



# Waste management in Sweden – Case study at the IKEA warehouses in Älmhult

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# Waste management in Sweden – Case study at the IKEA warehouses in Älmhult

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# Abstract

The thesis consists of a description of the waste management in Sweden today, related to a case study at IKEA's warehouses in Älmhult. Waste is globally one of the most important environmental challenges. Waste management in Sweden has developed a lot during the past years and is now standing in front of the next big challenge: to reach higher up in the waste hierarchy. By studying the academic literature and by interviewing actors relevant to the Swedish waste management scheme, ideas about challenges and improvements were presented. A large part of the Swedish waste volumes come from the industry and to be able to draw conclusions about how to improve the waste management in an industry the thesis included a case at IKEA's warehouses in Älmhult. The field research was based on site visits and a questionnaire aimed at the team leaders at the warehouses. There was also a study of IKEA's guidelines and targets regarding waste.

The results show a need for new policy instruments regarding the Swedish waste management scheme. Past instruments have focused on the lower parts in the waste hierarchy and new instruments need to focus higher. A mix of instruments seem to be most efficient. New fractions that are not sorted today will probably be more important in the future, for example textile and electronic waste.

For IKEA the results showed a need to improve the planning regarding the placement for the waste bins and the responsibility for the waste management, for example concerning the focus on the unsorted and wrongly sorted waste. The best methods for that would be improved information through labelling and increased information to the co-workers. Support by their waste contractor, SITA, would likely contribute to continual improvement.

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# Abbreviations

**CDC:** Distribution Centre at IKEA for orders direct from the customers

**DC:** Distribution Central at IKEA (ordinary warehouse)

**DS:** Distribution Services, DC's are part of these services

**EPA:** Environmental Protection Agency

**FY:** Fiscal Year, for IKEA it means September to August

**PLS:** a manual picking station at IKEA's warehouse

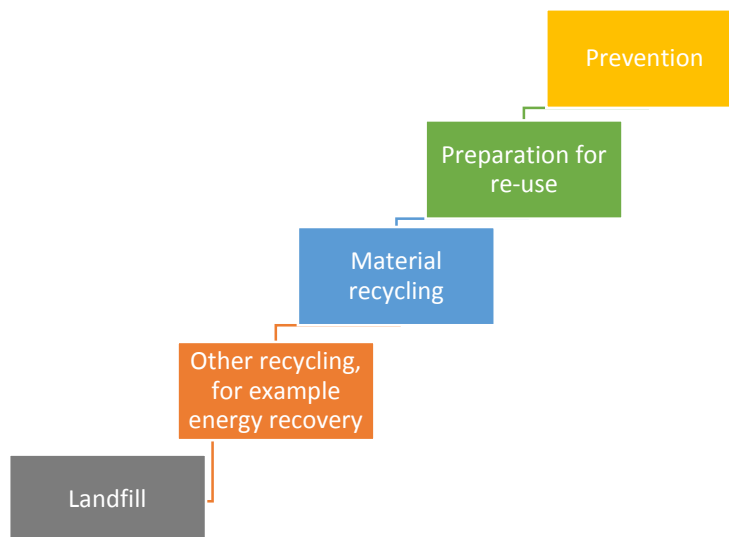
**TL:** Team Leader



# 1. Introduction

Waste is one of today's major environmental challenges. A large part of the waste comes from industrial activities and that sector has due to that a great responsibility to deal with their waste in a better way (Waste Sweden, 2014). Waste in Sweden could be divided into three different areas of responsibility. The municipalities are responsible for the household waste, the producers are responsible for the fractions with producer responsibility and the industry are responsible for other waste that they create and doesn't fit in these categories.

In EU's waste directive, the line of argument for future waste management in Sweden is to move upwards in the so called waste hierarchy, see Figure 1 (2008/98/EC). This thesis is thereby a part of an ongoing work on EU level.



**Figure 1.** The waste hierarchy that is presented in EU's waste directive (2008/98/EC).

Due to the activity in EU many policy instruments and also legislation have been implemented in Sweden to work towards a better waste management (The Swedish EPA, 2012b). These efforts have improved the Swedish management by moving the focus from landfill to incineration, but the next challenge is now to move from incineration to recycling, re-use and prevention (The Swedish EPA, 2012a). For this work there is a need for new strategies and policy instruments. The academic approach in this thesis is therefore an investigation of today's strategies and a study of what strategies are suggested and what actors in the Swedish waste management scheme think about it.

The thesis also consists of a case study at the two warehouses that IKEA Svenska AB (DS North Europe), furthermore called, IKEA, operates in Älmhult. The purpose is to investigate the possibilities for an industry, IKEA, to decrease the volume of unsorted waste and consequently increase the rate of recycled/re-used material. IKEA has, except for the household and food waste, one separate waste contractor, SITA<sup>1</sup>. I have therefore interviewed SITA to hear their thoughts about how they work towards a more sustainable waste management. The opinions of team leaders at IKEA in Älmhult were identified through a questionnaire.

The thesis also consists of a compilation of what targets that regard the Swedish waste management scheme with the Swedish national environmental quality objective *A Good Built Environment* as a basis.

## 1.1 Aim of the thesis

This thesis mainly aimed at investigating the waste management in a national perspective and more specifically to see how it works today and what strategies that could make it more efficient. Interesting in the development of recycling is what policy instruments and specific areas that will be prioritized ahead. The aim was also to have a case to investigate the possibilities for an industry, IKEA, to reduce their waste volumes, primarily the unsorted waste and thereby increase the recycling/re-use rate.

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<sup>1</sup> SITA is a company for recycling and waste management in Sweden (SITA, n.d.).

Included in this aim of the thesis was to get an understanding about what the actors that work with waste, both at IKEA and nationally, think is important regarding improvements.

Five questions were compiled to specify the purpose, see 1.2 Research questions.

## 1.2 Research questions

### 1.2.1 The Swedish waste management scheme

1. How does the Swedish waste management scheme work today? What is successful and what challenges are there?
2. What changes in the Swedish waste management scheme could be done to reach higher up in the waste hierarchy?

### 1.2.2 Waste management at IKEA

3. What procedures for waste management are implemented at the IKEA warehouses in Älmhult?
4. How can IKEA reduce the waste volume and increase the volume of recycled/re-used material?
5. How does IKEA's waste contractor, SITA, work towards a more sustainable waste management scheme?

## 1.3 Scope and limitations

This thesis focuses on the waste management scheme in Sweden through an environmental perspective. Other countries and perspectives as for example economical questions for different solutions and policy instruments have not been part of the main focus. Regarding the Swedish national environmental quality objectives (Environmental Objectives, 2013a), the analysis includes the impact on the goal A

*Good Built Environment.* Focus has also been on industrial waste. Municipal waste and waste that is included in a producer responsibility has just been part of the general discussion of the waste situation in Sweden.

When it comes to the case study at IKEA it is just the warehouses in Älmhult that have been studied. All other parts of IKEA's business as the stores, transport etcetera have been excluded, except for the description of the global sustainability strategy and goals. Regarding the warehouse buildings, house 1 has been excluded though that building is hardly used and the main waste challenges occur in building 2-4, see Figure 6. The specific design and the development for IKEA's products have not been studied though the waste in the warehouses mostly consist of packaging materials. The questionnaire that constitutes the main results from IKEA was only given to the team leaders at the two warehouses.

## 2. Methodology

The three different methods that were used are described below. Academic literature was searched with the Web of Science to get knowledge about the waste management today and future strategies.

### 2.1. Qualitative methodology

#### **2.1.1 Visits on site**

To get insight in the complexity of the challenges at IKEA, visits on site were carried through. With guided tours it was possible to observe how the waste management works today and it was a prerequisite to be able to study opportunities to more recycling. This guided tours included a review of which fractions that are used today, how the waste management is carried through in the warehouse, who is responsible for each moment etcetera. It also included getting knowledge about the report systems where it is possible to find statistics for the waste and even looking into the bins of unsorted waste to see what it contained.

By looking into these statistics and also by using the information from the analyses of the bins for unsorted waste it was possible to estimate how much waste that could be used for recycling instead. These actions helped making it possible to partly answer the third and fourth research question.

### **2.1.2 Semi-structured interviews**

For the first two and the fifth research questions, interviews were conducted with four actors that are acting in the Swedish waste sector: The Recycling Industries, The Swedish EPA and Waste Sweden as well as with IKEA's waste contractor, SITA. The purpose with interviewing SITA was to obtain information about waste management in a more broad perspective and to hear their visions for the future. This also gave answer to the fifth question, how SITA, work towards a more sustainable waste management scheme. All the interviews was performed by telephone.

All the interviews was semi-structured, which means that an interview guide with some questions was prepared before the meeting, see Appendix 1. This was the base in the interview, but beyond that it was possible to fill in with, for example, follow-up issues (Johannessen & Tufte, 2003). All the interviews was performed in Swedish and the results was translated into English.

To compile the results from the interviews the methodology that Johannessen & Tufte (2003) present for that was used.

Beyond this, there was also a literature study of articles and reports to give a review about the waste situation today and to form the basis for the line of reasoning in the thesis. It also contained suggestions for new policy instruments to help making a conclusion about what instruments that would be the most efficient.



## 2.2 Quantitative methodology - questionnaire

To be able to better answer the third and the fourth question, a questionnaire was handed out to the nine team leaders at the IKEA warehouses, seven of them responded. Of these team leaders there was one that has the general responsibility for the waste management in the warehouses and the other have responsibility for other parts of the work, see Question 1, Appendix 3. This was performed by the team leader that is responsible for waste management in the warehouse and it was carried through after the visits on site to make it possible to ask the most appropriate questions. The purpose then was to investigate what arrangements that have been done and could be possible in the future and also to hear their thoughts about the waste management today. The questions in the questionnaire was formulated to gain understanding for the team leaders' view of the waste management. Hopefully this gave honest and usable answers from those who are working with the waste management that will lead to more recycling. To get the most out of the questionnaire, Johannessen's & Tufte's (2003) methodology for this was used.

With a combined method including both a quantitative method, the questionnaire and a qualitative method, the visits on site with guided tours, a methodological triangulation was made. Johannessen & Tufte (2003) describe this method and emphasizes the advantages with getting a more nuanced view of a problem.

The questionnaire was handed out in a Swedish version and the results was translated into English. The results from the questionnaire was put together to be able to present valuable statistics. For this action Microsoft Excel was used.



## 3. The policy for Swedish waste management

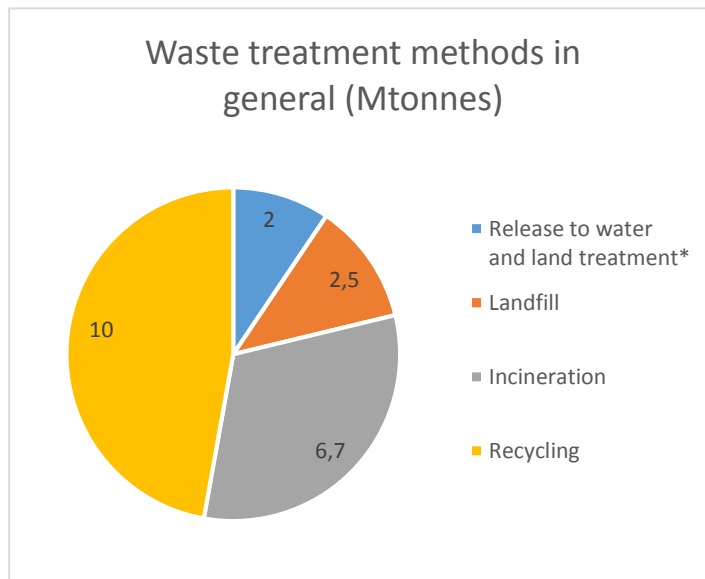
The following chapter consists of a compilation of waste statistics, the different strategies and targets in the Swedish waste management scheme and will give an overview of how it is controlled today. There is a presentation of the legislation and policy instruments that are used today and also of suggestions for new instruments. Beyond the legislation and policy instruments mentioned below, the Swedish waste management scheme is indirectly also covered by legislation for other sectors, for example the energy sector (Bisaillon & Finnveden, et al., 2009).

### 3.1 Waste statistics for Sweden

In Sweden the responsibility for waste statistics lies on the Swedish EPA (Allerup & Dunsö, et al., 2014). The statistics should, according to EU, be put together and presented every second year. The last report was made 2014 with the official statistics for 2012, which is used in the following diagrams. The statistics are also used to evaluate the national target achievement.

Mining processes is by far the sector that generates most waste in Sweden and after that comes the construction and building sector and the households (Allerup & Dunsö, et al., 2014).

Figure 2 shows the statistics for the different treating methods for non-hazardous waste in general in Sweden, waste from the mining industry is excluded (Allerup & Dunsö, et al., 2014).



**Figure 2.** Waste treatment in Sweden 2012, seen from the waste hierarchy perspective with the two highest steps (re-use and prevention) excluded (Allerup & Dunsö, et al., 2014).

\*Mostly consists of dredging spoils.

When it comes to trends it is difficult to evaluate, because a thorough presentation of statistics that now is done every second year has just been done since 2004 (Allerup & Dunsö, et al., 2014). During the years from that, EU also have changed their definition of what waste is. For household waste the rate of waste to incineration has not changed so much over the last years, but when it comes to industry, that rate has increased (Lundmark & Samakovlis, 2011).

The total waste volumes from 2010 to 2012 has increased and that is due to increased mining (Allerup & Dunsö, et al., 2014). If the mining waste is excluded there was a decrease with 2 million tonnes. In general, the material recycling has decreased during the last period of statistics, incineration has increased and landfill has decreased.

Figure 3 shows a detailed explanation of waste volumes and treatment methods in Sweden (Allerup & Dunsö, et al., 2014). Around 156 millions of tonnes of waste was generated in Sweden 2012, 129 millions of tonnes of that came from the mining

industry and 4,4 was secondary waste. 150 millions of tonnes of non-hazardous waste and 1,1 million of tonnes of hazardous waste were finished in Sweden. 26,1 is the total value for generated waste that is treated at waste treatment plants, imported waste (red arrow) and secondary waste (grey arrow). Secondary waste arises when primary waste after some kind of treatment shift to another type of waste, this could for example happen when a car is scrapped. The waste that is material recycled in the industry could for example be scrap in a plastic factory that is re-used in the manufacturing process.

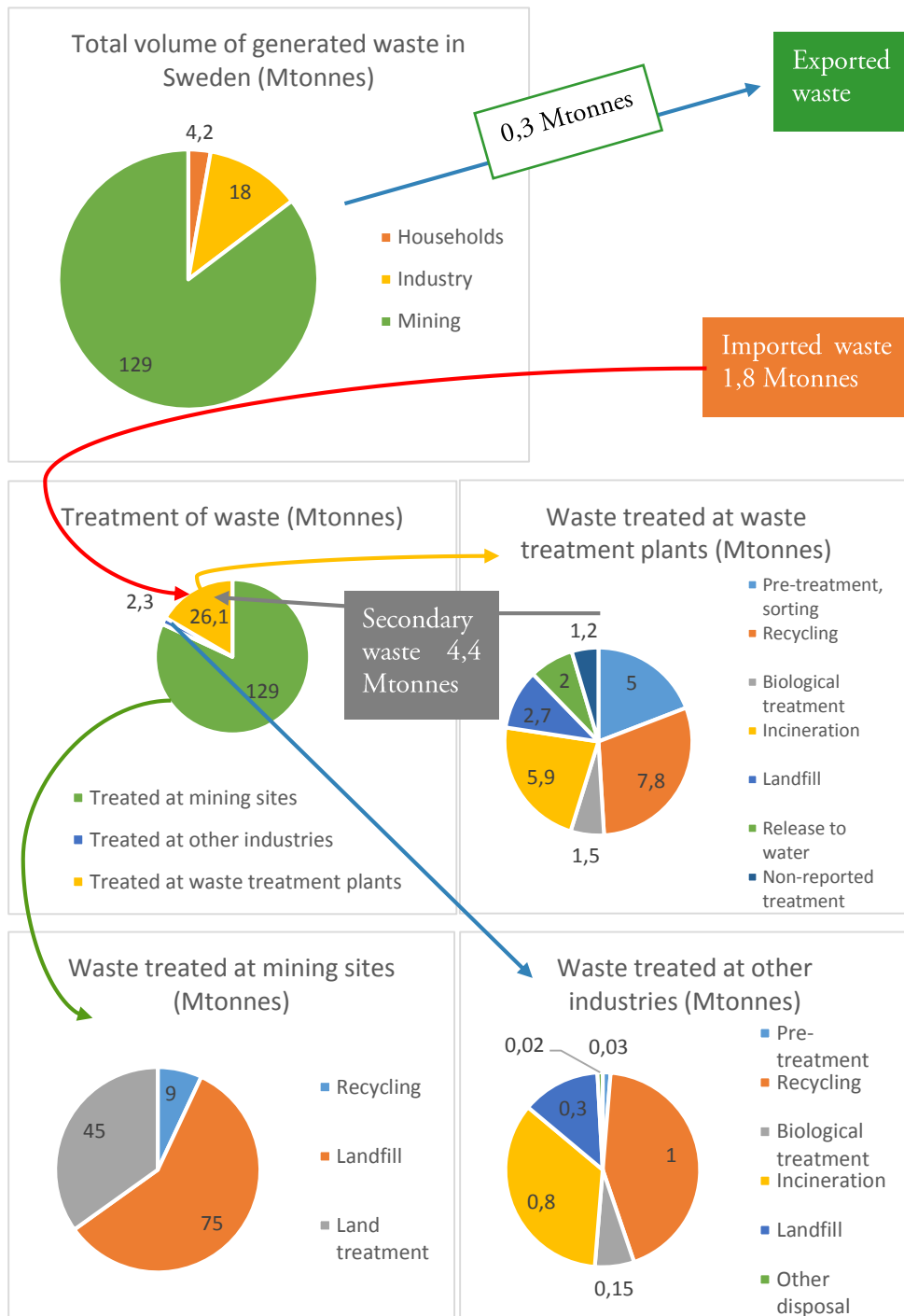
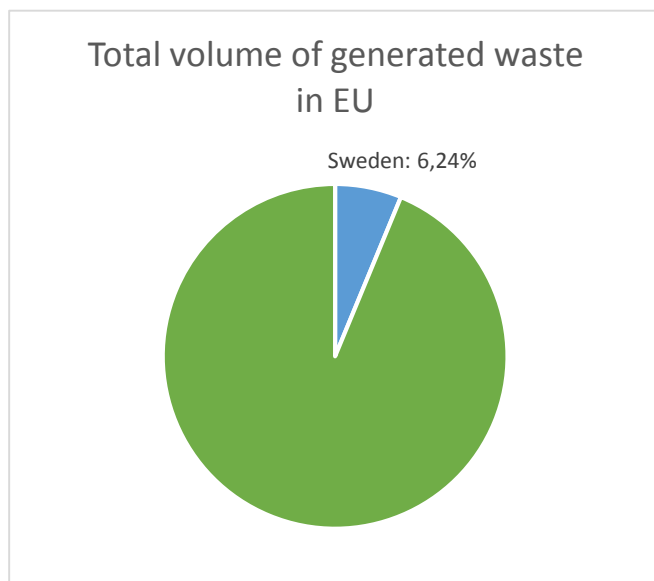


Figure 3. Waste volumes generated and treated in Sweden 2012 (Allerup & Dunsö, et al., 2014).

### 3.2 Waste statistics for EU

The total waste volumes for EU 28 was 2010 (data for 2012 was not available when the last report was developed) around 2,5 billions of tonnes (Allerup & Dunsö, et al., 2014). Figure 4 below show the Swedish waste volumes according to the whole EU.



**Figure 4.** Sweden's volume of generated waste in proportion to EU's generated volumes (Allerup & Dunsö, et al., 2014).

The volume of waste that is generated in EU has during the last years been rising (European commission, 2010). This has many reasons and many of them are related to higher living standards. The consumption is rising and the lifespan for many products are short, which generates a lot of waste. The increased use of single-use and disposable products also contribute to more waste. Electric waste and electronic equipment are the waste streams that grows fastest in the EU. The hi-tech products that are used today are also very complex, which makes it difficult to deal with the waste. It is a problem for the environment, when for example rare earth metals are used, but it is also a working environment problem when people put apart the different fractions in the product which can contain hazardous materials for the human health. In EU's Environment Action Programme, waste management is one of four prioritized

topics (1386/2013/EU). As a result of increasing waste volumes due to higher living standards this programme has the objective that the economic growth shouldn't lead to increased waste volumes.

The total waste volumes for different EU countries is hard to compare between the countries because for example the industry could vary very much, in Sweden the mining industry generates huge waste volumes and in a country without mining there could be much less waste volumes (Allerup & Dunsö, et al., 2014). If a highly populated country reports low waste volumes that could also be due to that all the waste is not collected.

### 3.3 Legislation and policy instruments

The responsibility for the Swedish waste lays on three different parts (Waste Sweden, 2014):

- The municipalities are responsible for the household waste
- The producers in the sectors that is included in the so called “producer responsibility”, see Figure 5, have the responsibility to collect and take care of the worn-out products
- Other waste holders (mostly the industry) are responsible for all other waste

The Swedish waste management scheme has during the last 20-25 years went through some important changes (Swedish EPA, 2012a). In the beginning of the 1990s a large proportion of all waste that was treated in Sweden was used for landfill, which has changed significantly. This is much due to introduction of new legislation and policy instruments. Since 2002 there is a ban for using sorted, combustible waste for landfilling. 2005 this ban was extended to also regard organic waste with some exceptions. There is also a tax for landfilling. Introduction of the carbon dioxide tax and producer responsibility for eight different fractions, see Figure 5, have also had significant importance.



The actions that have been made have in a great extent changed the focus for waste management from landfill to incineration and not so much towards the higher steps in the waste hierarchy, see Figure 1 (The Swedish EPA, 2012a). The next important challenge for decision makers is now to move the focus more towards re-use and prevention. The waste volumes have increased during the last years and research show that it will increase during the next years too (Ambell & Björklund, et al., 2010), therefore it is important to come up with new, better strategies.

The following parts constitutes a compilation of the directives and programmes that are of greatest importance for waste management in Sweden.

### **3.3.1 EU's waste directive**

The waste management in Sweden is first and foremost regulated by EU's waste directive (2008/98/EC). This directive defines that the mainly target when it comes to waste politics should be to "minimize the negative effects on people's health and the environment when generating and handling waste". It also presents the general definition of waste:

"Waste: an object the holder discards, intends to discard or is required to discard."

EU established this waste directive 2008 and the greatest difference in this new directive compared to older strategies was the change from seeing waste as a burden to see waste as a resource (2008/98/EC). This new regulation resulted in a change in the Environmental Code (SFS 1998:808), chapter 15 and also a new waste regulation (SFS 2011:927).

The line of argument in the EU directive is the so called waste hierarchy, which all waste management in EU should be based on, see Figure 1 (2008/98/EC). This hierarchy should be the order of prioritization when it comes to legislation and political decisions. It is also mentioned that every EU country should develop a waste plan and a program for waste prevention, in Sweden that responsibility lays on the EPA (SFS 2011:927). Regarding waste prevention the directive emphasizes some important

points to the member countries, for example to promote research and development, eco design, economic policy instruments and to promote re-using and reparation of worn-out products (2008/98/EC). The directive also mentions the importance of confirmation of targets for the waste management in the member countries. In the directive there are also two general targets for 2020:

- The preparation for re-use and material recycling of waste that comprises at least paper, metal, plastics and glass from households and similar sources should increase to at least 50 percentage of weight
- The preparation for re-use, material recycling and other recycling of non-hazardous construction and demolition waste should increase to at least 70 percentage of weight

In the expression “prevention” it is also included to reduce the hazardousness of the waste and the environmental impacts from the treatment (Arushanyan & Bisailon, et al., 2013). This means that policy instruments in the chemical field also have an impact for waste management. Another thing that could be said regarding prevention is that the greatest environmental profits come with decreased manufacturing and using and not as much for decreased impact from waste treatment (Sundqvist & Palm, 2010)

When it comes to general strategies from EU it can also be mentioned that the theory of circular economy has become important (European Commission, 2015). Circular economy is a strategy to see waste as a resource and use it more efficient through re-using, repairing, refurbishing and recycling.

### **3.3.2 The Swedish waste plan and the programme for waste prevention**

The national waste plan for Sweden was adopted by the Swedish EPA in May 2012 (The Swedish EPA, 2012a). The plan is evaluated every sixth year. The aim with the plan is to work towards a better management of resources and a better waste management and it constitutes a complement to the Environmental Code and other legislation and should contribute to the work with the environmental quality objectives.

In this plan there are targets and arrangements described for five different areas (The Swedish EPA, 2012a):

- Waste management in the building and construction sector
- Household waste
- Resource management in the grocery chain
- Waste treatment
- Illegal export of waste

The arrangements that are presented aim to decrease the waste volumes and the hazardousness, to take better advantage of the resources, stop the spread of hazardous substances and to improve the waste management in general (The Swedish EPA, 2012a).

The Swedish programme for waste prevention was adopted by the Swedish EPA in December 2013 (The Swedish EPA, 2013a). The programme is supposed to contain targets, arrangements and indicators that measure how the minimization process for waste and hazardous substances are developing. Eight direction targets and 167 arrangements have been stated in the programme. The targets are improving the work with the environmental quality objectives and work as a complement to the milestone targets. It is also a complement to the national waste plan. The programme has four focus areas: food, textile, electronics and construction and demolition. The aim with the programme is to constitute a guidance and inspiration to actors in the work towards reaching the environmental targets and ending up with less waste and more products constructed without hazardous substances. An updated version of the programme will be presented 2018.

### 3.4 The Swedish system for national environmental quality objectives

In Sweden there is a national system for environmental quality objectives which is approved and defined by the Swedish parliament (Environmental Objectives, 2013a). It consists of one generation target, sixteen environmental quality objectives and 24 milestone targets. It is the parliament that makes the overall decisions and for each environmental objective there is also a responsible authority (Environmental Objectives, 2012a). The county councils and the National Board of Forestry are working with the quality objectives on a regional level and the municipalities on a local level. Beyond that, the industry also has an important role in the achievements of the targets. In January 2015 a national coordinator for the industrial work with the environmental quality objectives was appointed and her task will be to integrate the industry's environmental efforts in the work with the environmental quality objectives (Environmental Objectives, 2014c).

The generation target specifies the direction and works as an overall guidance for the environmental work and implicates that the most important environmental challenges should be solved until the next generation takes over (Environmental Objectives, 2012b). The target states that focus should be to, for example, let eco systems recover and to conserve the nature resources.

The sixteen environmental quality objectives describe the target with the environmental work for each area more detailed with a description of the condition in the environment that the efforts aim to reach (Environmental Objectives, 2013a). For the different quality objectives there are specifications with more detailed descriptions of what the objectives mean. Each year both a national and a regional follow-up whether it is possible to reach the objectives in time are being produced (Environmental Objectives, 2013b). On a national level it is the Swedish EPA that hands in this follow-up to the parliament and on a regional level it is the county councils and the National Board of Forestry that presents target achievement in the counties. As basic data for the annual report a number of indicators that work as a resource to see how the development is are studied (Environmental Objectives,

2012d). On the portal for the environmental quality objectives there is a function to see these indicators where it is possible to choose objective and local/regional/national level (Environmental Objectives, 2012e).

The milestone targets are tools that are used to define what actions Sweden need to implement and what efforts that need to be done to reach the generation target and the environmental quality objectives (Environmental Objectives, 2013a). Milestone targets have been set for five different areas: reduced climate impact, waste, biodiversity, hazardous substances and air pollution (Environmental Objectives, 2014a).

When it comes to waste management it is primarily the environmental objective *A Good Built Environment* that is the most relevant. (Environmental Objectives, 2012f). Indirect the waste management could also influence the achievements for the quality objectives: *Reduced climate impact* and *A Non-Toxic Environment*.

### **3.4.1 A Good Built Environment**

*A Good Built Environment* is one of the sixteen environmental quality objectives that the Swedish parliament has adopted and the responsible authority is Boverket – the National Board of Housing, Building and Planning (Environmental Objectives, 2012a). The parliament has defined the objective as follows (Environmental objectives, 2010).

”Cities, towns and other built-up areas must provide a good, healthy living environment and contribute to a good regional and global environment. Natural and cultural assets must be protected and developed. Buildings and amenities must be located and designed in accordance with sound environmental principles and in such a way as to promote sustainable management of land, water and other resources”.

In the specifications for the objective a number of directions are specified that concerns: habitation and community planning, infrastructure, public transport, natural and cultural values, living environment, health and safety, conservation of

energy and nature resources and at last sustainable waste management (Environmental Objectives, 2012c).

The objective that concerns waste management is defined as follows (Environmental Objectives, 2012c):

“The waste management is efficient for the society, simple to use for the consumers and that waste is presented at the same time as the resources in the waste that is generated is taken advantage of in the greatest extent possible and that the waste’s impact on and risks for health and environment are minimized.”  
(Translation from the Swedish version)

For *A Good built Environment* there are also two milestone targets that regards waste management and they are the same as the two general targets that are presented in EU’s waste directive (The Swedish EPA, 2014a).

There are five indicators for the environmental objective *A Good Built Environment* that concerns waste management: household waste, recycling glass, recycling metal, recycling paper packaging, and recycling plastics (Environmental Objectives, 2013e). The aim is that this target should be reached until 2020, but the follow-up from 2014 shows that it is not possible to do so with the methods that are used today (Environmental Objectives, 2014b).

The Swedish EPA performs an annual follow up for the 16 environmental quality objectives and the milestone targets (The Swedish EPA, 2014a). The report from 2014 shows that it is not possible to reach the objective for *A Good Built Environment* until 2020 with the measures and policy instruments that are used today. It also shows that it is not possible to see a clear direction for the development of the objective. The conclusions say that there is a general need for more measures and new policies. The follow-up that has been done just include the household waste and that part of waste is still increasing although the pace for the increase is subsided.

The EPA also presented three important aspects of the work to come forward with the work with the environmental quality objectives (The Swedish EPA, 2014a):

- Ensure that decisions that already have been taken are getting realized
- Develop strategies for a sustainable consumption
- Communicate and inform more about the possibilities with environmental work

### **3.4.2 Suggestions for future strategies and milestone targets**

The Swedish Board of Housing, Building and Planning, Boverket has defined strategies to work with the environmental goal *A Good Built Environment* and the Swedish EPA has defined suggestions for new milestone targets regarding waste management (Boverket, 2014 & The Swedish EPA, 2013b). The purpose of these new strategies and goals is to increase the rate of waste that is recycled or re-used and to minimize the waste volumes in general. Boverket has one suggestion concerning recycling – *Energy and resource management* (Boverket, 2014). The most relevant part in this category is a subcategory called *Efficient use of materials*. In the description of this strategy it says that an efficient way of material management is an important part of the work to reach a good built environment. The resources that are used should in greater extent be renewable and recyclable. They also mention the importance of working with circular economy. Boverket's conclusion is that this strategy needs to be more integrated in the environmental goals and therefore this part should be investigated to be part of a new milestone target.

The suggestions for new milestone targets that the Swedish EPA presents have three categories that is interesting in the area of waste (The Swedish EPA, 2013b). They are: increased preparation for re-use and material recycling for waste, decreased volumes of food waste and textile waste. More specifically, the goals that are presented and are interesting in the waste topic are:

- At least 60 % of the household waste and corresponding waste from the industry is prepared for re-use or is material recycled
- It is easy for households and industry to leave products for recycling and waste for preparation for re-use
- The county councils and industry with a significant potential to better take advantage of the material in waste have developed industry-specific waste goals

The 60 % target could be compared to the general target for EU, which is 50 %. The Swedish EPA also presents some changes that could be made when it comes to policies (The Swedish EPA, 2013b):

- Increase the goals for recycling when it comes to producer responsibility for packaging and waste paper
- Demands for industry to establish a plan for waste management
- Initiate the development of goals for county councils and industry

Beyond that, they also mention the importance of increasing the re-use and the material recycling rate for textile and they suggest that a producer responsibility should be implemented for this fraction (The Swedish EPA, 2013b).



### 3.5 Policy instruments

Figure 5 shows a list of the instruments that concern the work with waste management in Sweden from the perspective of the environmental objective *A Good Built Environment* (The Swedish EPA, 2012b). It is seen from both an international level, an EU level and a national level. To be able to evaluate whether it is possible to reach the environmental targets in time it is important to investigate what policy instruments there are and if they are efficient.

Administrative	Economical	Informative
<ul style="list-style-type: none"> <li>•EU's waste directive, The waste hierarchy</li> <li>•EU's directive for incineration</li> <li>•EU's directive for landfilling.</li> <li>•The Swedish Environmental Code, chapter 2 and 15</li> <li>•The planning and building act</li> <li>•The Swedish waste Regulation</li> <li>•The Swedish waste plan</li> <li>•Regulation for landfilling.</li> <li>•Producer responsibility:               <ul style="list-style-type: none"> <li>•Batteries</li> <li>•Cars</li> <li>•Tires</li> <li>•Electrical devices</li> <li>•Packages</li> <li>•Waste paper</li> <li>•Medical products</li> <li>•Radioactive products and ownerless radiation sources</li> </ul> </li> <li>•The Swedish EPA's Regulations for a municipality's waste plan</li> </ul>	<ul style="list-style-type: none"> <li>•Emissions trading</li> <li>•Carbon dioxide tax</li> <li>•Landfill tax</li> <li>•Municipal waste tax</li> </ul>	<ul style="list-style-type: none"> <li>•Research program "Sustainable waste management"</li> <li>•Information about collection systems, the waste hierarchy, great examples etcetera</li> </ul>

**Figure 5.** Policy instruments that regards the work towards reaching the environmental objective regarding waste management (The Swedish EPA, 2012b).

The research that has been made during the last years regarding waste management in Sweden presents a need for better policy instruments that directs towards the higher steps in the waste hierarchy (The Swedish EPA, 2012a). The producer responsibility is one policy instrument that has helped increasing the material recycling for packages, but it is unclear whether this policy has headed the producers towards a design of the products that makes it easier to recycle.

In general there are four types of policy instruments that can be used (The Swedish EPA, 2012b):

- Administrative: for example laws and regulations
- Economic: for example taxes and fees
- Informative: for example education, guidance and environmental labelling
- Research

The administrative often mark the basis for other policies, for example economic and the informative can create a better acceptance for the policies and could improve the work with the other policies (The Swedish EPA, 2012b). When it comes to the economic policies it is important that they adjust the prices on goods and services so that they reflect all costs and benefits that the production and consumption of it generates. Economic policies could either work as a carrot or a whip to guide in a sustainable direction.

Bisaillon & Finnveden, et al. (2009) mention that the policy instruments that exist today mostly are concentrated to the lower parts of the waste hierarchy and not so much to waste prevention. One part of the policies that are deficient is the lack of price signals – most often there are no economical transactions between the consumer and the recycling company. This leads to a shortage of incentives for the consumer to decrease their volumes of waste. Bisaillon & Finnveden, et al. (2009) mean that politicians and industry have an important part in the work to change the problem with incentives and to lead the work towards reaching the environmental quality objectives.

Lundmark & Samakovlis (2011) conclude that economic policy instruments would be most fitted for this issue due to, for example, more incentives for different actors. Administrative policy instruments are also preferable due to a great target achievement, but they are not so flexible. Informative policies are usable in the work with household waste for example. They suggest a waste tax or a combination of a landfill tax and subsidies for recycling.

Towards Sustainable Waste Management (Towards Sustainable Waste Management, n.d.) and Waste Refinery (Waste Refinery, n.d.) are two research networks that perform research in the waste area. Both networks have also come up with suggestions for new policy instruments. Waste Refinery concludes that one important policy would be a target for prevention of food and textile waste (Bisaillon & Dahlén, et al., 2013). This would lead to decreased volumes of waste that is unsorted and also a significant decrease of carbon emissions. Bisaillon & Finnveden, et al., (2009) from Towards Sustainable Waste Management present a group of policy instruments in different categories. Several of the targets regard information to companies and consumers, for example information about current waste volumes for the company. There are also some economic and administrative policies, for example taxes for incineration of fossil material and bans for incineration of recyclable materials.

One of the greatest challenges for the target achievement for *A Good Built Environment* is to minimize the hazardousness (The Swedish EPA, 2012b). One problem is that different interests are standing against each other. Policy instruments that are planned are estimated to stabilize the waste volumes to today's levels, but it will be more difficult to minimize the hazardousness. The greatest challenge will be to move the waste from incineration to material recycling (Björklund & Elander, et al., 2014). Because of an over capacity at the incinerating plants and also a continued expansion of them as well as low incineration fees there are few economic incentives to recycle more. Low costs for virgin materials and technical difficulties also make it hard to increase the recycling. Another challenge is to get out more information in the society about recycling and its advantages. One of the fractions that are mentioned in the literature as important when it comes to recycling in the future is textile, which today in great extent is incinerated.

### 3.6 Environmental measures in the industry

The industry is not just only controlled by laws and policy instruments, when it comes to environmental efforts there are also has other driving forces (Almgren & Brorson, 2009). Many companies have voluntarily identified their environmental aspects and also implemented own environmental objectives in their business. Sometimes these objectives are part of an environmental management system at the company. The reasons for the industry to voluntarily implement these measures could both be to decrease the environmental impact, but also to meet demands from customers, increase the motivation among the co-workers, increase the quality of products and also to increase the profit. Companies are aware about the negative publicity it can have if environmental aspects are neglected.

The industry was leading already in the introduction of the ISO 14000-series due to increased attention to the environmental challenges in the society (Almgren & Brorson). To continue the industrial development they thought it would be an obstacle to ignore that discussion. Since that, the implementation of environmental management systems, as for example ISO 14001, has been widely implemented on both global and national scale. The implementation of a complete system with a policy, targets and routines could benefit the whole business with increased order and knowledge about the processes. One of the parts in such a system is constant improvement, which makes it possible to get the efforts to not stagnate.

### 3.7 Future strategies for waste management

Within the scope of the waste research programme Towards Sustainable Waste Management a model for future waste volumes in Sweden was developed for different scenarios (Ekvall & Stenmarck, et al., 2010). The outcome of the future waste volumes is due to several aspects, for example technological development, cost of natural resources and policy instruments. The model shows that input-related waste probably will decrease, but for household waste and staff-related waste (household waste for a

company) the situation is more varying due to different outcomes and in some scenarios the volumes increase and in some they decrease.

The results from the Towards Sustainable Waste Management project mentioned above were a couple of reports that for example presented 16 different potential policy instruments for the waste management in Sweden, this is a list of them (Bisaillon & Finnveden, et al., 2009):

- Information
- Raw materials tax
- Tax on hazardous substances
- Recycling certificates
- Prohibition of distribution of advertising to households that have not expressly agreed to this
- Reduced value added tax (VAT) on services
- Negative labeling of products with hazardous substances
- Requirements for companies to work on waste minimization
- Improved surveillance by authorities
- Weight-based waste-collection fee
- Environmentally differentiated waste-collection fee
- Consumer-friendly waste collection systems
- Climate Tax on incineration of waste with fossil origin
- Weight-based tax on incineration of waste
- Green electricity certificates for waste incineration
- Obligation to recycle recyclable materials

Information to household as a policy instrument is estimated to generate a reduction of 10 % of the household waste, but Ekvall & Sahlin, et al. (2010) concludes that this policy instrument wouldn't have the same effect for companies and organizations. The introduction of a tax for raw materials would probably have the greatest impact for the use of oil and plastics. Weight based waste collection fees have more doubtful results. It could either lead to waste prevention or to increased recycling or either to increased illegal waste treatment.

The policy instruments mentioned above were in an extended research investigated in a wider perspective and the conclusion from that research was that especially six instruments have great potential to decrease the environmental impact (Arushanyan & Bisailon, et al., 2013):

- Information
- Obligation to recycle recyclable materials
- Weight-based waste fee in combination with information and developed recycling systems
- Negative labeling of products with hazardous substances
- Prohibition of distribution of advertising to households that have not expressly agreed to this
- Differentiated VAT and subsidies for some services

The policy instrument for obligation to recycle recyclable materials was the one with the estimated greatest potential (Arushanyan & Bisailon, et al., 2013). Weight based waste fees already exist in many municipalities and it would be relatively easy to implement it in other municipalities too. Subsidies for services like leasing, repairing and renovation could be an effective tool to decrease the waste volumes.

In a newer report 10 other possible policy instruments were investigated to increase the waste volume that goes for recycling instead of incineration (Björklund & Elander, et al., 2014). This report presented two policy instruments that the researchers estimate would have a great potential to increase the volume of recycled waste and also relatively good potential to be realized. Those instruments were:

- Demand for material recycling on construction and demolition projects
- Demand to sort out and material recycle waste from industry and households

The effectiveness of a policy instrument can be different for different materials (Ekvall & Malmheden, 2014). For example is the recycling market more well-established for some materials, for example metals and not so well-established for other materials, for example textile. To increase the volume of collected recyclable materials, an extended

producer responsibility could be helping. Other instruments could be weight based waste collection fees and the obligation to recycle recyclable materials. Weight based waste collection fees have been implemented in some municipalities and more municipalities are planning to attach to it (Waste Sweden, 2011).

Regarding what fractions that should be prioritized when it comes to recycling it is possible to use different perspectives and get different answers (Ambell & Björklund, et al., 2010). If the largest fractions from mixed waste should be prioritized it would concern paper and plastic. If a potential environmental benefit per kilogram would be prioritized it would concern rubber and metal waste.

As the waste hierarchy is a very general model there is a need for decision makers to have a guideline for how to consider different types of waste flows according to the waste hierarchy (Del Borghi & Del Borghi, et al., 2009).

A common conclusion is that not a single type of policy instruments would solve all challenges, it is probably better with a combination of some different policy instruments (Lundmark & Samakovlis, 2011). The simplest instrument would be a general waste tax, but also a landfill tax combined with subsidies for recycling would result in an optimal solution. To get the tool accepted in different sectors it is important to not just have the environmental aspects in mind, but also the economic and social aspects (Björklund & Carlsson Reich, et al., 2007). For example, people in general are willingly to recycle more, but the information about what waste that can be recycled and how to do it is decisive (Ambell & Björklund, et al., 2010). Though Sweden is a large country it may be more efficient to have different solutions in different parts of the country (Björklund & Carlsson Reich, et al., 2007). It is also important to adjust the taxes so that incineration isn't cheaper than recycling. An important way to increase the advantages for recycling is the work with new innovations in different sectors, for example technological innovations (Johnstone & Nicolli, et al., 2012). In a short perspective though, it is important to increase the capacity in the incinerating plants to be able to decrease the landfilling, but that is not a good solution in a longer perspective (Björklund & Carlsson Reich, et al., 2007). To be able to decrease the waste volumes that goes to landfill, other policy instruments as

a combination of weight based fees and increased tax for landfill could have a positive impact on that work.

Waste Refinery has also presented an evaluation of different policy instrument (Bisaillon & Dahlén, et al., 2013). In contrast to Towards Sustainable Waste Management, this evaluation was made for policy instruments that already are decided or are suggested to be introduced. The different instruments that they evaluated were:

1. Including Swedish waste incineration with power and heat production in the EU Emissions Trading System for CO<sub>2</sub>
2. Electricity certificates to Norwegian waste incineration with power and heat production
3. Goal of increased biological treatment (mainly biogas production) of food waste
4. Climate bonus to renewable vehicle fuels
5. Financial support for methane reduction through biogas production from manure
6. Investment support for biogas production from food waste
7. Goal of food waste and textile waste prevention

The conclusions that were presented from this evaluation was that number 7 is one of the most important (Bisaillon & Dahlén, et al., 2013). Their estimation was that number 3, 4 and 7 have a great possibility to have an impact on the waste volumes that goes for incineration in Sweden. The extra advantage with number 7 is that it estimates to have a great impact on reducing emissions of greenhouse gases. One ton of food that is prevented is estimated to a reduction of 1,2 tonnes of CO<sub>2</sub>- equivalents. For prevented textile waste that number is 9,5 tonnes of CO<sub>2</sub>- equivalents/ton prevented waste.



## 4. IKEA's warehouses in Älmhult

The site that constitutes the case for this thesis is IKEA's warehouses in Älmhult, see Figure 6. These warehouses are part of IKEA Svenska AB and consists of two warehouses (Distribution Centrals (DC's)).



**Figure 6.** The map shows geographically where the warehouses are placed and the right picture shows how the four warehouse buildings are oriented (Eniro, n.d.).

There is DC North (house 2 & 3) and DC South (house 4), see Figure 7, 8 and 9, house 1 is excluded in this thesis. House 2 & 3 were built in the 1960s and house 4 in the 1990s (Vindstierna, pers. comm.<sup>2</sup>). House 4 is a larger building and house 2 & 3 have more limited space. In these warehouses there are different types of activities, for example loading and unloading of trucks and a picking station (PLS) where pallets are manually assembled with different articles.



**Figure 7.** House 2, DC North (Photo Eliasson).



**Figure 8.** House 3, DC North (Photo Eliasson).

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<sup>2</sup> Vindstierna, J. Team leader at IKEA with responsibility for waste management.



**Figure 9.** House 4, DC South (Photo Eliasson).

## 4.1 IKEA's guidelines

The following parts consist of a compilation of IKEA's different strategies, guidelines and plans that regard waste on both a global, regional and local level.

### 4.1.1 People & Planet Positive

People & Planet positive is the name for IKEA's global sustainability strategy for 2020 and was published for the first time in 2012 (IKEA, 2014). The aim with this strategy is to work towards a more sustainable world that provides a good quality of life for people, respects human rights and protect the environment. These factors should be fulfilled at the same time as the target is to increase IKEA's revenue. It was therefore a need for a change in the business model, which resulted in the development of this sustainability strategy. To be able to achieve a change, IKEA has put up three driving forces which will lead them in the right direction.

1. Inspire and enable millions of customers to live a more sustainable life at home
2. Strive for resource and energy independence
3. Take a lead in creating a better life for the people and communities impacted by our business

There are also some key points presented (IKEA, 2014). The IKEA Group should:

- Take a lead in turning waste into resources
- Develop reverse material flows for waste materials
- Ensure key parts of the range are easily recycled
- Take a stand for a closed loop society

Beyond the general visions there are also concrete targets for what should be achieved (IKEA, 2014). When it comes to waste that can be linked to DS and the target to convert waste to resources there are the following milestone targets:

- By August 2015, all home furnishing materials, including packaging, will be either made from renewable, recyclable or recycled materials
- By August 2016, reduce IKEA packaging waste in customer's homes by 10%
- By August 2020, 30% of the wood used by the IKEA Industry Group will be recycled
- Prevent and minimize waste generated from own operations and ensure that as much as possible is recycled. Strive for zero waste to landfill wherever possible
  - By August 2020, 90% of the waste from our own operation will be recycled or energy recovered, of which 80% of the waste from stores and distribution centers and 90% from IKEA Industry Group will be material recycled

#### **4.1.2 IKEA Distribution Services Sustainability Roadmap for 2020**

With the global documents towards sustainability as a basis a special roadmap for DS has been developed (IKEA internal document). This document specifies what actions for DS that need to be done to contribute to the goals and commitments in the sustainability strategy. Targets for different areas are presented and also some more general targets. This include the importance of a good communication and education for the co-workers about these targets. When it comes to waste actions and initiatives they are presented both on a global scale and also expectations on the units.

There are also actions for DS on a global level (IKEA internal document):

- Co-operate with other IKEA organizations on the development of routines, working methods and definitions for projects related to waste
- Conduct global waste mapping to benchmark the units to find alternative ways for recycling waste and identify end-of-life treatment
- Support the implementation of projects within circular economy depending on the needs

Expectations for the units are also presented, the ones that regards FY16 are (IKEA internal document):

- Support the global waste mapping
- Implement alternative ways for recycling when possible based on waste mapping
- Continuously investigate ways of preventing waste and re-using materials in the unit
- Strive for zero waste to landfill

Table 1 shows the general DS targets for material recycling (IKEA internal document).

**Table 1.** Summary of the general DS target for material recycling (IKEA internal document).

DS goals	DS result FY14	Goal FY16	Goal FY17-20
<b>Material recycling</b>	85,6 %	82 %*	85 %

\*The goal is lower than the result from FY14 due to a need to review end-of-life treatment for all waste streams. A consistent reporting of treatment methods should also be ensured.

### 4.1.3 Regional plan for DS North Europe

For each DS area that cover a couple of DC's there are an action plan for 1-3 years. In the regional action plan waste is one of the topics identified to be in the focus. (IKEA internal document).

There are two actions for FY15 stated (IKEA internal document):

- Secure the pre-requisites for improved waste sorting. This includes for example infrastructure, education and communication
- Investigate and prepare for demands from resource chain project<sup>3</sup> which include equipment, waste storage and capacity

To these actions there are also goals and they are mainly about to improve the recycling according to the DS2020 Roadmap target (IKEA internal document). The plan is that these actions should take place during FY15.

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<sup>3</sup> Resource chain is a global project to develop a framework for how IKEA should work with recycled and virgin material and reverse material flows (Dybiec, pers. comm.).

The actions have also been divided into more specific ways to work locally, see below (IKEA internal document).

- All co-workers understand, are committed and secure waste sorting in daily operations
- Structure and schedule for co-workers responsible for the unsorted waste
- Increased multi cycle quality (reduce single cycle)

#### **4.1.4 Local sustainability**

For each of the DC's there are also a local sustainability action plan developed (IKEA internal document). These action plans address some of the goals and commitments in the global strategies/plans. When it comes to local sustainability actions defined as priority in DC Älmhult's local plan, they are pretty similar as for the regional (IKEA internal document). There are several actions presented on the waste topic and these are also supposed to be fulfilled during FY15. The main local goals for the warehouses when it comes to recycling is **50 % recycled and 93 % sorted** (the local goals are lower than the global because of no solution for wood waste during FY15).

There are also some more general actions that could have impact on the waste management (IKEA internal document):

- Facility sustainability training for all co-workers
- Start up a green team
- New sustainability information walls/notice boards
- Communicate sustainability at weekly meetings at least 4 times/year
- Attend and communicate sustainability at 1 workplace meeting for all groups

The following actions in Table 2 that are defined in the local sustainability action plan are more specific for the waste management and here also follow some comments for the goal achievements (IKEA internal document).

**Table 2.** A compilation of the local goals and comments about them (IKEA internal document).

Action/goal	Comments
Mapping of all fractions end-of-life in order to comply with requirements and new global definition of “waste recycled”.	All fractions that we have had so far are mapped.
New recycling station for H2 &3.	Planned.
Look into possibility for recycling wood with SITA.	No current solution but ongoing investigation.
Communicate/implement recycling station areas at H4.	Testing new placements.
Separate and follow statistics on hard plastics – evaluate possibility of recycling.	Separated but no current solution from waste company.
Re-label and exchange bins at H2 and H3.	Started test with new bins/small stations in H2.
Review recycling in canteen to determine how to minimize unsorted household waste.	Have reduced the bins of household waste collected by Älmhult’s municipality and increased organic. More sorting possibilities planned for new canteen.
Recycling training for all co-workers.	Included in sustainability training.
Carry out recycling of pallet bands.	Test of routines and setup together with responsible TL.

#### 4.1.5 Waste guidelines

Regarding IKEA’s waste management there are one handbook and one guideline used (IKEA internal documents). The handbook regards all IKEA businesses and the guideline regards the DC:s and CDC:s. The general development during the last years have been to avoid waste to landfill. The next focus will now be to increase the material recycling as well as avoiding waste to landfill. The warehouses should ensure that the waste is treated in a safe way for both people and environment.

To reach these targets there is a need for an efficient waste management in the warehouses (IKEA internal document). The handbook and the guideline describe how different fractions should be sorted and the handbook also explains the waste hierarchy. It emphasizes the importance of seeing waste as a resource. Follow-ups are mentioned as something important and to investigate possibilities to improvements, help from the



waste contractor is suggested. Labelling and thorough information to the co-workers are other actions mentioned to reach a better waste management.

The guideline also mentions that scrapped goods should be used in the following order (IKEA internal document):

1. Co-operation with charity and social organizations
2. Sort into recyclable fractions
3. Energy recovery
4. Landfill

Furthermore, the guideline also describes how the waste management setup should be (IKEA internal document). According to this setup there should be waste islands every 30-40 m and it is important to have the waste management close to the generation of the waste. In such a waste island there should be: paper & cardboard, PE-foils, wood and unsorted waste. It is recommended to have a sorting station inside the building. To make this work efficient it is important to make sure that the co-workers have got the right information and motivation to fulfill the work correctly.



## 5. Results

The results part is divided in two sections. The first sections will give a presentation of the results from the interviews regarding the waste management in Sweden and the second part presents the results from the study of the waste management at IKEA with site visits and the questionnaire. The interview guide, a list of the persons that were interviewed and a complete compilation of the answers to the different questions in the questionnaire are presented in Appendix 1 and 3.

### 5.1 Qualitative survey – interviews

By interviewing different actors relevant to the Swedish waste management scheme it was possible to see several similar opinions and thoughts and also some differences. In general there is a positive view of the last years' successful work in Sweden, but they are also aware of the fact that Sweden has to continue the hard work towards improving the waste management and become more sustainable.

“The less finite resources we have, the more important is the waste management.” (Ihd)

There is also a clear thought about seeing waste as a resource and to apply circular economy as a way of thinking. They all agree that the waste management is not an easy topic and it is influenced by global political and economic questions and different countries have different possibilities to handle the waste.

### 5.1.1 Waste management in Sweden today

Important parts in the work during the last years have for example been: landfill bans, landfill tax and producer responsibility (Östlund). The focus has been to move from landfill to incineration. The next important step is to move towards more waste prevention and more recycling. Lindh means that we need to find new ways to make profits from the waste more than once. One part that constitutes a problem in that work is that it is very cheap to incinerate waste in Sweden today (Ihd). To be able to recycle products more efficient, the design of the products is important (Lindh, Nilsson-Djerf.). Lindh also mention that if the price differences wouldn't be so large, he think that there would be more recycling in Sweden.

Ihd and Nilsson-Djerf mention that focus during the years have changed and now is waste more and more seen as a resource, circular economy has become an important concept. Ihd also mention that there is considerable activity in the EU regarding waste and she believe that this activity will continue increasing, because the whole EU have to conserve their resources. Östlund means that it is important to have much focus on what happens on EU-level, but to make sure that measures are implemented, the work on a local level is important too. For example is the information to municipalities important. Information is something that SITA works with according to Lindh and he means that it has had a great effect on the recycling rate for their clients.

An obstacle that is mentioned several times is that to increase recycling there is a need for clean waste streams (Östlund). But Östlund also mention that this is a conflict between recycling and the environmental objective *A Non-Toxic Environment*. She means that *A Non-Toxic Environment* strives for absolutely non-hazardous waste streams, but to increase the recycling maybe low levels of hazardous substances have to be accepted.

“There is a conflict between *A Non-Toxic Environment* and recycling, we want to have a non-toxic environment, but maybe you shouldn't push it too far, we may have to accept a little amount, but it is hard to tell where that limit should be.” (Östlund)

Ihd agrees with Östlund:

“If everything would be more non-toxic than what it is when it is virgin, it is very little that can be recycled.” (Ihd)

On the other hand Östlund also means that there is no meaning to recycle materials with hazardous substances, because then these substances are brought back into the circular flow and have to be dealt with the next time it is recycled too.

According to hazardous substances in products Nilsson-Djerf mentions that as a problem with one of the fractions that have the largest challenges – electronic waste. He means that it is not just an environmental issue, but also a health issue for those who will take apart the product for recycling after it is used. He suggests a better pricing for such products which better reflects the environmental and health costs. Environmentally it is bad to not recycle it because it contains rare earth metals (Ihd).

Another waste fraction that Nilsson-Djerf mentions as important is the food waste. He mean that it is important to make sure that food waste isn't landfilled, because it will then leak methane. Other fractions that are mentioned as important to have focus on is construction and demolition waste and packaging waste, especially plastics.

Regarding fractions that aren't sorted in a large extension today textile is argued by all that were interviewed to be important. Some textile is today re-used in for example Second Hand shops (Ihd), but there is a need for better and cheaper technologies to recycle it too, to make sure that it isn't incinerated (Nilsson-Djerf, Lindh). The importance of technologies to recycle textile is much due to the environmentally bad manufacturing (Ihd, Nilsson-Djerf). Nilsson-Djerf suggests that a producer responsibility for textile would be appropriate.

“People in Sweden are very good at giveaway textiles for charity, but in general we are not as good at buying from Second Hand.” (Nilsson-Djerf)

Wood waste, on the other hand, doesn't have the same need for new technology (Nilsson-Djerf). It is a great fuel for incineration and it doesn't have the need to be recycled in a larger extent.

Östlund means that focus has during the last years been on household waste and sees a need for more policy instruments that in a wider perspective also include other types of waste. It is important to generally strive for the highest steps in the waste hierarchy, even though it mostly work as a communicative tool and has more shades for different materials in reality (Nilsson-Djerf). The most important strategy is to prevent waste, but the detoxification that incineration perform is also important (Ihd).

“I think that you always have to strive to reach higher and when it comes to circular economy the thought is that we shouldn't introduce and use materials that we can't take care of or re-use in a good way.” (Östlund)

“I think that the trend we have today will continue, we will see an increased recycling, landfilling will decrease even more, we will hopefully see much more focus on circular economy, partly that we prevent waste and also that we see waste as a resource. We have talked about that for many years, but we really hope to do it.” (Nilsson-Djerf)

Regarding waste import there is a clear opinion that it is not a long-term good solution to import waste to Sweden. In a short perspective though, it is better to import waste for incineration in Sweden, than to use it for landfill in other countries (Östlund). In a longer perspective the other countries have to build up their own waste management systems (Nilsson-Djerf).

### 5.1.2 Future strategies

The all four actors had a clear thought that new policy instruments are needed to improve the waste management in the future. Informative policy instruments was mentioned as important, but Nilsson-Djerf meant that informative policies need to be combined with other instruments, for example economical. Different suggestions for economic policy instruments were mentioned from different parts: incineration tax (Östlund), weight based waste taxes in the municipalities (Östlund) and a global carbon dioxide tax (Nilsson-Djerf). Regarding waste prevention Nilsson-Djerf also mean that buying high quality products and repairing them instead of buying new is important. Ihd also mentions reparation and suggests a deduction for that as an economic policy instrument. Administrative policies were also mentioned (Lindh, Östlund). Another strategy that was mentioned as potentially useful for the future was the move from product based economy to service based economy (Nilsson-Djerf).

To make sure that decisions that have been made also are implemented, Östlund means that the government has an important role. She also means that targets in general need to be realistic, but challenging. Nilsson-Djerf suggests more practical measures:

“I think that you have to see it practically, it is very good to have overall, national strategies, but it is also important to reach the goals. At the same time, it is easy to say, but how should that be carried through in reality?” (Nilsson-Djerf)

Regarding producer responsibility Nilsson-Djerf has different opinions. On the one hand he is positive, but when it comes to the producer responsibility for paper and packages he means that it would be more efficient that the collecting responsibility should rely on the municipalities. The producers would still have the responsibility to recycle the waste after the collecting.

To reach the targets it is also important to make sure that all actors work together in the same direction (Ihd, Östlund). Nilsson-Djerf also requests a good engagement from the industry and points that they during the last years have improved their waste management in large extent. Regarding the household waste, availability to waste

disposal sites is decisive (Nilsson-Djerf) and Östlund means that the municipalities need to work more with waste prevention. With more resource effectiveness, Ihd think that the owner question when it comes to waste will be a very important question in the future.

From a waste company's perspective it is always important to strive for a more sustainable waste management, because it is important if the company should be leading on the market (Lindh). In this work he mentions that SITA has the Swedish environmental quality objectives as a guide and SITA has also adopted to environmental management systems. As SITA is a global company there is a possibility to use ideas from different countries as well.



Table 3 below shows a summary of the most important answers from the interviews.

**Table 3.** Summarizing table of the results from the interviews.

Topic	The Recycling Industries	SITA	The Swedish EPA	Waste Sweden
<b>Waste management today? Changes?</b>	<ul style="list-style-type: none"> <li>-Ownership.</li> <li>-Great development during the last years.</li> <li>-Circular economy.</li> <li>-Seeing waste as a resource.</li> <li>-Producer responsibility.</li> </ul>	<ul style="list-style-type: none"> <li>-More recycling today than some years ago.</li> <li>-Less waste for thermal power stations.</li> </ul>	<ul style="list-style-type: none"> <li>-Much focus on household waste.</li> <li>-Landfill tax, landfill ban, producer responsibility.</li> <li>-Much focus to move from landfill to incineration.</li> </ul>	<ul style="list-style-type: none"> <li>-Sweden is among the best.</li> <li>-Circular economy.</li> <li>-Landfill bans.</li> <li>-Important to not use food waste for landfill.</li> </ul>
<b>Problems</b>	<ul style="list-style-type: none"> <li>-Ownership.</li> </ul>	<ul style="list-style-type: none"> <li>-Pricing for treatment.</li> </ul>	<ul style="list-style-type: none"> <li>-Too cheap raw materials.</li> <li>-Bad profitability for recycling.</li> <li>-Food, textile, electric waste, construction and demolition waste.</li> </ul>	<ul style="list-style-type: none"> <li>-Political, legal, attitude and production problems.</li> <li>-Local efforts have to be made.</li> <li>-Industry waste, construction and demolition waste, hazardous waste, electric waste.</li> <li>-Packages, paper, change the producer responsibility.</li> </ul>
<b>Recycle textile? Wood?</b>	<ul style="list-style-type: none"> <li>-Started a textile group.</li> <li>-Low profitability for textile waste.</li> <li>-Cotton is not a preferable material.</li> </ul>	<ul style="list-style-type: none"> <li>-Working on a way to recycle textile.</li> </ul>	<ul style="list-style-type: none"> <li>-No great environmental profit in recycling wood.</li> </ul>	<ul style="list-style-type: none"> <li>-Working with textile, it is a bad fuel for heating.</li> <li>-Producer responsibility for textile?</li> <li>-Wood: great fuel.</li> </ul>

	-No clear method to recycle wood.			
<b>Actions</b>	-EU-level.	-New ways to use material more than once. -Product development.	-Clean recycle flows. -Conflict between environmental quality objectives.	-Probably more recycling and waste prevention and less landfill in the future.
<b>Industry</b>	-Strive for the same targets.		-Waste council with different actors.	-Many companies work with waste – important.
<b>Continue to work upwards in the waste hierarchy?</b>	-Yes, but don't forget the incineration's detoxification.		-Yes, according to circular economy. -Different materials – more or less adapted for recycling.	-It is a communicative tool, in reality – more steps.
<b>Waste import</b>	-A short term solution. -Not sustainable to continue building more thermal heating plants.		-Good in a short term instead of use it for landfill in other countries.	-Not a long term solution, the countries need to have own solutions.
<b>How to reach the targets? Policy instruments?</b>	-Economic policy instruments: deduction for repairing, incineration cost. -Information is also important. -Good discussion with different actors, need to have the same targets.	-Informative policy instruments, maybe also for example taxes.	-A combination: weight based waste taxes in municipalities + information. -Administrative policy instruments are also efficient. -Make sure decisions are carried through before coming up with new.	-A combination: information, economic policy instruments: global carbon dioxide tax. -Local efforts with a wider perspective in mind are important.

## 5.2 IKEA's waste management scheme

All the waste that is produced at IKEA's warehouses is handled by SITA, except for the household waste and the organic waste (generated in the canteens and the office areas) that is handled by Älmhult's municipality. The waste that SITA handles is weighted when they come and collect it and then they charge IKEA for that waste volume. The waste that the municipality takes care of is not weighted, they only empty the waste bins and instead charge for the amount of bins of different sizes. All the household waste is energy recovered and the amount is usually around 2000 kg per month. The organic waste is used for biogas and that amount is roughly 1000 kg per month. When SITA and the municipality have received the waste they report the weight (or amount of bins as mentioned above) and then IKEA has a program with all the statistics where this data is added. This makes it possible to study how the trends change. IKEA also has a cooperation with the Quality team, which works for example with scrapping of some articles and makes a thorough work to sort the different fractions. Most of the waste fractions are freighted to other places outside Älmhult. Regarding re-use and prevention, no statistics are kept for that. Due to quality assurances etcetera there is not much of the waste that can be re-used. For example, cardboard pallets that are only used once, need to be disposed of.

During the year there are some months when the waste volume for a specific fraction could be very high. Mostly these times are due to a larger scrapping that has been made for a specific product, for example old IKEA catalogues. When there is a larger scrapping process planned, SITA is contacted and together they decide how to handle that waste.

### 5.2.1 Fractions for sorting in the warehouses

In Table 4 below the different fractions that are sorted in the warehouses are listed. When it comes to the unsorted waste, the household waste is included. This household waste occurs mostly in the canteens and in the restaurant that is placed in house 2. For the users of the canteens for the office workers and for the visitors in the restaurants there are only two waste fractions: household waste or organic waste. In the warehouses there are waste bins for different fractions placed out where there is a need for it.

**Table 4.** Treatment methods for the different fractions at the warehouses.

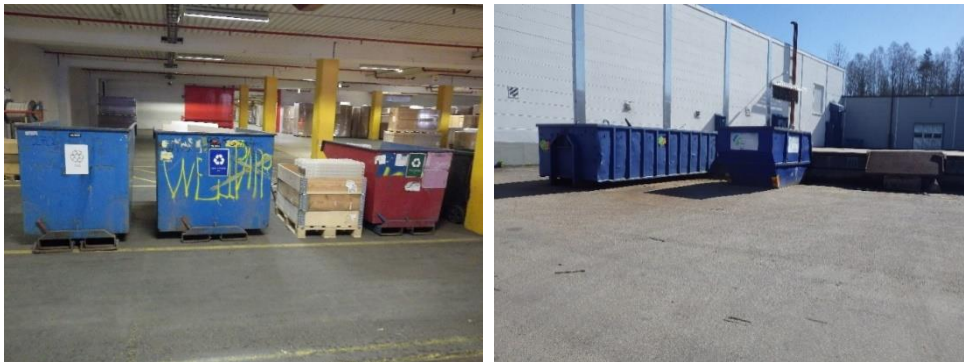
Recycled	Energy recovered
Corrugated cardboard	Processed wood
Paper	Solid wood
Mixed metal	Mixed plastic *
Plastic film	Expanded polystyrene (Styrofoam)
Mixed product glass	Unsorted waste
Mixed light sources	Oil contaminated materials
Fluorescent	Paint and paint tins **
Mixed electrical or electronic equipment	Other hazardous waste **
Mixed batteries	Engine/lubricant oils
Food waste	
Aerosol cans **	

\* This fraction mainly contain pallet bands and they have until today been energy recovered, but there is work in progress to get them recycled and for the moment they are just collected and stored, waiting to be sent for recycling.

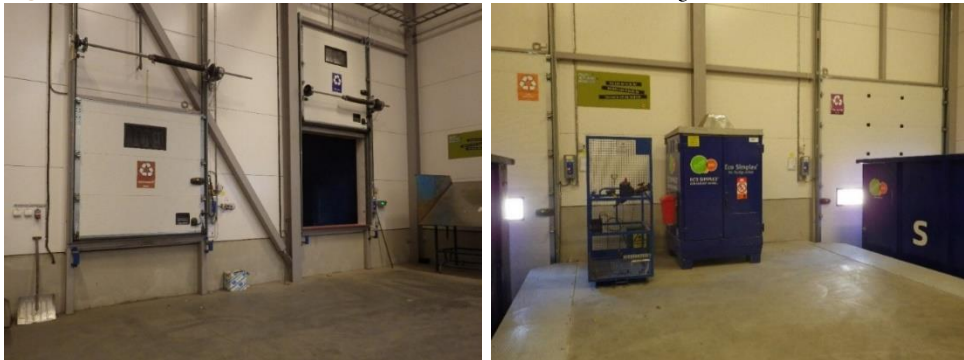
\*\* For these fractions the content of the tins, cans etcetera is burned and then the package itself is recycled.

For the two warehouses there are mainly two different types of challenges. The main problem for DC South is due to the large spaces, the long distances between the different fraction bins. In DC North the problem is that the space is limited and there is a need to put effort to the decisions where to place the waste bins to get the most waste to be sorted correctly.

In general, the most waste consists of packaging materials. The greatest waste volumes are handled at the PLS and the most common fractions there are cardboard, non-rigid plastics and pallet bands. At the loading and unloading places there is not so much loose waste, it mostly consists of pallet bands and cardboard pallets. The waste from DC North is freighted to a building beside house 1 and also to a place between house 2 & 3, where the sorting is done, see Figure 10. On DC South there is a new environment station inside the warehouse where the waste is sorted, see Figure 11.



**Figure 10.** Waste stations at DC North – inside and outside the buildings (Photo Eliasson).



**Figure 11.** The new environment station at DC South (Photo Eliasson).

Closest to the loading platforms in all the houses there are solutions for the most common waste fractions. DC North has a mobile solution and DC South has a stationary, see Figure 12 and 13. Further into the buildings there are bins for more fractions.

There is no clear responsibility distribution for the waste in the warehouses, many different people work with it when there is time and there is no clear description of what that work comprises.

The results regarding the study of the unsorted waste show that most of it consists of cardboard and other wrongly sorted materials, see Figure 12, 13 and 14. This is mostly at the loading platforms, but also inside the buildings. As mentioned before, the bin for unsorted waste almost exclusively consists of cardboard.

Figure 14 shows a bin for non-rigid plastics and as the picture shows it also consists of other materials as cardboard and pallet bands. Another example of wrongly sorted materials was at the loading platform on DC South, see Figure 13. The left bin is for unsorted waste and the right one is for pallet bands. As the picture show, pallet bands are put in the bin for unsorted waste even though there is a bin for it.



**Figure 12.** The mobile waste solution at DC North. Three fractions, from the left: pallet bands, non-rigid plastic and unsorted waste (Photo Eliasson).



**Figure 13.** The stationary solution at the loading platforms at DC South. Two fractions, from the left: unsorted waste and pallet bands (Photo Eliasson).

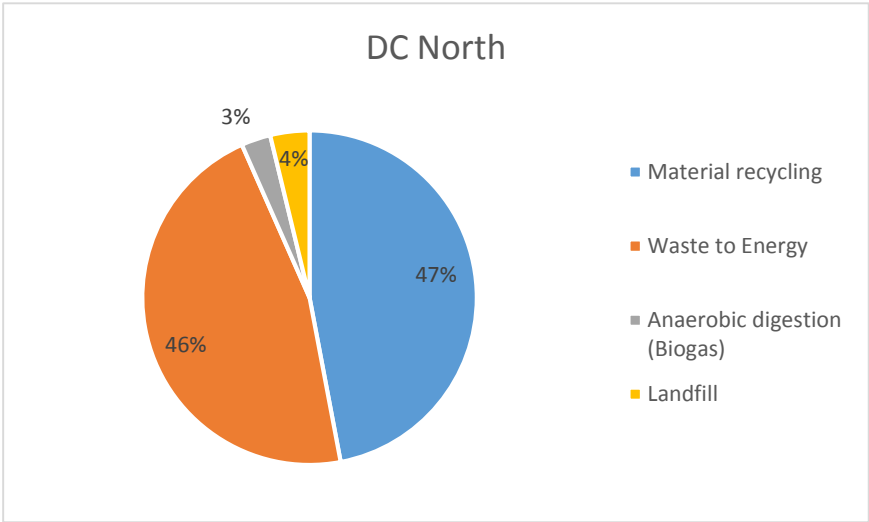


**Figure 14.** A bin for non-rigid plastics (Photo Eliasson).

When it comes to increasing prevention of waste there was one action mentioned that can have a large impact on the material used. It regarded how tight the pallet bands and plastic films are attached to the pallet. If the materials are attached more tightly, the amount of material used for that is decreasing.

### 5.2.2 Waste volumes and target achievements

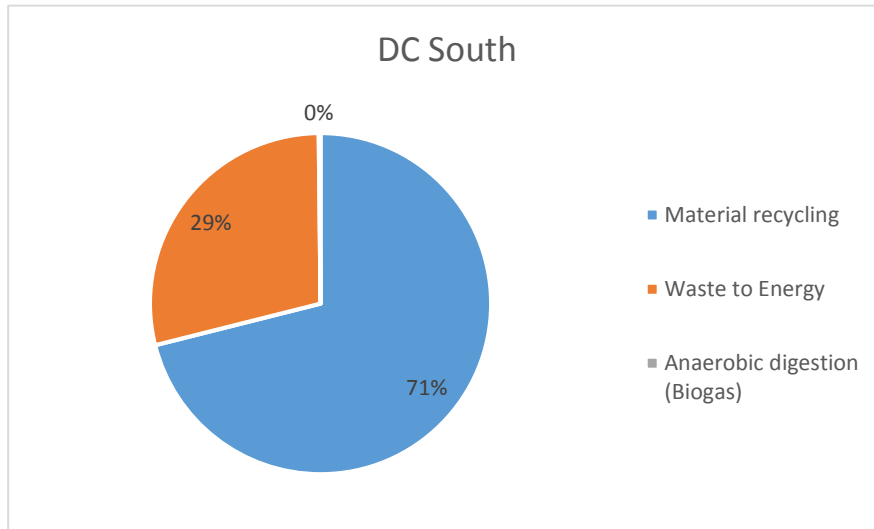
The site visits at IKEA and the study of their waste volumes showed that almost all the waste is sorted for recycling or for energy recovery, see Figure 15 and 16. There is just a small volume that goes for landfill, cooking oils and according to Svahnström (pers. comm.<sup>4</sup>) it is hard to use that to something else. The oils come from a grease trap in the restaurant and mostly contain water. The high recycling rate is due to the new recycling area at the south site, see Figure 11, which has made the waste management easier and more efficient. Table 5 below and Figure 20 and 21 in Appendix 2 show a detailed compilation of the waste volumes for the different fractions.



**Figure 15.** Statistics for treatment methods for the waste from DC North (September 2014 to January 2015).

<sup>4</sup> Svahnström, H. Previous sustainability developer at the DC's in Älmhult.





**Figure 16.** Statistics for treatment methods for the waste from DC South (September 2014 to January 2015).

**Table 5.** IKEA's statistics for waste volumes to different waste treatment methods.

Treatment	North (kg)	South (kg)
<b>Material recycling</b>	57 053	407 053
<b>Landfill</b>	4 600	12
<b>Waste to Energy</b>	56 248	164 654
<b>Anaerobic digestion (Biogas)</b>	3 445	975
<b>Total</b>	121 345	572 864

With a recycling rate at 50 % at DC North and 71 % at DC South it means that both sites are reaching the local recycling target at 50 % for FY15, even though it is on the margin for DC North, see Table 6. Both the warehouses are also reaching up to the target for sorted waste at 93 % for FY15.

**Table 6.** Recycling targets and performance for them at both DC North and DC South.

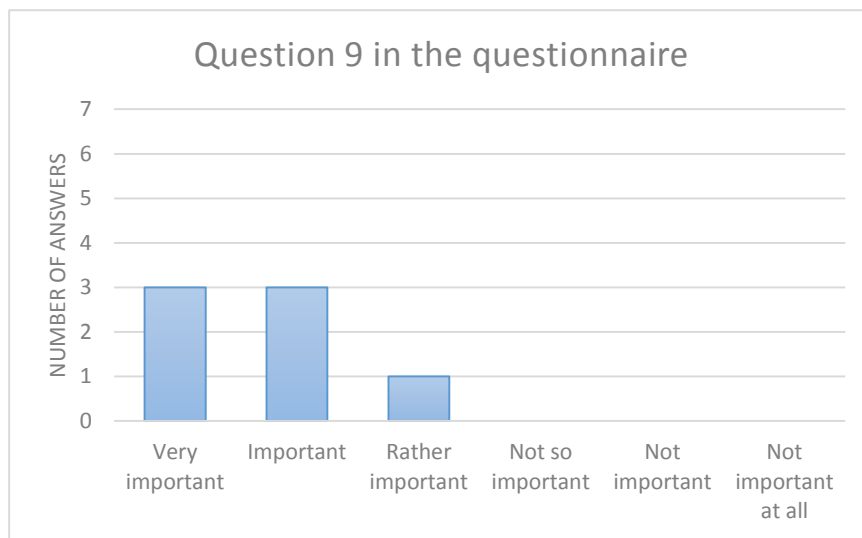
Targets	Performance – DC North	Performance – DC South
Recycling (material recycling + food waste) 50 %	50 %	71 %
Sorting (recycling + energy recovery) 93 %	96 %	100 %

**5.2.3 Plans for the future**

Regarding targets for the future that are mentioned in Table 2 some of the actions mentioned are now planned to be realized. At first a new environment station for DC North is planned. There is also an ongoing work to put together a group that will be responsible for the waste management and regarding that group it will also be clearer what their tasks will be and who has the responsibility. Education to the co-workers has been carried out during the winter and spring. There is also an ongoing work to implement a strategy to recycle the pallet bands.

### 5.3 Quantitative survey – questionnaire

There were 7 of the team leaders that filled in the questionnaire and all the work stations were represented. The results showed a variety of thoughts, but in many questions they agreed. None of them thought they hadn't got enough information about how to sort the waste and thought that the waste management today is good or rather good. They also mentioned the waste management as something important, see Figure 17.

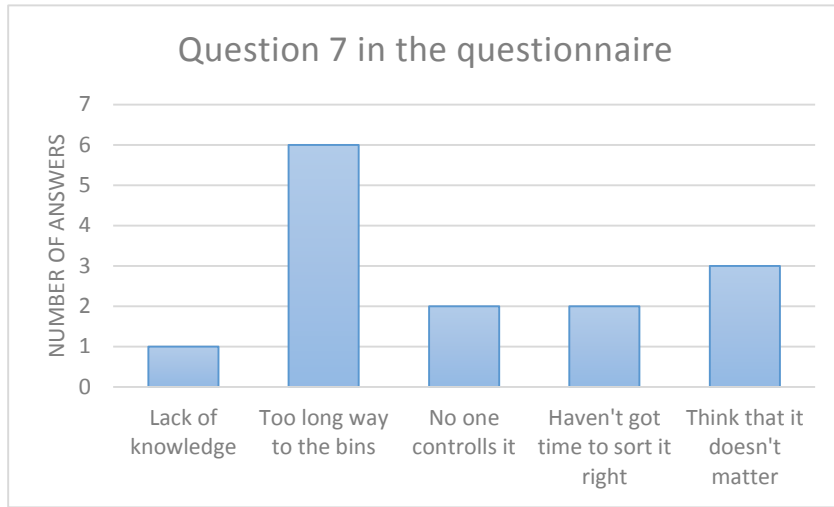


**Figure 17.** Answers to the question: How important is it for you to sort as much waste as possible for recycling?

Most of them thought that the co-workers in general are interested in improving the waste management. There was a thought though, that there might be a bad knowledge among them:

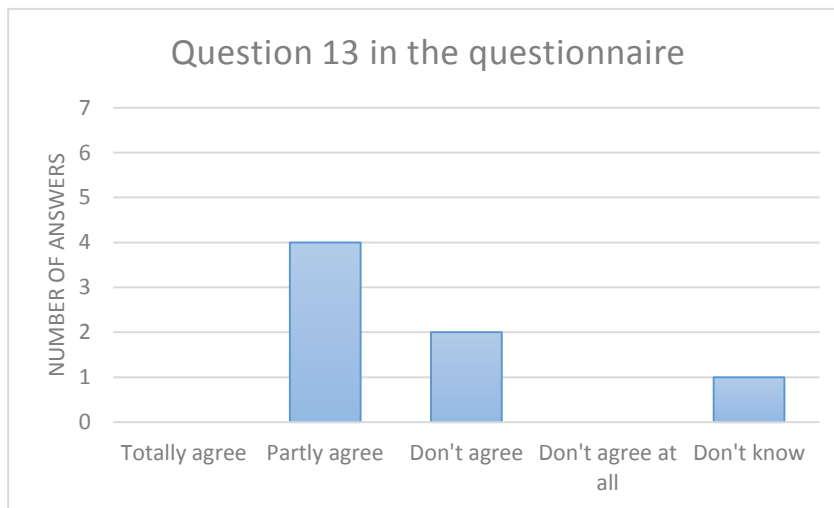
“I think that some of them still think that everything ends up at the same place.”

Besides lack of knowledge there were also several other factors that the team leaders thought might be the reason to the large waste volumes that aren't sorted, see Figure 18.



**Figure 18.** Answers to the question: What do you think are the main reasons that so much waste is unsorted when it could have been recycled? (Mark all that correspond).

When it comes to the question if they thought that the total waste volume is larger because the co-workers think it is more “okay” then because it is recycled, there were a variation of answers, see Figure 19.



**Figure 19.** Answers to the proposition: I experience that in total, more waste is disposed when recycling is chosen because it is more “okay” than if everything had been incinerated.

Regarding the fractions that often are unsorted there was a clear result that cardboard and plastics were the most common. Regarding cardboard there was a suggestion that the mobile solution for sorting on DC North should have a bin for cardboard too, see Figure 12. A majority of the team leaders also thought this mobile solution could be used on DC South too. There was a comment that the solutions on the loading platform on DC South are good but the mobile solution could be used further into the building. When it comes to changes that has been made, the new environment station at DC South was mentioned as a successful one.

Only four of seven knew if they had got information about waste prevention and re-use, the other three didn't know. When it comes to information about IKEA's sustainability though, everyone had got information, but none of them completely agreed that this information was sufficient. Regarding the Swedish environmental quality objectives only three had got information about them, all of them thought that this information had helped them in the waste management.

Finally, there were a couple of thoughts that might help improve the waste management. First of all, a clear scheme for the responsibility of the waste management was requested and that a special group should work with this. Better handing over to the next worker that tells what work has been done should be developed. A development of a working description for this group was part of this suggestion.



## 6. Discussion

The discussion part is divided in two sections. The first regards the general waste management in Sweden and the second regards the waste management at IKEA.

### 6.1 Waste management method in Sweden

The results from this thesis show interesting results regarding the waste management in Sweden, both thoughts about how it works today and also about how things can be changed to work better in the future. Solving the waste challenges is a complex question which contains topics as consumption, product design etcetera not just from a national level but also from a global level. Many of the thoughts from the different actors are similar to the strategies that are mentioned in the literature. Sweden seem to be facing a new phase regarding the waste. From successful work with moving from landfill to incineration it is now time to change the strategies to be able to change from incineration to higher steps in the waste hierarchy. It is clear that different policy instruments seem to be more or less efficient for different steps in the hierarchy and also for different materials. The question is then which policy instruments that would be most appropriate for this new challenge.

On the one hand there seem to be a general need for policy instruments that strive to reach the overall policy that the EU directive presented. On the other hand there seem to be a need for policy instruments for fractions that either have high waste volumes and on the other hand for fractions that are important to minimize regarding to other aspects, for example a high environmental impact. According to the later aspect, fractions that have been mentioned both in the literature and in the interviews as especially important are: electronic waste, construction and demolition waste, food waste and textile waste. Emissions from landfilled food waste was mentioned in the

interviews as something that should be avoided due to emissions of methane. In other fractions the impact is more unknown, for example regarding the content of electronic waste and its effects. When it comes to the Precautionary Principle it would be appropriate to work towards better strategies to work with that.

When it comes to hazardous substances in the waste it was mentioned a conflict between an increased recycling and *A Non-Toxic Environment*. Both these aspects are important towards a sustainable society and therefore it is important to find strategies and compromises that could be some kind of optimal solution. The target to recycle may then not be appropriate for all materials, perhaps it is more environmentally efficient to incinerate hazardous materials to get rid of them.

Regarding the waste fractions that constitute the largest volumes, packaging waste and especially plastic packages, seem to be the ones that need new strategies. Even though there is a producer responsibility for packaging waste there still seem to be a problem. There is therefore reason to find new strategies even though there already is a policy instrument. The results from both the literature and the interviews show that the general belief is that a combination of policy instruments is the most efficient strategy. Since much focus during the last years have been on EU, it may be the time to focus more locally now. As it was mentioned in the interviews such efforts as information to municipalities and a good availability for waste disposal sites could be efficient in increasing the recycling. Because that Sweden is a large country with much variation it is important that strategies for availability are locally adjusted.

To reach even higher in the waste hierarchy it is important that all municipalities have a waste plan for prevention and introduce weight based waste fees. According to the Swedish EPA's point that the current decisions need to be fulfilled, it is necessary that the policy instruments work close to the problem. This was also mentioned in the interviews, methods to work with the overall strategies from EU on a local level are important. To make recyclable materials obliged to be recycled, there would probably also be a decreased incineration.

Even though the producer responsibility might not have solved all challenges with the fractions regarded, there were thoughts that it might work as an effective



policy instrument. Textile was mentioned as a possible fraction for a new producer responsibility and perhaps other problem fractions mentioned above also could be covered by that, for example electronic waste.

One problem that was mentioned in the interviews was the pricing for different waste treatment methods. Recycling today is more expensive than incineration, but with an increased demand for recycled materials the profitability would probably increase. But to increase the demand there will be a need for policy instruments as for example a raw material tax. There might also be a need for changed quality criteria for different materials if they should be exchanged from virgin to recycled. Regarding economical questions it is not sustainable to increase the addition of thermal power plants. As the interviews say this might be a good solution in a short perspective, but since waste management is a global problem, it will be needed to have functional systems in more countries so that they can deal with their own waste in a sustainable way. Building for more incineration in the future is not according to the programmes and strategies that counts for the waste management.

As the interviews told, the work towards circular economy is getting more and more common. According to the strategies from EU with the waste hierarchy this is the right way to go. Resources will be more important in the future and to see waste as a resource will be more necessary when there will be a lack of virgin materials. According to the interviews it is important to have focus on what happens on an EU-level, but to reach the goals the local efforts are just as important as well as the fact that all actors work towards the same direction. The government has a great responsibility to make efficient decisions about strategies that lead to a more sustainable waste management.

As seen in the statistics, the industry stand for a large part of the waste volumes. As many companies already have done, it is important that more companies also take their responsibility and implement measures that lead to decreased waste volumes. To be able to have a sustainable consumption in the future, these efforts from the industry itself will be a prerequisite. Strategic efforts that lead to decreased environmental impact and increased profit for the company is a way that will lead to a more

sustainable society. Implementing an environmental management system is one example of such efforts that many companies globally have made for many years.

As a conclusion regarding the environmental objectives it is necessary to come up with compromises between the different objectives – to have a clear presentation of what is included in the different targets. Investigations and reports from the Swedish EPA need to be used to improve that work. As mentioned above, the industry also constitutes an important actor in the work to implement and use environmental quality objectives.

## 6.2 IKEA's routines for waste management

The results from the case regarding waste management at IKEA showed both solutions that works well and parts that need a change to achieve a decreased volume of unsorted waste. The positive results are that there is a high recycling rate already and there seem to be an interest among the team leaders to reach even more recycling. Among the team leaders there also seem to be a good knowledge about how the waste should be sorted and there have been changes made to make the waste management more efficient. There also seems to be an interest among the co-workers to recycle more. The focus has changed from landfill → incineration to incineration → recycling, which is the same development as for Sweden in general.

Even though there is a good knowledge about how the waste should be sorted, at least among the team leaders, there still is a large volume that is unsorted when it could be recycled. As the results showed, there could be several aspects that affects that behavior. The aspect that got most answers was that it is too far to the waste bins. As DC South is a larger warehouse it might be a greater problem there. DC North has on the other hand too small space to have a stationary solution and therefore the mobile solution works out quite well. The suggestion is therefore that such mobile solutions are introduced at DC South too. As there already are similar solutions at the loading platforms, these mobile solutions might be placed further into the building to be most efficient.

The fraction that by far is the most common unsorted is cardboard. When studying both the current solutions at DC South and DC North there is a clear lack of bins for cardboard. There are several bins for unsorted waste at both sites, but at the loading platforms there are none for cardboard. The suggestion is that a bin for cardboard is fixed on both the mobile solution at DC North and the stationary solution at DC South. This new bin on the mobile solution should be placed on the front and the bin for unsorted waste should be placed on the back to avoid throwing waste in that bin by routine. When introducing these new bins it is also important to inform that they exist and there should be labelling that tell what to put and not to put in the different bins. That counts for all bins in general in the warehouses. Another tip is that the bins for unsorted waste should be smaller than the other to avoid

unsorted waste. Over the bin for unsorted waste there could also be a sign that says “Are you sure?” to remind the co-workers about sorting the waste correctly.

The placement of the larger collecting stations in the warehouses are according to IKEA’s strategies also important. As the survey showed, the new station at DC South has worked out well. Such a station should also be installed at DC North to avoid the long transports of the waste to a place outside the building. The responsibility for that work should be clear and also the hand over to the next person about what has been done and not. The new waste management group should have the responsibility to carry that work through.

Regarding information, it is also important to give information both to team leaders and to co-workers about IKEA’s sustainability strategy and goals and the Swedish environmental quality objectives. It is important that everyone know what to work for and why, that increases the motivation a lot. It is also important to give information about improvements that have been done. If the volume of unsorted waste decreases, it is important to give information about that, which also increases the motivation. There should also be information given about re-use and waste prevention. Lindh at SITA said that information is a good policy instruments and that SITA work towards finding new ways to be able to use a material more than once. A suggestion would be to have a meeting with Lindh where he can inform about how they work with waste and how IKEA together with SITA may find new ways to sort the waste and have better strategies and information to avoid unsorted waste. Lindh could also have a discussion with IKEA about future strategies with perhaps new fractions etcetera. As SITA has adopted to environmental management systems, information and support to their clients should be part of their work.

Regarding re-use, there should also be a survey whether some of the waste can be re-used, for example some of the cardboard waste. One other effort that would prevent more waste would be to check how tight the plastic films and pallet bands are attached to the pallets. An idea is also to have some kind of reporting about the volumes of re-used waste as there is for recycling, to better be able to see improvements.

As the results showed, there are waste that is unsorted even if there are bins for it beside. To avoid this, increased information about how to sort that special fraction have to be given to the co-workers. This mostly concerned pallet bands.

Finally there were also some things that could be done regarding the household waste. The waste that comes from the canteens and the restaurant is today not sorted and the bins that the municipality take to incineration is not weighted. If the waste that could be sorted also became sorted, the cost for those bins would decrease.



## 7. Conclusions

This part describes the most important conclusions from this thesis with the research questions as basis. The conclusions are divided in two parts – one each for the Swedish waste management scheme in general and for IKEA's waste management.

### 7.1 The Swedish waste management scheme

1. **How does the Swedish waste management work today? What is successful and what challenges are there?**
  - a. The Swedish waste management scheme is facing a new phase. Before, there were much focus on moving from landfilling to incineration, now more focus on moving from incineration to recycling, re-use and prevention.
  - b. There is a need for new policy instruments regarding both fractions that have high waste volumes and that for example have a high environmental impact.
  - c. The effectiveness of a policy instrument can vary for different steps in the waste hierarchy and between different materials.
  - d. Especially important are: electronic waste, construction and demolition waste, food waste, textile waste and packaging waste especially plastics.
  - e. Some fractions have known environmental impacts, for example methane emissions from landfilled food waste and other fractions have more unknown impacts, for example electronic waste.
  - f. There is a conflict between increased recycling and efforts towards *A Non-Toxic Environment*. There is a need for compromises between that topics.

2. **What changes in the Swedish waste management could be done to reach higher up in the waste hierarchy?**
  - a. A general knowledge about what happens on an EU-level is important, but to achieve changes in Sweden there is a need for local and concrete strategies.
  - b. More information to the municipalities and better availability for the waste disposal sites is important. The municipalities also have to work more with waste prevention.
  - c. Information is in general a demanded policy instrument, but the most efficient is a combination with for example economic instruments. That could be: producer responsibility for textile and electronic waste, raw material tax, obligation to recycle recyclable materials.
  - d. Import of waste is just a short-term good solution, other countries need to build up their own systems.
  - e. The Swedish government has an important role to make sure that measurements are carried through to improve the Swedish waste management scheme.

## 7.2 Waste management at IKEA

3. **How does the waste management at IKEA work today?**
  - a. There is a high recycling rate today, but much unsorted waste that can be recycled instead, mostly cardboard and pallet bands.
  - b. There is an interest among the team leaders to increase the recycling rate and they have in general good knowledge about how to sort the waste. They also think that there is an interest among the co-workers to recycle more.
  - c. Changes to improve the waste management has during the last years been done, for example is there a new environmental station for waste management at DC South.
  - d. The development from incineration → recycling instead of landfill → incineration is the same as in Sweden in general.



- e. The most common reason to unsorted waste is too long distances to the right bins. Regarding cardboard there are also a lack of bins.
- f. The mobile solution for waste at DC North works great, but this solution as well as the stationary solution at the loading platform at DC South are missing bins for cardboard.
- g. The new environment station at DC South works well.

**4. How can IKEA reduce the waste volume and increase the volume of recycled/re-used material?**

- a. Cardboard bins should be fixed to the mobile solution at DC North and the stationary solutions at DC South.
- b. Mobile solutions should also be introduced at DC South.
- c. The waste bins for unsorted waste should be smaller and fewer. They should also be placed more hidden so that hopefully more waste is being sorted.
- d. Simple and clear labelling at all bins should be set up. By the bins for unsorted waste there should also be a sign at that bins which says “Are you sure?”
- e. Information about the new bins and generally about IKEA’s sustainability strategy, the Swedish environmental quality objectives, re-use and prevention should be given to all co-workers. Information should also be given when improvements have been achieved.
- f. There should be an investigation whether it is possible to re-use more and there should be a report system for that.
- g. There should be an environment station at DC North too, as there is at DC South.
- h. There should be a better structure for the waste management and a clear responsibility distribution. The handovers to the next person should be clear.

5. How does IKEA's waste contractor, SITA, work towards a more sustainable waste management?
- a. SITA works with the Swedish environmental quality objectives as a basis and has adopted to environmental management systems.
  - b. For SITA it is important to be leading on the market and is therefore working towards finding better solutions.
  - c. Lindh at SITA should have a meeting with IKEA with information about how SITA together with IKEA can find new ways to minimize the volume of unsorted waste.
  - d. Lindh can also talk about future strategies and new fractions with IKEA.

# Thanks

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# Appendix 1: Interview guide

## The Recycling Industries

- Tell me about your role in the Recycling Industries!
- What are your opinions about today's waste management?
- What are the biggest obstacles/challenges to increase the recycling rate?
- Which fractions are the most problematic? Which could be recycled in a larger extent?
- Recycle wood, textile?
- What actions have to be done/are underway?
- How has the development been? What significant changes have been made?
- What do you think about the industry's involvement today? More in the future?
- In what way is the environmental quality objectives included in your work?
- Do you think that it is motivated to continue to work upwards in the waste hierarchy or should it be seen differently depending on which material it concerns?
- What are your opinions about increasing the recycle rate when Sweden today imports waste for incineration?
- One part that the Swedish EPA mentions as important in the work towards reaching the targets is to make sure that decisions that have been made also are being realized, where do you think it is important to lay focus in that work?
- What type of policy instruments in the society do you think would be most efficient to reach the environmental quality objectives? Administrative? Economic? Informative?
- Other suggestions for improvements?

## SITA

- Tell me about your field of responsibility!
- Future plans? New fractions? Targets?
- How does it generally look? Much unsorted? Have any greater changes been made?
- What are the biggest obstacles/challenges to increase the recycling rate?
- How is the combustible waste treated? Does everything go to energy recovery?
- Where is the waste freighted?
- Is there any possibility to increase the recycling rate in the present situation?
- How does SITA work with the Swedish environmental quality objectives?
- How does SITA work to decrease the volume of unsorted waste?
- Has SITA a sustainability strategy? Environmental management system?
- What interest does SITA have in increasing the recycling rate?
- Does SITA work with emphasizing re-use and waste prevention?
- What type of policy instruments in the society do you think would be most efficient to reach the environmental quality objectives? Administrative? Economic? Informative?

## The Swedish Environmental Protection Agency

- Tell me about your role in the environmental objective *A Good Built Environment!*
- What are your opinions about today's waste management?
- What are the biggest obstacles/challenges to increase the recycling rate?
- Which fractions are the most problematic? Which could be recycled in a larger extent?
- The Swedish EPA has presented new suggestions to milestone targets – what do you think about them, what has been important when you have developed them?
- Recycle wood, textile?
- What actions have to be done/are underway?
- How has the development been? What significant changes have been made?
- What do you think about the industry's involvement today? More in the future?

- Do you think that it is motivated to continue to work upwards in the waste hierarchy or should it be seen differently depending on which material it concerns?
- What are your opinions about increasing the recycle rate when Sweden today imports waste for incineration?
- One part that the Swedish EPA mentions as important in the work towards reaching the targets is to make sure that decisions that have been made also are being realized, where do you think it is important to lay focus in that work?
- What type of policy instruments in the society do you think would be most efficient to reach the environmental quality objectives? Administrative? Economic? Informative?
- Other suggestions for improvements?

## Waste Sweden

- Tell me about your role in Waste Sweden!
- What are your opinions about today's waste management?
- What are the biggest obstacles/challenges to increase the recycling rate?
- Which fractions are the most problematic? Which could be recycled in a larger extent?
- Recycle wood, textile?
- What actions have to be done/are underway?
- How has the development been? What significant changes have been made?
- What do you think about the industry's involvement today? More in the future?
- Do you think that it is motivated to continue to work upwards in the waste hierarchy or should it be seen differently depending on which material it concerns?
- What are your opinion about increasing the recycle rate when Sweden today imports waste for incineration?
- One part that the Swedish EPA mentions as important in the work towards reaching the targets is to make sure that decisions that have been made also are being realized, where do you think it is important to lay focus in that work?
- What type of policy instruments in the society do you think would be most efficient to reach the environmental quality objectives? Administrative? Economic? Informative?
- Other suggestions for improvements?

## Interviews

### **The Recycling Industries: Ihd, V. 2015-03-17**

The Recycling Industries is a trade organization for recycling companies that are working with environmental and ethical questions in their business (The Recycling Industries, n.d.). The general target is to work towards a long-term sustainable recycling. Their members see waste as a resource and they are around 6000 co-workers.

### **SITA: Lindh, M. 2015-03-17**

SITA is a company for recycling and waste management in Sweden (SITA, n.d.). It is also a part of the international environmental company Suez Environment. The focus in SITA's work is new thinking and long-term sustainability.

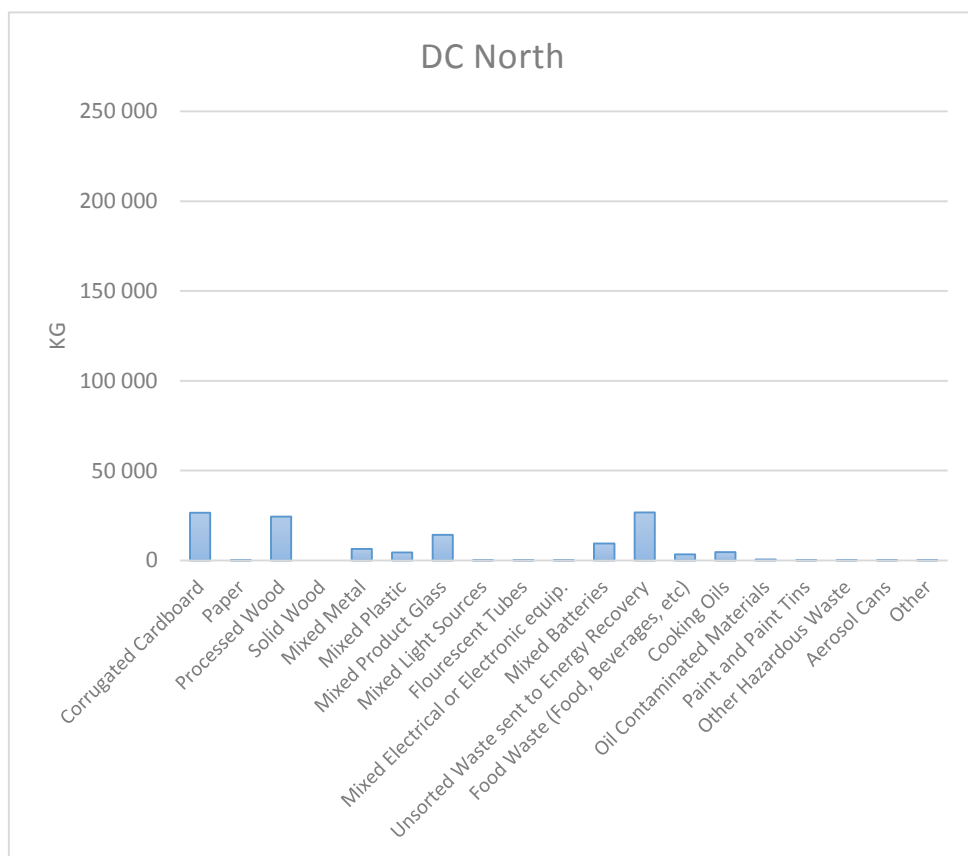
### **The Swedish Environmental Protection Agency: Östlund, C. 2015-03-18**

The Swedish EPA has the general responsibility for an environmentally acceptable waste management in Sweden (The Swedish EPA, 2014b). They should also make sure that the waste management is efficient for the society and the consumers. They are for example working with guidance, follow-ups for the environmental quality objectives and development of new statistics.

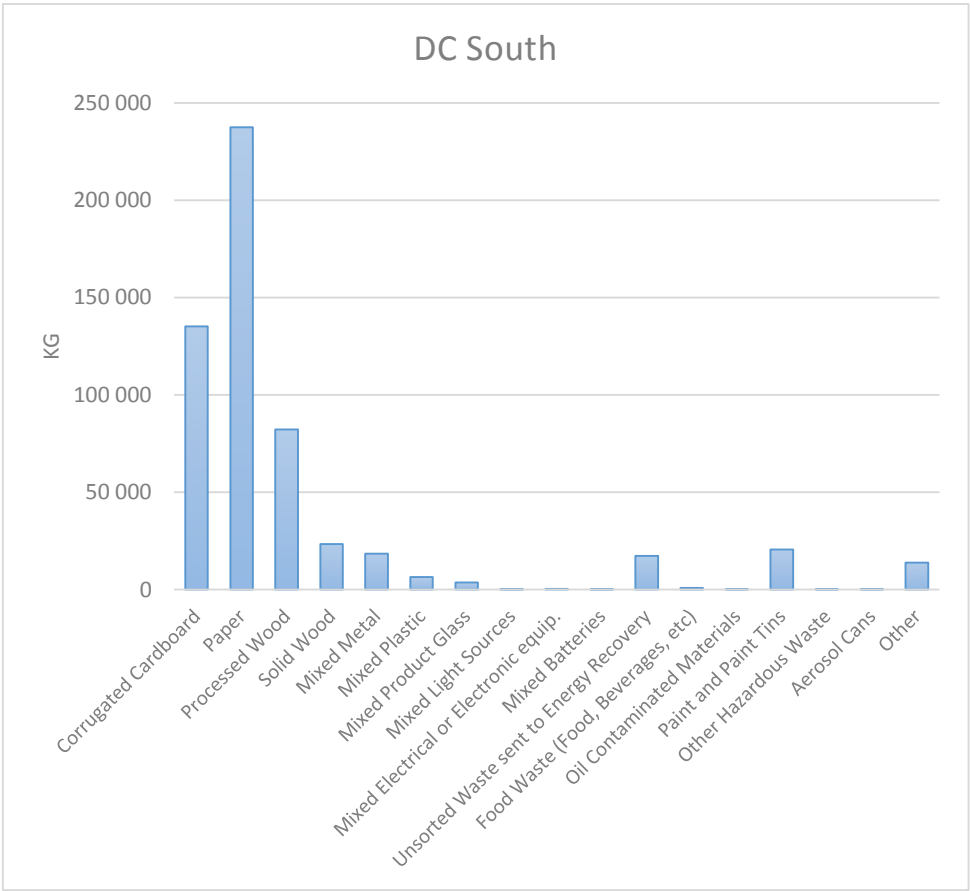
### **Waste Sweden: Nilsson-Djerf, J. 2015-03-19**

Waste Sweden is another trade organization for recycling and waste management in Sweden (Waste Sweden, n.d.). They have around 400 members and most of them are municipalities. Their target is to work with waste in a way that people's health and the environment is protected. Material, raw material and energy should be used to encourage economize of resources.

## Appendix 2: detailed results for IKEA's waste management



**Figure 20.** Waste volumes for DC North September 2014 to January 2015 divided into the different fractions.



**Figure 21.** Waste volumes for DC South September 2014 to January 2015 divided into the different fractions.



## Appendix 3: Questionnaire to the team leaders

My name is Caroline Eliasson and I study environmental science at Lund University.

This questionnaire is a part of my project to increase the recycling rate at IKEA's warehouses in Älmhult.

I'm working with trying to find strategies to avoid that waste is unsorted when it could be recycled.

The results from my work will contribute to a deeper understanding about what You team leaders think are working and not working when it comes to waste at the warehouses. It will hopefully lead to an easier sorting of the waste in the future.

The questionnaire consists of **20 questions and propositions.**

Take Your time and be as honest as You can.

**The questionnaires are impersonal and it will therefore not be possible to see what answer that belongs to a particular person.**

Thank You very much for Your participation!

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**1. What stations are included in Your field of responsibility? (Mark all that correspond)**

Loading	Discharge	PLS	Basement	In-line	Out-line
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Other  
(specify):

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**2. How do You think that the waste management works today?**

Very good	Good	Rather good	Rather bad	Bad	Very bad
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Comments:

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**3. How good do You think You are yourself at sorting the waste correctly?**

Very good	Good	Rather good	Rather bad	Bad	Very bad
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Comments:

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**4. I have got enough information about how we should sort the waste.**

Totally agree	Partly agree	Don't agree	Don't agree at all	agree	Don't know
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Comments:

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**5. I think that the co-workers generally are interested in recycling more than what is done today.**

Totally agree	Partly agree	Don't agree	Don't agree at all	agree	Don't know
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Comments:

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**6. What type of waste do You think most often is unsorted instead of recycled?**

Cardboard	Plastics	Metal	Glass	Don't know
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Other  
(specify):

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**7. What do You think are the main reasons that so much waste is unsorted when it could have been recycled? (Mark all that correspond)**

Too little knowledge	Too far to the bins	No one controls it	Don't have time to sort it right	Think that it doesn't matter
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Other (specify):

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**8. I think that mobile waste bins as those at DC North would work as a solution at DC South too.**

Totally agree	Partly agree	Don't agree	Don't agree at all	Don't know
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Comments:

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**9. How important is it for You to sort as much waste as possible for recycling?**

Very important	Important	Rather important	Not so important	Not important	Not important at all
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Comments:

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**10. Changes that have made it easier to sort the waste for recycling has during the last years been implemented. If You agree, please specify what.**

Totally agree	Partly agree	Don't agree	Don't agree at all	agree	Don't know
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Comments:

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**11. Have You got any information regarding *re-use* and *waste prevention*? If Your answer is yes, please also see the next question.**

Yes	No	Don't know
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

---

**12. The information regarding *re-use* and *waste minimization* was sufficient.**

Totally agree	Partly agree	Don't agree	Don't agree at all	agree	Don't know
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Comments:

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**13. I experience that in total, more waste is disposed when recycling is chosed because it is more "okay" than if everything had been incinerated.**

Totally agree    Partly agree    Don't agree    Don't agree at all    Don't know

Comments:

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**14. Have You got any information regarding IKEA's sustainability strategy? If Your answer is yes, please also see the next question.**

Yes                                      No                                      Don't know

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**15. The information regarding IKEA's sustainability strategy was sufficient.**

Totally agree    Partly agree    Don't agree    Don't agree at all    Don't know

Comments:

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**16. Have You got any information regarding the Swedish environmental quality objectives? If Your answer is yes, please also see the next question.**

Yes

No

Don't know

---

**17. The information regarding the Swedish environmental quality objectives gave You understanding/help about how/why waste should be sorted.**

Totally agree

Partly agree

Don't agree

Don't agree  
at all

Don't know

Comments:

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**18. Is there any type of waste that isn't sorted today that could be, do You think?**

Answer:

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**19. Is there anything that You are unsure about if or how You should recycle it?**

Specify:

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**20. Is there anything when it comes to the waste management at the warehouses that can be improved? Where are the biggest challenges?**

Answer:

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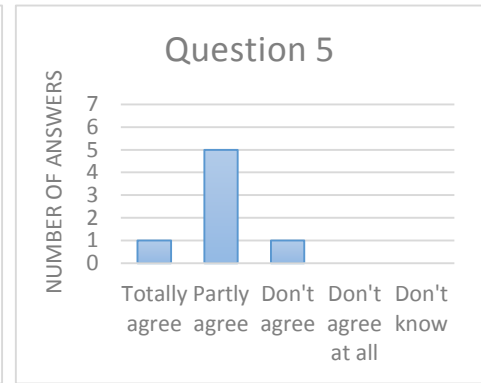
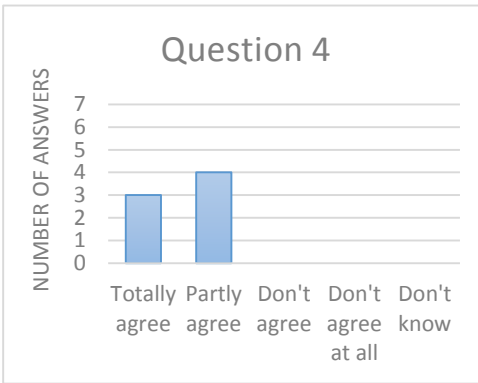
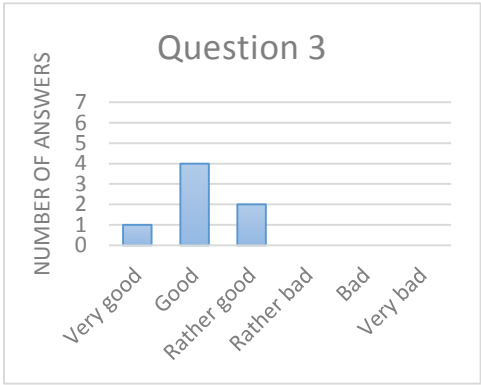
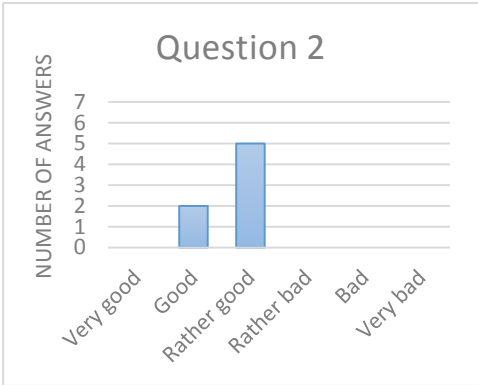
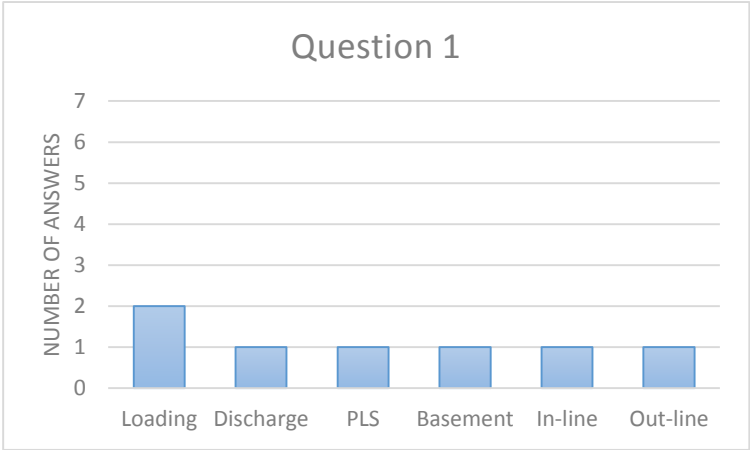
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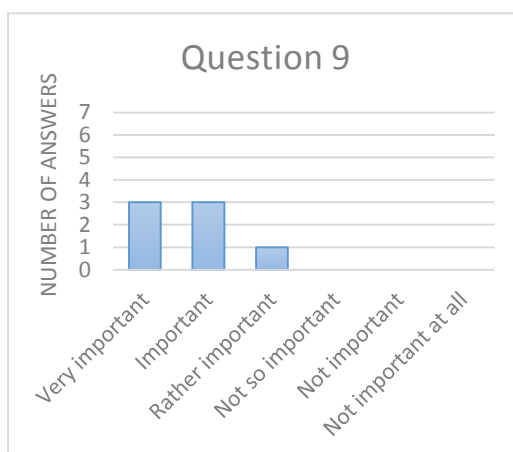
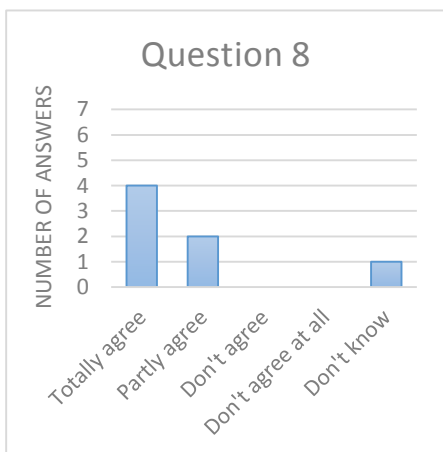
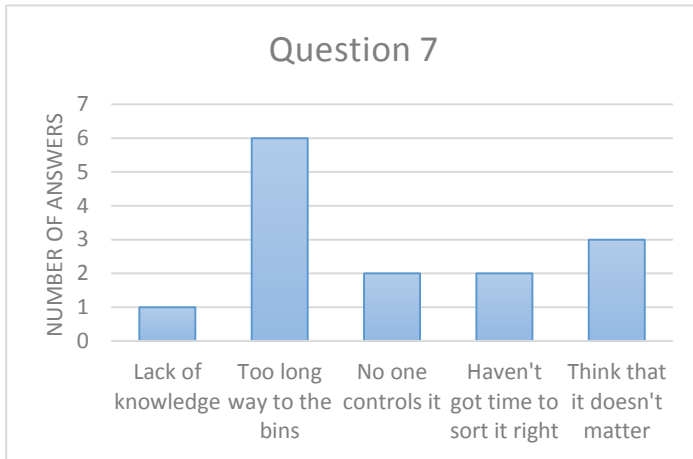
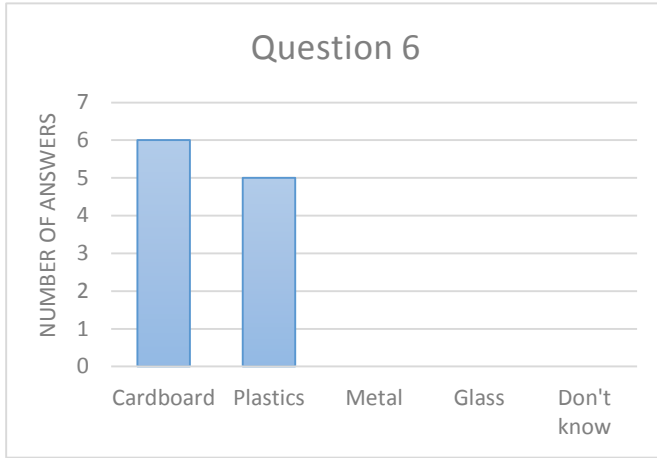
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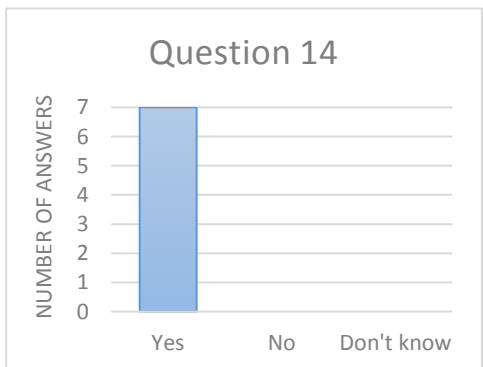
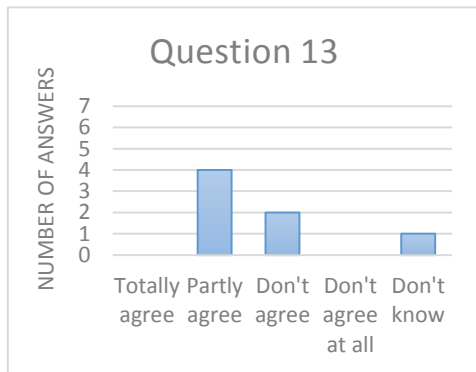
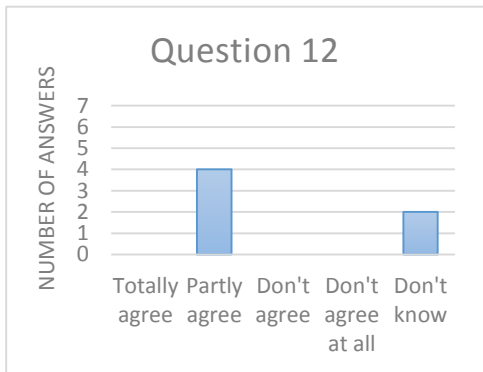
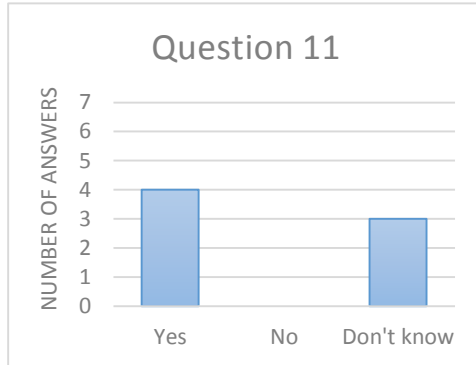
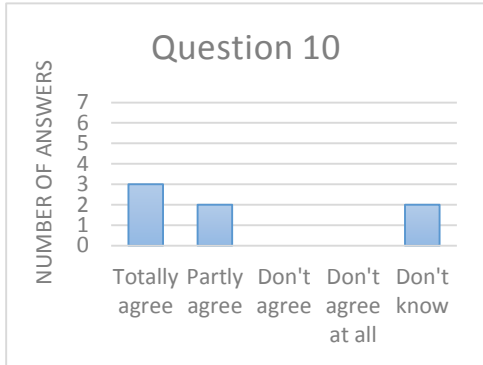
**Thank You very much for Your participation!**

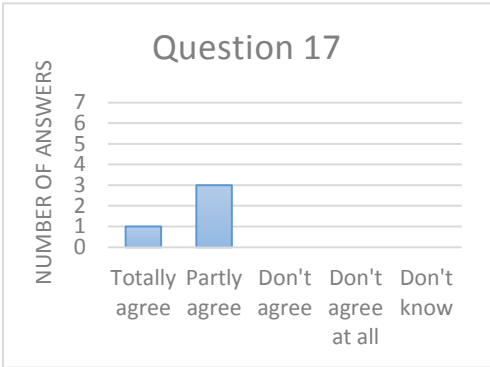
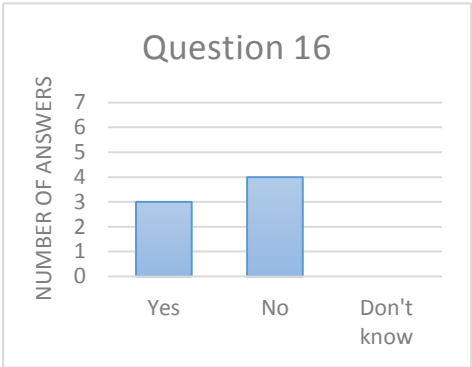


The following figures present the results from the questionnaire, question for question. Question 18-20 are excepted because those questions were not of multiple-choice type.













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