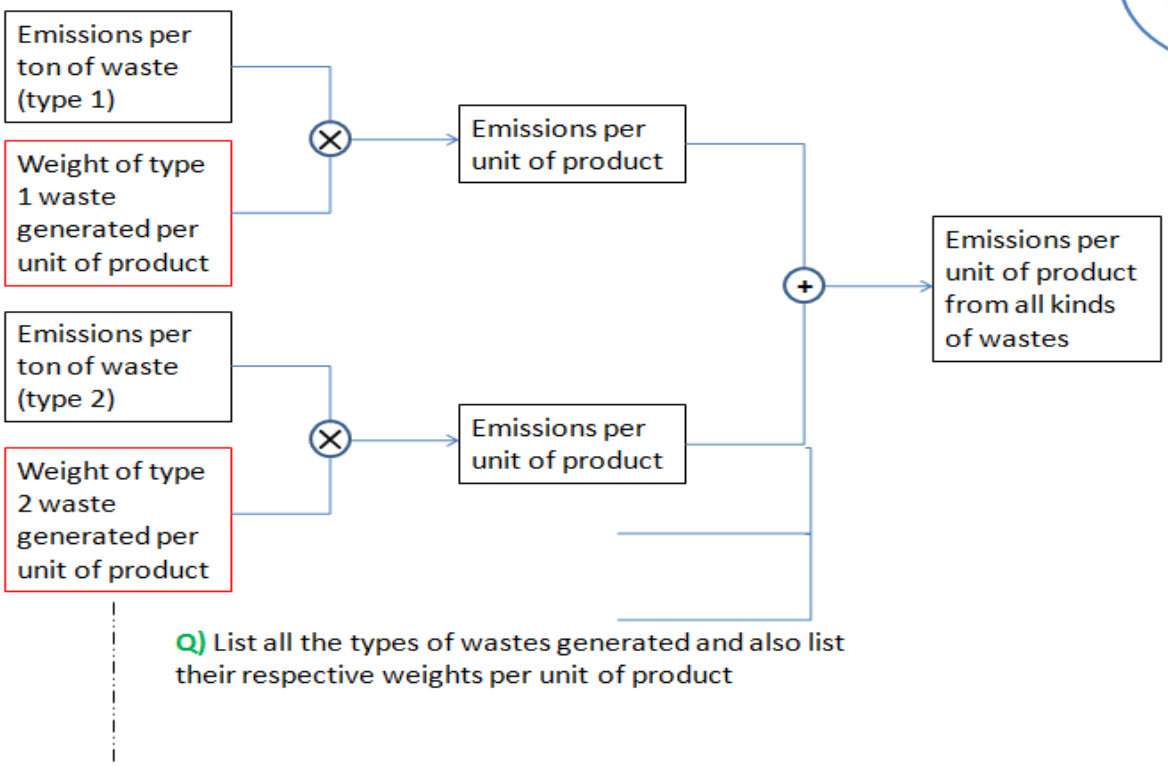
Q) Distance from production plant (place where waste is generated) to landfill or recycling plant

Q) Amount and type of fuel used (or) vehicle type

Q) No. of tons of waste carried per trip

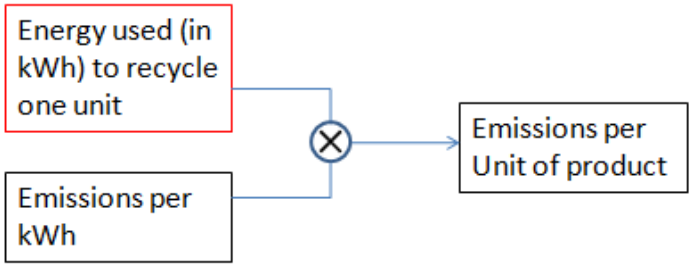
Q) Tons (weight) of waste generated per unit of product

Box 12



Q) List all the types of wastes generated and also list their respective weights per unit of product

Box 13



Q) Energy used (in kWh) to recycle one unit (after usage)

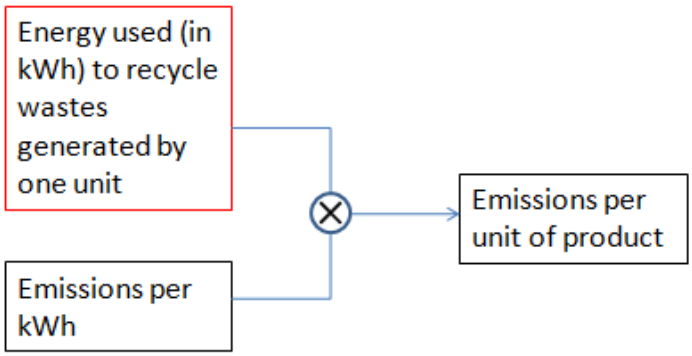
or

If energy corresponding to one unit recycling is not avaliable then please provide us an approximate estimate.

or

Please provide us the total energy used and number of units recycled so that we make an approximation ourselves

Box 14



Q) Energy used (in kWh) to recycle wastes generated by one unit

or

If energy corresponding to recycling wastes generated by single unit is not avaliable then please provide us an approximate estimate.

or

Please provide us the total energy used and amount of wastes processed.
Also provide the details of number of units from which that waste is generated.

Q) Mention the total amount of electricity (in kWh), gas (in kWh), diesel (in litres), petrol and anything else used in the production process of the finished goods. (It can be yearly data. Also, mention the total number of units manufactured in the plant per month or per year so that we can approximate per unit.)

General Questionnaire for calculation of product carbon footprint

Instructions:

In case you are not able to provide the exact data, it can be an approximate. If it is impossible even to approximate then skip answering that question. Please try to answer all the questions. Thank you very much for your time and effort.

Questions:

1) List all the raw materials and describe them as clearly as possible.

2) What is the amount (weight) of each raw material type that goes into the making of one unit of the product?

3) Please mention the total number of units of all categories of products manufactured in the plant per year.

4) Please mention total amount of fuel used for all kinds of transport purposes, also mention the fuel types.

5) Mention the total amount of electricity (in kWh), gas (in kWh), diesel (in litres), petrol (in litres) and anything else used in the production process of the finished goods. It can be yearly data.

6) Mention the various types and amounts of wastes generated per year.

7) Do you have any estimate of the energy (in kWh) consumed for the recycling of wastes generated during the production process

8) Do you have an estimate of the energy (in kWh) consumed in the process of recycling the used product (when your consumer disposes the product after using it)