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Material Recycling without Hazardous Substances

– Experiences and future outlook of ten manufacturers of consumer products



An interview study

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Preface

The Swedish Chemicals Agency is an authority under the Ministry of the Environment. Our mission is to limit the health and environmental risks associated with chemicals by promoting legislation and other incentives in Sweden, in the EU and globally. Our work aims at achieving the Swedish environmental quality objectives, in particular ´A Non-Toxic Environment´ and as well promoting materials cycles that are resource efficient and as far as possible free from hazardous substances[1].

The ambition of the EU is to move towards a recycling society that uses waste as a resource, most recently expressed in the *Roadmap to a resource-efficient Europe* by the European Commission. When implementing policy measures to achieve increased recycling, fundamental questions arise how to ensure that the materials from discarded products do not cause risks to humans or the environment when used in new applications due to the content of hazardous substances. How do we stimulate non-toxic material cycles?

We are surrounded by products in our daily life that contain hazardous substances, and these products eventually become waste. It is not only the waste classified as hazardous that contains hazardous substances, but also waste from discarded toys, furniture, textiles and other products do. The identification of substances of very high concern is a continuing process within the EU, and the knowledge increases on where these substances are used and in which materials and products they may be found. Even if some of these substances have been restricted in some uses, there are overall very few legal restrictions on hazardous substances in products. Also, old products containing restricted or otherwise unwanted substances are still in use or accumulated in society which may contaminate the material streams.

In order to learn more about how product manufacturers and distributors manage these challenges, and what they foresee in the future, we commissioned an interview study. The study was conducted by Naoko Tojo and Åke Thidell at the International Institute for Industrial Environmental Economics at Lund University between May and August 2012.

The authors are responsible for the content of this report.

Our hope is that this report will support continuing processes and discussions primarily within the EU and internationally, but also in Sweden, to stimulate and promote non-toxic and resource-efficient recycling.

The Swedish Chemicals Agency

[1] ´Resource efficient and non-toxic material cycles´ is one of the components of the Generational goal which is the overall goal of the Swedish environmental policy.

Acknowledgements

The authors would like to thank the interviewees from industry and business for their important contributions. You have all contributed with your examples, experiences and suggestions, which to a large extent build this report. The authors wish to underline that the reproductions of these examples in the report aim at providing samples from companies known to be proactive within the area of the study - not for any comparisons of the companies or for general descriptions of their individual sustainability endeavour. Rather, the examples could serve as inspiration for other companies facing similar challenges. We would also like to thank Mr. Lucas Playford for his thorough text editing.

Naoko Tojo and Åke Thidell
International Institute for Industrial Environmental Economics at Lund University, Sweden

Content

Executive Summary

Manufacturers and distributors of products (articles) have a crucial role in the selection and/or verification of materials for their new products. They face challenges in developing and in selling environmentally sound products that are both more resource efficient and safe – the companies are encouraged to increase the use of recycled materials while at the same time must ensure that their products are free from hazardous substances that can cause risks to humans and the environment.

The aim of this report is to support continuing processes and discussions, primarily within the EU and internationally, to stimulate and promote non-toxic and resource-efficient recycling.

The study sought to obtain concrete knowledge on perception, experiences, and future outlook of manufacturers and distributors who have been proactive in at least one of the two areas; the increased use of recycled materials and the decreased use of hazardous substances. The study addressed the following two questions specifically:

1. Which possibilities and hindrances exist for manufacturers and distributors when using recycled materials in light of the potential existence of hazardous substances in the recycled materials?
2. What strategies and approaches do manufacturers and distributors have to collect and manage information on substances in products and materials, and what are the benefit and cost of taking such approaches?

In total, ten companies were selected for structured, open-ended interviews from the following four product groups: Interior products; Clothing and shoes; Toys and other children's products; and Electrical and electronic equipment (EEE). All companies have markets in multiple countries and the number of countries in which they have retailers range from 4 to 44. The views and experiences of the interviewees do not necessarily represent all companies in the respective sectors – the sample for the study was not sufficient to obtain the comprehensive picture for the whole industry sectors. However, the key findings, as summarised below, give interesting insights into the companies' experiences and views regarding opportunities and challenges on these issues.

Based on the key findings, the study highlights issues which have high implication for policy makers in order to stimulate non-toxic material cycles:

- Continuing legislative drive in reducing the use of hazardous substances, managing information on chemicals in products and stimulating efficient resource use
- Developing standardised test methods suited for recycled materials
- Increasing traceability of material content
- Improving technical development and R&D
- Enhancing enforcement of existing legislation

Finally, suggestions are made on areas in which further studies and research are needed, such as on waste sorting systems, traceability of the origin of collected materials and a better understanding of how general chemical management approaches are implemented in the sectors.

Key findings of the study

Ambitions and goals

- **The companies interviewed have been reducing the use of hazardous substances proactively and have developed mechanisms to manage chemical information in products.**

All the interviewed companies indicated that they seek to reduce the use of hazardous substances in their products in order to comply with legislation in different regions/markets. Many of them also seek to go beyond the legislation to ensure the health and safety of their customers, and to be proactive in avoiding business risks. Amongst the common reference points referred to include the list of substances identified as SVHC (substances of very high concern) under the REACH Regulation (the Candidate list). A number of companies indicated that when a substance they use in their products is listed as SVHC, they start to explore alternatives since it may trigger authorisation requirements of the substance in the future. Some companies also address a broader range of hazardous substances than those included in the Candidate list.

- **Substantial differences are observed regarding the ambitions for the increased use of recycled materials amongst the interviewed companies.**

While the interviewees from the interior products sector and from the clothing and shoes sector indicated their intention to increase the use of recycled materials (one textile company indicated 100% as its goal), the interviewees from the toy sector explicitly mentioned that their companies do not intend to use recycled materials due to very strict chemical safety requirements. The ambition of interviewed companies in the EEE sector varies: one seeks to secure the use of recycled materials from specific sources, another is at an explorative stage, and the third indicated that its priority shifted from the increased use of recycled materials to material safety since the entry into force of legislation such as the REACH Regulation and the RoHS Directive. Plastics were amongst the material streams most frequently discussed by the interviewed companies as, compared to scrap metals, they face difficulties in finding recycled plastics that meet with their quality requirements.

- **Recycled materials need to meet essentially the same quality and safety requirements as those set for virgin materials.**

The companies that use recycled materials indicate that their quality and safety requirements for recycled materials are essentially the same as those set for virgin materials.

Barriers and future opportunities

- **Main barriers for the increased use of recycled materials include risk of contamination, costs associated with avoidance of such risks, and limited availability.**

The barriers indicated by interviewees were many, but common ones include the risk of contamination of hazardous substances due to poor recycling processes and old products containing banned or otherwise unwanted hazardous substances. The cost of testing and the lack of traceability of the origin of the recycled materials were also seen as barriers. As the origin of recycled materials tends to vary from one batch to the other, the frequency of tests is higher for recycled materials when compared to virgin materials. In addition, the availability of recycled materials is currently quite limited.

- **The interviewed companies see future opportunities in overcoming the barriers. Increased use of recycled materials depends on the development of cleaner material streams, which require cleaner input materials, development of better separation/cleaning technologies, and standards for recycled materials.**

The use of recycled materials currently available in the market faces many challenges regarding their quality. However, some interviewees are hopeful in the creation of cleaner material streams in the future. This requires, amongst others, the enhancement of the quality materials used in the products currently manufactured. Consideration should be made regarding, amongst others, the recyclability and chemical content of the materials. Development is also required regarding the end-of-life phase of products, most notably the need for better sorting and cleaning technologies of mixed materials collected. Further efforts could also be made at the collection stage to avoid the mixture of different types of products coming into one stream. Moreover, standards set for recycled materials could enhance their use, if the standards would guarantee the quality of recycled materials.

- **While the significance of the presence of chemical legislation is commonly recognised and future development was anticipated, the importance of enforcement on all actors was also highlighted.**

The presence of legislation is perceived to be significant in improving the quality of material streams. Interviewed companies also anticipate that discussions on legislation related to chemicals to continue. Meanwhile, some interviewees also stated the importance of better enforcement of the existing legislation to all market players, including, amongst others, small importers. It would otherwise negatively affect the companies working proactively in the area of chemical management by putting their products at a cost disadvantage with companies whose products do not go through the same testing and verification methods to ensure compliance with existing legislation.

Chemical information management

- **The companies interviewed have taken different approaches in managing chemical information in products.**

In order for companies to be able to take proactive measures in reducing hazardous substances in their products, it is essential to have control over the chemical content of their products. The vast majority of the interviewed companies use a so-called negative list, while one company uses a positive list (allowed substances). One company manages to have full material declaration at the moment, while another strives to obtain that from its suppliers. The majority of companies interviewed have their own systems for collecting information from their suppliers, while two of the EEE manufacturers and one of the clothing suppliers collaborates with their competitors in this area.

Companies who have taken part in an industry-wide system for collection of chemical information from their suppliers indicate that such systems make information transfer less costly, both for them and for their suppliers.

- **Main cost items for chemical information management in products are personnel costs and chemical analyses, although a concrete cost figure is not available.**

The main cost items mentioned by the interviewees are on personnel engaged in the management of the information system and chemical analyses, as well as on tests required for quality assurance. The fact that many of the employees engaged in chemical information

management are also engaged in other tasks, such as quality assurance and environmental improvement, makes it difficult for companies to isolate the exact costs associated with chemical information management.

- **Chemical information transfer to professional customers and consumers takes place mainly on demand, and very few requests come from the waste sector.**

While a few companies provide information related to chemical content voluntarily on their website, the majority of the companies provide information to their customers and consumers on demand. Only a few companies interviewed experience difference between customers and consumers. Professional customers ask for more extensive information in such cases. A number of interviewees are undecided as to which way would be most meaningful in communicating chemical information to customers and consumers.

The interviewed companies hardly experienced any requests coming from the waste sector regarding the chemical content of their products. Some companies meanwhile seek to proactively communicate with actors in the waste sector to enhance the environmental performance of their products (e.g. recyclability of their products/specific materials they use).

Sammanfattning

Tillverkare och distributörer av varor har en avgörande roll när det gäller att välja och ha kontroll på material som ingår i deras nya varor. Det är en utmaning att utveckla och sälja miljöanpassade varor som är både resurseffektiva och säkra. Företagen uppmuntras att använda mer återvunnet material samtidigt som de måste försäkra sig om att deras varor inte innehåller farliga ämnen som kan innebära risker för människor och miljö.

Syftet med denna rapport är att stödja fortsatta processer och diskussioner, främst inom EU och internationellt, för att stimulera och uppmuntra till en giftfri och resurseffektiv materialåtervinning.

Studien sökte konkret kunskap om vilka erfarenheter, uppfattningar och framtidsutsikter som tillverkare och distributörer har som gått före inom åtminstone ett av de två områdena: ökad användning av återvunnet material och minskad användning av farliga ämnen. Studien ville ha svar på följande två frågor:

1. Vilka möjligheter och hinder finns för tillverkare och distributörer när de använder återvunnet material mot bakgrund av att det kan finnas farliga ämnen i det återvunna materialet?
2. Vilka strategier och tillvägagångssätt har tillverkare och distributörer för att samla in och hantera information om ämnen i produkter och material, och vilken nytta och vilka kostnader är förenade med det?

Totalt valdes tio företag ut för strukturerade, öppna intervjuer inom följande fyra produktgrupper: inredning, kläder och skor; leksaker och barnprodukter; elektrisk och elektronisk utrustning (EEE). Alla företagen har marknader i många länder och antalet länder där de har återförsäljare varierar i antal från 4 till 44.

De intervjuades åsikter och erfarenheter är inte nödvändigtvis representativa för alla företag inom respektive bransch - urvalet i undersökningen var inte tillräckligt för att ge en heltäckande bild. De viktigaste slutsatserna sammanfattas nedan. De ger en intressant inblick i företagens erfarenheter och synpunkter när det gäller möjligheter och utmaningar inom detta område.

Med utgångspunkt från de viktigaste slutsatserna lyfter studien fram frågor som har betydelse för beslutsfattare när det gäller att uppmuntra till giftfria materialkretslopp:

- Fortsätta att lagstifta om minskad användning av farliga ämnen, hantera information om kemikalier i varor och stimulera till att utnyttja resurser effektivt.
- Utveckla standardiserade testmetoder som är lämpliga för återvunnet material.
- Öka spårbarheten av materialinnehåll.
- Förbättra den tekniska utvecklingen och forskning och utveckling.
- Förbättra tillsynen över existerande lagstiftning.

Studien föreslår även områden där ytterligare undersökningar och forskning behövs, såsom avfallssorteringssystem, spårbarhet av det insamlade materialets ursprung och bättre förståelse för hur utbredd användningen av olika kemikaliehanteringsmetoder är i branscherna.

Undersökningens huvudslutsatser

Ambitioner och mål

- **De intervjuade företagen har på ett aktivt sätt minskat användningen av farliga ämnen och har utvecklat system för att hantera information om kemikalier i varor.**

Alla intervjuade företag angav att de strävar efter att minska användningen av farliga kemikalier i sina produkter för att följa lagstiftningen inom olika regioner och marknader. Många av dem strävar också efter att gå längre än lagstiftningen för att säkra kundernas hälsa och säkerhet, och för att aktivt undvika affärsrisker. Bland de vanliga referenspunkterna som företagen hänvisar till är listan med SVHC-ämnen (substances of very high concern) i Reach-förordningen (kandidatförteckningen). Ett flertal företag angav att när ett ämne som de använder i sina produkter finns på kandidatförteckningen, börjar de att undersöka alternativ eftersom det kan uppstå krav på tillstånd i framtiden. Några företag uppmärksammar även fler farliga ämnen än de som finns på kandidatförteckningen.

- **Stora skillnader har iakttagits hos de intervjuade företagen när det gäller ambitioner att öka användningen av återvunnet material.**

Medan intervjuade från interiörbranschen och klädes- och skobranscherna avsåg att öka användningen av återvunnet material (ett textilföretag angav att målet för dem var att använda återvunnet material till 100 procent), uttryckte de intervjuade personerna från leksaksbranschen att deras företag inte avsåg att använda återvunnet material på grund av mycket stränga krav på kemikaliesäkerhet. Ambitionen hos företagen inom elektronikbranschen varierar; ett företag strävade efter att säkerställa användningen av återvunnet material från särskilda källor, ett annat företag befann sig i ett utvecklingsskede och ett tredje sade att de ändrat sin prioritering från ökad användning av återvunnet material till materialsäkerhet sedan Reach-förordningen och RoHS-direktivet trätt i kraft. Plast var bland de materialflöden som diskuterades flitigast bland de intervjuade företagen, eftersom det jämfört med metallskrot finns svårigheter att hitta återvunnen plast som motsvarar företagens kvalitetskrav.

- **Samma kvalitets- och säkerhetskrav behöver i huvudsak gälla för återvunnet material som för jungfruligt material.**

De företag som använder återvunnet material menar att deras kvalitets- och säkerhetskrav för återvunnet material huvudsakligen är desamma som för jungfruliga material.

Hinder och framtida möjligheter

- **De största hindren för att öka användningen av återvunnet material är risken att det innehåller farliga ämnen, kostnader förenade med åtgärder för att undvika sådana risker samt begränsad tillgänglighet.**

Hindren som de intervjuade angav var många men vanligast var risken att materialet innehåller farliga ämnen på grund av dåliga återvinningsprocesser och på grund av gamla produkter som innehåller förbjudna eller på annat sätt oönskade farliga ämnen. Testkostnader och brist på spårbarhet för återvunna material uppfattades också som hinder. Eftersom det återvunna materialets ursprung tenderar att variera mellan olika leveranser, är antalet tester högre för återvunnet material jämfört med nytt material. Dessutom är tillgängligheten av återvunnet material för närvarande ganska begränsad.

- **De intervjuade företagen ser möjligheter att överbrygga hindren. Ökad användning av återvunnet material är beroende av utvecklingen av renare materialströmmar, vilket kräver renare grundmaterial, utveckling av separations- och reningsmetoder samt standarder för återvunnet material.**

Användningen av återvunnet material som för närvarande finns tillgängligt på marknaden innebär många utmaningar när det gäller kvalitet. Många intervjuade är ändå hoppfulla när det gäller att få till stånd renare materialflöden i framtiden. Detta kräver bland annat att kvaliteten blir bättre på de varor som tillverkas nu. Möjligheter till återvinning och varors kemikalieinnehåll måste uppmärksammas. Sluthanteringen av produkter behöver också utvecklas, främst för att tillgodose behovet av bättre sortering och reningsmetoder för insamlade blandade produkttyper.

Ytterligare åtgärder kan göras vid insamlingssituationen för att undvika att olika slags varor hamnar i samma flöde. Dessutom kan standarder för återvunna material bidra om de kan garantera kvaliteten hos det återvunna materialet.

- **Betydelsen av att det finns regler för kemikalier är allmänt accepterad och framtida utveckling väntad. Vikten av tillsyn över alla aktörer framhölls särskilt.**

Att det finns lagstiftning förutsätts vara avgörande för att förbättra kvaliteten på materialflödena. De intervjuade företagen förväntade sig att diskussionen om lagstiftning om kemikalier kommer att fortsätta. Några intervjuade pekade på vikten av bättre tillsyn över att marknadsaktörerna följer existerande lagstiftning, även mindre importörer. Det skulle annars få en negativ inverkan på företag som arbetar förebyggande med kemikaliehantering genom att deras varor hamnar i ett kostnadsunderläge jämfört med företag vars produkter inte genomgår samma testnings- och säkerhetsmetoder för att garantera att existerande lagstiftning efterlevs.

Hantering av information om kemikalier

- **De intervjuade företagen har olika sätt att hantera information om kemikalier i varor.**

För att företagen ska kunna vidta förebyggande åtgärder genom att minska farliga ämnen i varorna, är det nödvändigt att de har kontroll över varornas kemikalieinnehåll. De flesta av de intervjuade företagen använder en så kallad negativlista, medan ett företag använder en positivlista (tillåtna ämnen). Ett företag samlar in fullständig materialdeklaration medan ett annat strävar efter att få det från sina leverantörer. Majoriteten av företagen som intervjuats har sina egna system för att samla in information från leverantörerna, medan två elektroniktillverkare och en leverantör av kläder samarbetar med sina konkurrenter inom detta område.

Företag som har deltagit i ett branschgemensamt system för att samla in kemisk information från sina leverantörer säger att sådana system gör informationsutbytet mindre kostsamt, både för dem och för deras leverantörer.

- **De främsta kostnaderna för att hantera information om kemikalier i varor är personalkostnader och kostnader för kemiska analyser, men en konkret kostnadsuppskattning finns inte.**

De intervjuade sade att de största kostnaderna gäller personal som arbetar med informationssystem och kemikalieanalyser, liksom kostnader som krävs för kvalitetssäkring. Det faktum att många anställda som arbetar med att hantera information om kemikalier också arbetar med andra uppgifter, såsom kvalitetssäkring och miljöförbättringar gör det svårt för företag att exakt beräkna vilka kostnader som följer av hantering av information om kemikalier.

- **Förmedling av information om kemikalier till kunder och konsumenter sker huvudsakligen efter förfrågan och mycket få förfrågningar kommer från avfallssektorn.**

Medan några företag frivilligt på sina webbplatser förmedlar information om kemikalie-innehåll, ger flertalet företag information till sina kunder och konsumenter på förfrågan. Endast några få av de intervjuade företagen upplever någon skillnad mellan professionella kunder och konsumenter. De professionella kunderna frågar i sådana fall efter mer utförlig information. Några av de intervjuade vet inte vilket sätt som skulle vara det mest meningsfulla när det gäller att kommunicera information om kemikalier till kunder och konsumenter.

De intervjuade företagen fick nästan inga förfrågningar från avfallssektorn när det gäller innehållet av kemikalier i deras varor. Samtidigt försöker några företag aktivt kommunicera med aktörer i avfallssektorn för att utveckla miljöaspekterna när det gäller deras produkter (till exempel återvinningsmöjligheter för varorna eller angående särskilda material de använder).

1 Introduction

Manufacturers and distributors of products have a crucial role in the selection and/or verification of materials for their new products. It is essential for them to know what substances are included in the products they put on the market. Manufacturers and distributors face many challenges in developing environmentally sound products that are both resource efficient and safe to humans and the environment. Manufacturers are encouraged to increase the use of recycled materials while at the same time keeping their products free from hazardous substances that can cause risk to human and the environment, and distributors are equally encouraged to sell products that contain, amongst others, these two properties. However, while the requirements to use recycled materials increase, information regarding the content of hazardous substances in materials and products is often insufficient. Given this reality, how do manufacturers and distributors consider this challenge? Which strategies do they have to address these requirements? Which drivers are most important for them? Which tools do they need?

1.1 Aim of the study

This study, commissioned by the Swedish Chemical Agency (KemI), sought to *obtain concrete knowledge on the perception, experiences, and future outlook of manufacturers and distributors of selected product groups in two related areas: the increased use of recycled materials and the decreased use of hazardous substances.* The study addressed the following two questions specifically:

1. Which possibilities and hindrances exist for manufacturers and distributors when using recycled materials in light of the potential existence of hazardous substances in the recycled materials?
2. What strategies and approaches do manufacturers and distributors have to collect and manage information on substances in products and materials, and what are the benefits and costs of taking such approaches?

1.2 Scope and methodology

In accordance with the KemI's strategy on products,[2] the study focused on the manufacturers and distributors of the following four product groups: interior products; clothing and shoes; toys and other children's products; and electrical and electronic equipment. The particular range of products within the respective sectors that are covered in this study are summarised in Table 1.

Table 1: Product sectors and specific types of products covered in this study

Product sector	Types of products
Interior products	Flooring systems with different materials e.g. wood, vinyl, linoleum and textile, interior products e.g. furniture, home textiles, kitchen utensils
Clothing & shoes	Fashion clothing including shoes, sports wear and outdoor clothing
Toys & other children's products	Toys (wooden, plastics), other children's products
Electrical & electronic equipment	Large and small home appliances, mobile phones, ICT equipment and systems

[2] KemI (2011). *Kemikalier i varor. Strategier och styrmedel för att minska riskerna med farliga ämnen i vardagen.* Rapport Nr. 3/11. Swedish Chemicals Agency, KemI: Sundbyberg.

In light of the overall aim of the project – to obtain concrete knowledge on the perception and experiences of manufacturers and distributors of selected products in the increased use of recycled materials and the decreased use of toxic substances – amongst various actors in the market, manufacturers and distributors who have been proactive in at least one of the two areas were selected. Insights of these so-called "front runners" would provide policy makers with concrete knowledge on the actual challenges and drivers these companies have experienced, as well as their outlook and possibilities that they foresee. The knowledge would serve as an important starting point when discussing and deciding upon the necessity and direction of future policy actions.

While the geographical base for most of the companies in the study was Sweden/Nordic countries, a few companies whose headquarters are located in other countries, as for instance, Japan, were also included. All of the companies interviewed have markets in multiple countries, however their geographical focus varies, and the number of countries in which they have retailers range from 4 to 44. Likewise, the range of products they manufacture/distribute varies: some have rather narrow range (e.g. mobile phones, toys, sports wear) while others have a wider portfolio (e.g. various types of electrical appliances, interior products). The size of the companies also varies: from 20 to more than 130 000 in terms of the number of employees. Due to requests of anonymity from several interviewees, the names of the companies are not disclosed. Meanwhile, some features of the companies (e.g. geographical base, main market, product portfolio, the number of employees) as well as the positions of the interviewees are found in Appendix I. Appendix I also highlight the product portfolio covered in this study amongst various products the interviewed companies manufacture/distribute.

The study took the form of structured, open-ended interviews with the personnel engaged in the areas related to this project such as the management of chemicals/quality, recycled materials, end-of-life management of their products and the like. In total, 12 representatives from 10 companies in the four product groups were selected in consultation with KemI, and were interviewed to form the basis of this study.

A detailed interview guide, consisted of a number of open-ended questions, was developed in close consultation with KemI. These questions were categorised into six question items for the respective two questions addressed in this study, as well as one overarching question, and were sent to the interviewees when they were contacted (see Appendix II). Depending on, amongst others, the type of the companies, as well as the information we could obtain prior to the interviews through company websites and other written sources, we tailored questions within the frame of the interview guide. Furthermore, based on the answers received during the course of the interviews, supplemental questions were added. The duration of the interview was somewhere between an hour and a half to two hours. Except for two interviews that were conducted face-to-face, all the interviews were conducted via telephone. In order to ensure that the information shared by the interviewees was understood correctly, a summary of the interview or a draft report was sent to the interviewees for their review and comment. Based on the feedback received from the interviewees, as well as personnel at KemI, the report was revised.

1.3 Guide to the reader

Following this introductory chapter, Chapter 2 provides a concise overview of the policies on chemicals and waste within the EU, related especially to the product groups covered in this study. The overview is followed by a presentation of the findings from the interviews of the manufacturers and distributors in the four product sectors, combined with a comparative

analysis of the findings (Chapter 3). The detailed findings from the interviews with companies in the respective four sectors are found in Appendix III. The report provides a conclusion with reflection on the implications of the findings to policy makers and some suggestions for further studies and research.

2 Overview of policy in the EU and UN

There exist a number of government interventions, both implemented and discussed, that may influence the increased use of recycled materials as well as the reduction of hazardous substances in products. This Chapter seeks to provide a concise overview of recent development of EU strategies related to the two areas, as well as the content of existing legislation and policy initiatives pertaining to the two areas at the EU and United Nations level, relevant to the sectors covered in this study. Instead of describing the overview of respective legislation and initiatives, we highlight the parts relevant to recycled materials and hazardous substances.

2.1 Recent development of EU strategies

Promotion of recycling as a means to enhance resource efficiency, as well as reducing the use of hazardous substances, are amongst the long-standing components of environmental policies in a number of countries around the world, including the EU.[3] Over the years, there has been a general shift in the environmental policy making, from end-of-pipe, command-and-control measures focusing on point-sources, to preventative, goal-oriented, non-prescriptive measures taking life-cycle perspective. In Europe, this was manifested in, amongst others, the development of Integrated Product Policy at the beginning of the 21st century.[4] Along this shift, importance of incorporating consideration on various environmental aspects at the design phase of products has been recognised by both manufacturers and policy makers. For instance, a review of design strategies of twenty one manufacturers of electrical and electronic equipment and cars in Japan and Sweden in 2000/2001, clearly indicated that enhancement of resource efficiency and a reduction of hazardous substances have been, along with the enhancement of energy efficiency, core pillars of the strategy for a vast majority of them.[5] On the policy side, examples are found, amongst others, in several product-specific laws in Europe such as on batteries,[6] end-of-life vehicles[7] and electrical and electronic equipment (EEE).[8]

Along with other countries in the world, the closure of material loops has been a continuous aspiration within the European environmental policy. The European Commission's Thematic

[3] In Europe, waste prevention and waste recovery appeared as early as the European Commission's communication of 1972. Laws governing dangerous substances have existed since the late 1960s. See, for example, Krämer, Ludwig. (2007). *EC Environmental Law. Sixth Edition.* London: Sweet & Maxwell Ltd.
[4] See, for example, COM(2001)68 final. *Green Paper on Integrated Product Policy.* For more information, please see, for example, http://ec.europa.eu/environment/ipp/home.htm
[5] Tojo, Naoko. (2004). Extended Producer Responsibility as a Driver for Design Change – Utopia or Reality? IIIEE Dissertations 2004:2. Lund: IIIEE, Lund University.
[6] Council Directive 91/157/EEC on batteries and accumulators containing certain dangerous substances. OJ L 078, 26/03/1991 P. 0038-0041, which is repealed by Directive 2006/66/EC of the European Parliament and of the Council of 6 September 2006 on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC. OJ L 166, 26.9.2006, p. 0001–0014.
[7] Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on end-of life vehicles. OJ L269, 21/10/2000 p.0034 –0043
[8] See Section 2.3.1 and 2.3.2.

Strategy on the prevention and recycling of waste[9] explicitly refers to recycling society as the EU's long-term goal, as follows:

> *The Long-term goal is for the EU to become a recycling society, that seeks to avoid waste and uses waste as a resource. With high environmental reference standards in place the internal market will facilitate recycling and recovery activities.*[10]

In recent years, following the global financial crisis and recognition on the importance of resource security, resource efficiency and closure of material loops has been re-highlighted, this time not only within the discourse of environmental policy but also within that of industry policy. Communication on Sustainable Consumption and Production and Sustainable Industry Action Plan[11] highlighted the role of the so-called Ecodesign Directive (see more on 2.3.4), and indicates the importance on the issue of resource use and hazardous materials, as follows.

> *Implementing measures will consider key environmental aspects over the life-cycle of the products. They will in particular take into account energy and resource use of products. Other issues, such as the need to reduce the use of hazardous materials and rare resources will be considered as appropriate.*

The Communication also indicates the reduction of the dependency on raw materials and encouragement of optimal resource use and recycling as one of their action plans. This is addressed additionally in a number of documents focusing on the availability and means of securing substances that are currently considered critical for the further development of high-tech eco-friendly industry (most notably rare earth metals).[12]

Recycling is also included in one of the six focus areas for the so-called Lead Market Initiatives, for which demand-side innovation policy approach is coordinated at the EU level. The mid-term report of the Lead Market Initiatives suggests both upstream measures (e.g. measures to stimulate the recyclability of products and content of recycled materials in the products, better utilisation of the Eco-design Directive) and downstream measures (e.g. eco-innovation in recycling technologies) for the future action.[13]

The Europe 2020 Strategy for smart, sustainable and inclusive growth,[14] which seeks to indicate the overall policy direction to help the EU and the Member States deliver high levels of employment, productivity and social cohesion, set "a resource efficient Europe" as one of its flagship initiatives. Amongst the action items for EU Member States, as suggested in the document, include the use of various types of policy instruments to reduce resource use and use of structural funds to enhance more efficient recycling. More effective recycling was also mentioned as an action item of the European Commission in another flagship initiative, entitled "An industrial policy for the globalisation era".

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[9] COM (2005) 666 final. Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and The Committee of the Regions. Taking sustainable use of resources forward. A Thematic Strategy on the prevention and recycling of waste.
[10] Ibid., footnote 9, p.6.
[11] COM (2008)397/3. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the Sustainable Consumption and Production and Sustainable Industrial Policy Action Plan.
[12] See, for instance, COM(2011)25 final. Communication from the Commission to the European Parliament, the Council, the European economic and Social Committee and the Committee of the Regions: Tackling the Challenges in Commodity markets and on Raw Materials.
[13] SEC (2009) 1198 final. Commission Staff Working Document. Lead Market Initiative for Europe. Mid-term progress report.
[14] COM (2010) 2020 final. Communication from the Commission. Europe 2020. A Strategy for smart, sustainable and inclusive growth

In September 2011, the EU Commission presented the Roadmap to a Resource Efficient Europe,[15] which elaborates medium and long-term objectives and means to achieve the flagship initiative on resource efficient Europe. The Roadmap made a number of references to the importance of taking both upstream measures (e.g. design change of products based on life-cycle approach, and including reusability, recyclability, recycled content, durability, cooperation amongst all the actors along the value chain) and downstream measures (e.g. enhancement of market for recycled materials, high quality recycling). The Roadmap, as quoted below, also explicitly indicates the necessity of reducing the use of hazardous substances in order to enhance resource efficiency:

> *Avoiding, wherever possible, the use of dangerous chemicals and promoting green chemistry can help protect key resources like soil and water, and make others, like materials, safer, easier and less costly to recycle and reuse. The approach to chemicals management promoted by fully implementing REACH will help identify opportunities for substituting dangerous chemicals with safer and technologically and economically viable alternatives.*

A proposal for a new Environment Action Programme for the EU is expected to be presented by the EU Commission in November 2012. The EU environment ministers adopted Council conclusions[16] in June 2012 setting the framework for the programme. In the Council conclusions the ministers urge the Commission to *inter alia* include measures that support the conditions for a circular and green economy, including measures that stimulate efficient resource use, non-toxic material cycles and waste reduction, as well as the move towards an economy based on reducing, re-using and recycling waste without compromising safety, environment and health.

2.2 General legislation on waste, chemicals, and products in the EU

The aforementioned development of policy discourse in Europe has been translated into a number of laws in the areas of waste, chemicals, and products. Amongst them, a handful of general regulations and directives relevant to this study are governing waste and chemicals irrespective of industry sectors are briefly introduced.

2.2.1 Waste Framework Directive[17]

Originally introduced in 1975, a framework directive on waste was renewed in 2008. The Directive, amongst others, clearly states the so-called *waste hierarchy* in its Article 4, as follows:

1. *The Following waste hierarchy shall apply as a priority order in waste prevention and management legislation and policy:*

(a) prevention;
(b) preparing for re-use;
(c) recycling;
(d) other recovery, e.g. energy recovery; and
(e) disposal.

[15] COM(2011)571 final. Communication from the Commission to the European Parliament, the Council, the European economic and Social Committee and the Committee of the Regions. Roadmap to a Resource Efficient Europe.
[16] Council of the European Union (2012). Setting the framework for a Seventh EU Environment Action Programme – Council Conclusions (11186/12)
[17] Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives

Waste prevention, the highest in the hierarchy, is defined in Article 3 paragraph 12 as follows:

> *'prevention' means measures taken before a substance, material or product has become waste, that reduce:*
> *(a) the quantity of waste, including through the re-use of products or the extension of the life span of products;*
> *(b) the adverse impacts of the generated waste on the environment and human health; or*
> *(c) the content of harmful substances in materials and products.*

As found above, the definition clearly includes the reduction of harmful substances in materials and products. The Directive further mandates the Member States to establish a *waste prevention programme* (Article 29), and lists in Annex IV examples of measures that could be included in the programme, which include, amongst others, measures to enhance efficient use of resources, R&D for cleaner products, promotion of eco-design and promotion on credible eco-labels. Article 8 refers to the possibilities of Member States to introduce measures based on the concept of *extended producer responsibility* (EPR), which could potentially serve as waste prevention measures mentioned previously.

Regarding *recycling*, the Directive mandates that by 2020, 70% of non-hazardous construction and demolition waste, excluding soil and stones, should be prepared for reuse, recycled or gone through other types of material recovery (Article 11). End-of-life management of EEE, which also covers some toys, include recycling targets amongst others, and is governed in a separate directive (see Section 2.3.1 on the WEEE Directive). Currently, no legislation exists at the European level setting collection/recycling targets for clothing and shoes. The Directive also does not set any specific requirement for the use of recycled materials in products.

In order to facilitate the use of recycled material while securing its safety, the Directive laid down a basic set of criteria for substances or objects to cease to be waste – thus no longer subject to various requirements related to waste –, and introduced a procedure to develop specific criteria for each substance or object (*end-of-waste criteria*) (Article 6). Amongst the basic criteria include that "the use of the substance or object will not lead to overall adverse environmental or human health impacts" (Article 6.1 (d)).

The Directive indicates that end-of-waste specific criteria should be considered for, amongst others, aggregates, metal, and textiles. According to the European Commission's website, as of summer 2012, the only objects for which end-of-waste criteria have been set are iron, steel, and aluminium scraps.[18] For each type of metal, criteria are set for 1) quality of scrap resulting from the recovery operation, 2) waste used as input for the recovery operation, and 3) treatment processes and techniques.[19]

2.2.2 REACH Regulation[20]

The EU REACH Regulation of 2006 regulates the chemicals put on the European market through their registration, evaluation, authorisation, and restriction, depending on the risks the

[18] European Commission. (2012). Waste Framework Directive. End-of-life Criteria. [On Line]. Available: http://ec.europa.eu/environment/waste/framework/end_of_waste.htm [25 August 2012]

[19] Council Regulation (EU) No 333/2011of 31 March 2011 establishing criteria determining when certain types of scrap metal cease to be waste under Directive 2008/98/EC of the European Parliament and of the Council

[20] Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC.

chemical in question may have for human health and the environment. The Regulation is of relevance for producers of products covered in this study as, in addition to chemical substances and chemical preparations, it also applies to substances contained in articles.[21] The most relevant provisions of the REACH Regulation for producers of final products include registration (Article 7 Paragraph 1), notification (Article 7 Paragraph 2), communication of information (Article 33), duties for downstream users (Articles 37-39), authorisation (Article 55-66), and compliance with restriction (Article 67). [22]

Concerning *registration,* producers and importers of products must submit a registration regarding any chemical substance found in the products, provided that (a) chemicals present in those products exceeds one tonne per producer or importer per year, and (b) the chemical "is intended to be released under normal or reasonably foreseeable conditions of use" (Article 7 Paragraph 1).

Producers and importers of products need to *notify* the European Chemicals Agency (ECHA) when their products contain hazardous substances that are included in the REACH candidate list of identified substances of very high concern (SVHC) which is published by ECHA[23] when both of the following conditions are met: (a) the Candidate List substance is present in products above a concentration of 0.1 % weight by weight, and (b) the sum of contents above 0.1% of this Candidate List substance in all products produced by the same producer or importer exceeds one tonne per year (Article 7 Paragraph 2).[24]

In addition, producers, importers, and other suppliers of articles containing substances listed on the SVHC candidate list (in concentrations above 0.1%, but irrespective of volume) are obliged to *communicate information* available to them down the supply chain (Article 33(1)) and to consumers upon request (Article 33(2)). However, in regard to the end-of-life phase, despite that disposal consideration is supposed to be included in, for instance, the safety data sheet that the supplier of a substance or a mixture shall provide (Article 31, Annex II), the REACH Regulation does not require communication of such information to actors in the end-of-life phase of the products.

Producers who incorporate substances or mixtures into articles or in other ways use substances or mixtures must fulfil the duties for downstream users in Articles 37-39. In short this means a duty to *either* implement the risk reduction measures recommended by the supplier in an exposure scenario annexed to the Safety Data Sheet (Article 37 Paragraph 5), *or* to make an own Chemical Safety Assessment (Article 37 Paragraph 4) and report the use – if more than 1 tonne/year – to ECHA (Article 38).

Substances on the candidate list may be subject to *authorisation* requirements. Companies using a substance that require authorisation must provide information on, amongst others, an

[21] The REACH Regulation uses the term "article" instead of "products". The term "article" is defined as "an object which during production is given a special shape, surface or design which determines its function to a greater degree than does its chemical composition" (Article 3 Paragraph 3).

[22] The content of this section is partly adapted from Tojo, Naoko, Kogg, Beatrice, Kiørboe, Nikola, Kjær, Birgitte and Aalto, Kristiina (forthcoming). *Prevention of Textile Waste. Material flows of textiles in three Nordic countries and suggestions on policy instruments.* NMR-Temanord series. Forthcoming publication.

[23] The properties of these hazardous chemicals include carcinogenic, mutagenic, reproductive toxic, persistent, bioaccumulative and toxic and very persistent and very bioaccumulative (Article 57). Detail criteria of these chemicals are listed in Annex XIII of the REACH Regulation.

[24] The requirements do not apply if the producer or importer can ensure that humans or the environment will not be exposed during foreseeable conditions of use and disposal. Producers and importers do not need to notify/register if the substance subject to registration or notification has already been registered for that specific use (Article 7 Paragraph 6).

analysis of alternatives and technical and economic feasibility of substitution when applying for the authorisation (Article 62 Paragraph 4).

As of summer 2012, 84 substances are on the Candidate list.[25] Meanwhile, according to ECHA, the dossier of additional 38 chemicals is under way.[26] So far 14 substances have been included in Annex XIV for authorization requirements[27], the Member States have agreed to add 10 more, and ECHA has recommended inclusion of additional 10 substances[28].

Furthermore, the Regulation *restricts* manufacturers from both using and/or putting on the market chemicals, or products containing chemicals, listed in Annex XVII of the Regulation, unless they comply with the conditions set forth for each chemical in the Annex XVII (Article 67). With the latest update of the REACH Regulation available on ECHA homepage in summer 2012, 60 chemical substances in different applications are listed in Annex XVII.

2.2.3 Product safety directive[29]

The Product Safety Directive 2001/95/EC aims at making all consumer products safe to use, including avoided health risks from chemicals, while ensuring the proper functioning of the EU internal market. According to the Directive, producers are responsible for providing safe products (Article 3 Paragraph 1). What is considered as safe is determined based on, amongst others, legislation and standards introduced both at the EU and national level (Article 3 Paragraph 2, 3). The Directive does not lay out specific requirements regarding hazardous substances.

The requirements laid down in the Product Safety Directive complement product-specific law in areas such as producers' and distributors' obligations (Article 5) and the power of national authorities, which cover requirements on marking, warning, bans and withdrawal of products that may pose risks and/or may be/are dangerous (Article 8). The Directive is connected to the EU-wide information sharing system called RAPEX (Rapid Alert System for non-food consumer products) (Article 10). This system makes it possible to make quick decisions to prevent dangerous products from being placed on the EU market.

2.2.4 Biocidal Products Regulation[30]

The Biocidal Products Regulation, which came into force in 2012, deals with issues related to the placing of biocidal products on the marketing and use of biocidal products. Biocidal products are substances and mixtures that contain active substances that act against harmful organisms (Article 3 Paragraph 1 (a)). Examples include disinfectants, preservatives, and pest

[25] European Chemical Agency. (2012). Candidate List table. [On Line]. Available. http://echa.europa.eu/web/guest/candidate-list-table [25 August 2012]
[26] Environmental Data Service. (2012, 20 August). *ECHA prepares a further 38 SVHC proposals.* ENDS Environment Daily. [On Line]. Available. www.environment.daily.com [20 August 2012]
[27] European Chemical Agency. (2012). [On Line]. http://echa.europa.eu/sv/addressing-chemicals-of-concern/authorisation/recommendation-for-inclusion-in-the-authorisation-list/authorisation-list [12 December 2012]
[28] European Chemical Agency. (2012). [On Line]. http://echa.europa.eu/sv/addressing-chemicals-of-concern/authorisation/recommendation-for-inclusion-in-the-authorisation-list/previous-recommendations/3rd-recommendation [12 December 2012]
[29] Directive 2001/95/EC of the European Parliament and of the Council of 3 December 2001 on general product safety.
[30] Regulation (EU) No 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products.

control agents (Annex V). The Regulation replaces the Biocidal Products Directive from 1998.[31]

The Biocidal Products Regulation requires that biocidal products are *authorised* before they are placed on the market (Article 17), and that all active substances contained in biocidal products be *approved* beforehand (Article 4). Meanwhile, active substances that have harmful chemical properties, – essentially the same properties that would categorise substances as substances of very high concern under the REACH Regulation[32] – will not be approved (Article 5). Moreover, substances meeting the substitution criteria, as laid down in Article 10 of the Regulation, will be listed as candidates for substitution during the approval procedure.

A so-called ”treated article” – a product that has been treated with or incorporates a biocidal product – shall be labelled with information about the biocide and necessary precautions where a claim is made for the article regarding biocidal properties or when the approval of the active substance requires it. The supplier of a treated article shall provide information to consumers on the biocidal product contained in the article upon request (Article 58).

2.3 Product-specific legislation in the EU

In addition to the above-mentioned directives and regulation, there are a few product-specific laws that concern specific products covered by this study, such as electronics and toys.

2.3.1 WEEE Directive

The original Directive on waste electrical and electronic equipment (WEEE Directive) came into force in early 2003[33] and a revised Directive came into force in August 2012.[34]

Based on the concept of extended producer responsibility, the WEEE Directive, in essence, requires producers (manufacturers, importers, and distant sellers) of EEE to organise and finance the end-of-life management operation of WEEE. The Directive covers various types of EEE[35]. While the scope of the original Directive was limited to WEEE listed under 10 categories, the revised Directive, after a transition period of 6 years, sets an open scope, in which EEE are categorised into six in Annex III, with some exemptions specified (Article 2).[36]

The original WEEE Directive set a collection target of 4 kg per person per year of WEEE generated from households (Article 5 Paragraph 5). The revised Directive, after 1 January 2016, will have a percentage target of 45% of the average weight of EEE put-on-the market of the previous three years. The target will be enhanced to 65% (or 85% of WEEE generated) from 2019 (Article 7). The overall ambition behind the collection target is to capture valuable resources as well as hazardous substances contained in WEEE.

[31] Directive 98/8/EC of the European Parliament and of the Council of 16 February 1998 concerning the placing of biocidal products on the market.
[32] See footnote 23. Detailed definition relevant to this Regulation is found in Article 5 Paragraph 1.
[33] Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment (WEEE)
[34] Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE) (recast)
[35] The definition is found in Article 3 (a) of the original Directive and Article 3 Paragraph 1 (a) of the revised Directive
[36] The new categorisation are 1. Temperature changing equipment, 2. Screens and monitors, 3. Lamps, 4. Large equipment, 5. Small equipment, 6. Small IT and telecommunication equipment.

The Directive requires producers to meet recovery and recycling (and in the revised Directive, also including preparing for reuse) targets, differentiated amongst different categories of WEEE (Article 8 of the original Directive, Article 11 of the revised Directive). The Directive also stipulates the proper treatment of WEEE, which includes the specification of how certain components with hazardous substances need to be treated (Annex II of the original Directive, Annex VII of the revised Directive).

The Directive also requires producers to provide information that would facilitate reuse, recycling and treatment, to reuse, recycling and treatment facilities (Article 11 of the original Directive, Article 15 of the revised Directive). In relation to hazardous substances, the article stipulates that information on their location needs to be provided. However, it does not require the provision of information on the material composition of components/products.

Finally, the Directive has a general provision for the enhancement of product design (Article 4 of both the original and revised Directive). The provision in the revised Directive mentions specifically of the Eco-design Directive (see Section 2.3.4). However, it does not refer to the use of recycled materials or of hazardous substances.

2.3.2 RoHS Directive

The original Directive on the restriction of the use of certain hazardous substances in EEE (RoHS Directive), introduced in 2003,[37] was developed and introduced in parallel to the WEEE Directive. Similarly to the WEEE Directive, the RoHS Directive also went through the revision process a few years after its entry into force. The new Directive came into force in 2011.[38]

The RoHS Directive essentially prohibits the use of six substances – lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB), and polybrominated diphenyl ethers (PBDE) – in EEE put on the EU market (Article 4 of the original Directive, Article 4, Annex II of the new Directive). The Directive meanwhile provides exemption to various applications listed in Annexes[39]. For some of the exemptions, a threshold level as well as a specific date of expiration is set. For all the other exemptions general dates of expiration apply (Article 5.2).

The scope of the original RoHS Directive is based on the original WEEE Directive – it was essentially the same but excluded medical devices and monitoring and control instruments (Article 2 Paragraph 1). The new RoHS Directive kept the same categorisation as the original WEEE Directive, but include medical devices and monitoring equipment, and also include "other EEE not covered by any of the" ten "categories" (Annex I).

2.3.3 Toy Safety Directive

The Directive on the safety of toys,[40] which came into force in 2009, replaced the old Directive on the topic from 1988.[41] As the vast majority of the provisions in the 1988 Directive were repealed in July 2011, the description here focuses on the 2009 Directive, unless otherwise mentioned.

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[37] Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

[38] Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment. (recast)

[39] Annex of the original Directive, Annex III and IV of the new Directive

[40] Directive 2009/48/EC of the European Parliament and of the Council of 18 June 2009 on the safety of toys

[41] Council Directive (88/378/EEC) of 3 May 1988 on the approximation of the laws of the Member States concerning the safety of toys

The Toy Safety Directive applies to "products designed or intended, whether or not exclusively, for use in play by children under 14 years of age" (Article 2 Paragraph 1)[42],

Manufacturers of toys must ensure that the toys they put on the market are designed and manufactured in compliance with the safety requirements laid down in Article 10, which is further articulated in Annex II. Annex II of the Directive contains six categorises of safety requirements, one of which is on chemical properties. Prior to the placement of a toy on the market, manufacturers must analyse the hazards covered in the six categories that the toy may present, an+d assess the potential exposure to these hazards (Article 18).

Compared to the 1988 Directive, requirements related to chemicals (Part III of Annex II) became more extensive. Amongst the changes related to the chemical contents, as found in Annex II Part III, include, for instance:

- The use of substances that are classified as carcinogenic, mutagenic or toxic for reproductions (CMR) of Category 1A, 1B or 2 under the CLP Regulation[43] are essentially prohibited (paragraph 3), unless specific conditions laid out in Paragraph 4-7.
- The use of fragrances that may cause allergic reactions, as listed in the tables under Paragraph 11, are restricted, or subject to labelling requirement.
- The use of various types of metals should not exceed the threshold level set in the table under Paragraph 13.
- The use of nitrosamines and nitrosable substances is prohibited beyond specified threshold level (Paragraph 8).
- Chemicals used in toys intended for use by children under 36 months or in other toys intended to be placed in the mouth, need to meet specific limit value to be decided in accordance with Article 46 (2) (Appendix C to Annex II Part III).

In addition, the Directive requires manufacturers, importers, and distributors to provide instructions and safety information easily understood by consumers in the given market (Article 5 Paragraph 7, Article 6 Paragraph 4, Article 7 Paragraph 2). The distributors also need to make sure that the toys they distribute bear a marking indicating conformity to the Directive, i.e. CE-marking. There is also labelling requirement set on certain fragrances when exceeding the threshold level as stipulated in Annex II Part III Paragraph 11.

2.3.4 Ecodesign Directive[44]

Originally drafted by DG Enterprise in May 2000 as a design directive for EEE, the Directive 2005/32/EC,[45] often referred to as EuP Directive, became a framework directive for setting eco-design requirements for energy-using products (EuP). The scope of the Directive was further expanded and was replace with a so-called ErP Directive in 2009, covering various

[42] Exceptions for five types of toys are listed in Article 2 Paragraph 2 and 19 types of products listed in Annex I which are not considered as toys.
[43] Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directive 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006.
[44] The content of this section is mostly taken from Tojo, Naoko and Lindhqvist, Thomas. (2010). *Product-oriented Environmental Interventions. Bundling of effective policy instruments.* IIIEE report 2010:1. Lund: IIIEE, Lund University.
[45] Directive 2005/32/EC of the European Parliament and of the Council of 6 July 2005 establishing a framework for the setting of ecodesign requirements for energy-using products and amending Council Directive 92/42/EEC and Directives 96/57/EC and 2000/55/EC of the European Parliament and of the Council.

energy-related products (ErP).[46] Interestingly, with the revived recognition of various environmental aspects other than energy efficiency, the original "nick-name" of the Directive – Ecodesign Directive – also has been revived in recent policy documents (see Section 2.1), thus it will be referred to as such in this report.

The Ecodesign Directive, through the implementation of measures specified in Article 15 and further elaborated in Annexes I and II, sets eco-design requirements for products in the EU market. Annex I sets forth a method for setting generic eco-design requirements without numerical limit values. It requires the Commission to identify significant environmental aspects throughout the life cycle of the product in question. Manufacturers should in turn develop the ecological profile of the product and evaluate alternative design solutions. Manufacturers may also be required to provide information on aspects such as manufacturing process, significant environmental characteristics, and means to minimise impacts during the use and/or end-of-life phases. The requirement could also take the form of limit values for specific environmental aspects, as laid down in Annex II. In summation, while the implementing measures would be different from one product to the other, one can see that it is a combination of information provision and emission standards.

The Directive is supposed to "consider the life cycle of the EuP and all its significant environmental aspects, *inter alia*, energy efficiency" (Article 15. 4 (a)). The Directive essentially should be able to address environmental impacts from the life cycle perspective excluding raw material extraction (Article 2 Paragraph 13). The detailed list of eco-design parameters found in Annex I endorses this. A closer look at the implementing measures that appeared so far, however, indicates that the specific eco-design requirement focuses almost exclusively on the energy use arising from the use phase of the products. Nevertheless, the revived recognition of other environmental impacts, such as resource efficiency, highlights the potential of the Ecodesign Directive (see Section 2.1 and Section 2.3.1). Discussions to include aspects other than use-phase energy efficiency have begun to take place at the EU level.[47]

2.4 International policy development and legislation

2.4.1 Stockholm Convention on Persistent Organic Pollutants[48]

The Stockholm Convention on Persistent Organic Pollutants (POPs) is a global treaty to protect human health and the environment from chemicals that remain intact in the environment for long periods, become widely distributed geographically, accumulate in humans and wildlife, and have adverse effects on humans and the environment. Given the long-range transport and geographical spread of POPs from point sources, no single government acting unilaterally can protect its citizens or its environment from POPs. In response to this global problem, the Convention, which was adopted in 2001 and entered into force in 2004, requires the currently 178 Parties to take measures to eliminate or reduce the release of 22 listed POPs into the environment. The Convention regulates the substances both intentionally and unintentionally produced or stockpiled, including products and articles in use or wastes consisting of, containing or contaminated with, one or more of the POPs covered under the Convention.

[46] Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products (recast).
[47] Personal communication with Karolina Peterson, Swedish Energy Agency. 13 September 2012.
[48] The content of this section is largely taken from Tojo, Naoko, Kogg, Beatrice, Kiørboe, Nikola, Kjær, Birgitte and Aalto, Kristiina (forthcoming). *Prevention of Textile Waste. Material flows of textiles in three Nordic countries and suggestions on policy instruments.* NMR-Temanord series. Forthcoming publication.

When coming into force in 2004, the Stockholm Convention covered 12 POPs. In May 2009, the Conference of the Parties to the Convention adopted the decision of adding nine POPs. Included in the new nine POPs are commercial Penta BDE and commercial Octa BDE. These two substances are reported to be in on-going use as brominated flame retardants in many products produced before 2003, and the recycling of materials from such products are encouraged to continue or to increase. The Parties therefore agreed on an exception from Article 6 (d) in the Convention regarding commercial Penta BDE and Octa BDE, thereby permitting a country to allow for the recycling of articles that contain or may contain these chemicals. The exception made provisions for the use and final disposal of articles manufactured from recycled materials that (may) contain Penta BDE or Octa BDE, provided that "the recycling and final disposal is carried out in an environmentally sound manner and does not lead to recovery of" Penta BDE and Octa BDE "for the purpose of their reuse" (Part IV and V of Annex A, Stockholm Convention). The need of this exemption will be reviewed by the Parties in 2013.

Amongst products in which Penta BDE or Octa BDE has been widely used are EEE, products for buildings and construction, wire and cables, textiles, transportation sector applications, and other purposes such as packaging, padding, toys, furniture, and small appliances.[49] In the case of EU, the use and placing on the market of these brominated flame retardants, as well as products that contain them, have been prohibited since 2003 via Directive 2003/11/EC.[50] This has phased out the use of these substances in the EU in new products. However, these brominated flame retardants are still found in products that are becoming waste, and there could still be uncertainties regarding the presence of these substances when using recycled materials.

2.4.2 SAICM

The Strategic Approach to International Chemicals Management (SAICM) was adopted by the International Conference on Chemicals Management (ICCM) in 2006, as a policy framework to achieve the objective that, by 2020, chemicals are produced and used in ways that lead to the minimisation of significant adverse effects on human health and the environment, as agreed at the World Summit on Sustainable Development in Johannesburg 2002. In June 2012, sound chemicals management was again recognised as crucial for sustainable development at the United Nations Conference on Sustainable Development (UNCSD - "Rio+20"), who called for effective implementation and strengthening of the SAICM.

SAICM is a global multi-stakeholder process based on cooperation on equal terms between all stakeholders. The major stakeholder groups are governments, regional economic integration organisations such as the EU, intergovernmental organisations, non-governmental organisations, including business and industry, environment, health and consumer organisations, as well as trade union and science organisations.

SAICM covers chemicals at all stages of their life cycle, including in products and waste. The objectives are grouped under the following five themes: 1) Risk reduction, 2) Knowledge and information, 3) Governance, 4) Capacity-building and technical co-operation and 5) Illegal

[49] Secretariat of the Stockholm Convention on Persistent Organic Pollutants. (n.d.). *Questionnaire for submission of information on New POPs in accordance with SC-4/19.* [On Line] Available. http://chm.pops.int/Implementation/NewPOPs/DecisionSC419Informationrequest/tabid/666/Default.aspx [20 March 2012]

[50] Directive2003/11/EC of the European Parliament and of the Council of 6 February 2003 amending for the 24th time Council Directive 76/769/EEC relating to restrictions on the marketing and use of certain dangerous substances and preparations (pentabromodiphenyl ether, octabromodiphenyl ether)

international traffic. These objectives will be achieved, among other ways, through the implementation of activities set out in the Global Plan of Action. The ICCM reviews the progress towards the 2020-goal and promote and provide guidance on implementation of the strategic approach. One function is also to call for appropriate global action on *emerging policy issues* as they arise and to forge consensus on priorities for cooperative action.

One adopted emerging policy issue is the lack of information on chemicals in products. A project lead by the United Nations Environment Programme (UNEP) was started in 2009 in order to identify stakeholders' needs and existing gaps regarding information on chemicals in products (the CiP project). At its third session in September 2012, the ICCM agreed to develop, by 2015, a proposal for a voluntary international programme for information on chemicals in products along the supply chain and throughout their life cycle. The goal is to facilitating and guiding the provision, availability, and access to relevant information on chemicals in products amongst all stakeholder groups, including developing guidance on what information could be transferred and how information access and exchange could take place to enable companies in supply chains, consumers, waste actors, and other stakeholders to practice sound chemicals management throughout the lifecycle of products.

3 Findings from the interviews and comparative analysis

This chapter seeks to provide the essential findings from the interviews with representatives from 10 companies. While providing the findings, commonalities and differences found within the sector and between the four sectors covered in this study are also analysed. Attention is also given to any tendencies that can be observed based on the features of the companies such as range of products the companies handle, the size of the companies and the like.

As mentioned in Section 1.3, the detailed findings from the interviews are summarised by sector and are found in Appendix III.

Due to the anonymity request of a handful of companies interviewed, the companies are identified with the ID (A to J) provided in Appendix I. The product sector of the respective companies are summarised in Table 2.

Table 2: Product sectors and the ID of companies interviewed

Product sector	Types of products	Company ID
Interior products	Flooring systems with different materials e.g. wood, vinyl, linoleum and textile, interior products e.g. furniture, home textiles, kitchen utensils	A, B, C
Clothing & shoes	Fashion clothing including shoes, sports wear and outdoor clothing	D, E
Toys & other children's products	Toys (wooden, plastics), other children's products	B, F, G
Electrical & electronic equipment	Large and small home appliances, mobile phones, ICT equipment and systems	H, I, J

3.1 Company's ambitions, goals and targets

This first section presents and analyses the overarching ambitions, goals and targets the interviewed companies have in relation to the two areas of this study: a) the increased use of recycled materials and b) reduced use of hazardous substances (question item 1.1, see Appendix II).

3.1.1 Increased use of recycled materials

The overall direction and ambitions of the companies regarding the increased use of recycled materials varied significantly both between sectors and within sectors.

All the three companies producing and/or selling interior products (Company A, B and C) as well as two clothing companies (Company D and E) indicated their intention to increase the use of recycled materials. Amongst the five companies, only one company (Company B) has already set numerical targets for different materials, although another (Company E) was in the process of doing so. Meanwhile, Company B emphasised the importance of considering whether the use of recycled materials is the best option for the sustainable management of materials.

Standing on the other end of the spectrum are the toy companies (Company F and G), who clearly indicated their priority is material safety over the use of recycled materials. The interviewee from Company F stated that in his view, the use of recycled materials would not mean environmental superiority in their sector.

The most diverse views and experiences were found amongst the producers of electrical and electronic equipment (EEE). Company H stated that they were in the process of exploring the use of recycled materials in products. Company J, meanwhile, used to have high ambition in the increased use of recycled materials at the end of 1990s. Their direction shifted, however, after the emergence of legislation that restricts the use of certain substances, such as the RoHS Directive and the REACH Regulation in the EU. Company I had strategies for the use of very specific recycled materials such as PET bottles, CDs, and certain grades of aluminium. Company I was the only company amongst the EEE industry interviewed that currently sets targets for the increased use of recycled materials.

An explanation of the difference between the sectors could be the presence of legislative pressure on hazardous substances. Namely, both the toy manufacturers and EEE manufacturers face legislation restricting the use of hazardous substances addressing the respective sectors specifically. Due to the rather recent development of the legislation, the companies are still striving hard to comply with the legislation, and in some cases, try to anticipate the future development of the legislation. Their attention is thus focused more on material safety, vis-à-vis hazardous substances, than the increased use of recycled materials.

3.1.2 Reduced use of hazardous substances

Compared to the variety found in the case of companies' direction regarding increased use of recycled materials, the overall direction of the interviewed companies regarding the reduced use of hazardous substances was the same. They all seek to reduce the use of hazardous substances. Except for a floor manufacturer (Company A), all the interviewed companies mentioned of compliance with legislation or standards found in legislation for banned and restricted substances. Some (Company B, F and G) explicitly stated their ambition of going beyond legislative requirements, and three companies in the EEE sector indicated that they would strive to go beyond legislation when feasible. Company E referred to the global voluntary standards, bluesign,[51] which incorporates various requirements found in national and regional legislation as well as voluntary standards. Company I mentioned of the importance of pressure from their customers.

Other ambitions/mind-sets or approaches referred to include substitutions for safer alternatives (Company A, B, G, H, I, J), enhancement of knowledge of chemical content (Company A, B, G, H, I, J), and performing assessments of new materials (Company B, F, G, H, I, J).

Considering the fact that the sectors covered in this study were selected in accordance with the priority set forth by the Swedish Chemical Agency, and that many of the companies selected for the interviews have been known for their efforts in this area, it is not surprising that the ambitions expressed by the interviewed companies are high. Interesting to note is the shift of priority experienced by Company H. Compliance with legislation is a minimum requirement for a company to survive, and the study re-affirms the importance of legislation in forcing changes that may not otherwise be done.

3.2 Possibilities and hindrance of using recycled materials while managing hazardous substances

Following the overall ambitions of the two areas, the findings in relation to the first question, – which possibilities and hindrances exist for manufacturers when using recycled materials in

[51] For more information on bluesign, see, http://www.bluesign.com/.

light of the potential existence of hazardous substances in the recycled materials? – are summarised and analysed.

3.2.1 Current status regarding the use of recycled materials

The level of the use of recycled materials differs significantly amongst the sectors and within the sector in some cases. On one end of the spectrum are toy manufacturers (Company F, G): except for production spills and some paper for packaging used by Company G, they do not use any recycled materials in their products.

Both of the two companies interviewed in the clothing sector has the ambition to increase the use of recycled materials, although the sportswear company (Company E) is far ahead (50%) with distinctive sourcing strategy, compared to the fashion clothing company (Company D) whose achievement has been rather small. However, Company D clearly indicated its ambition to improve in this area. It corresponds to the overview that the interviewee from Company E provided: sportswear industry is ahead of fashion industry, but some actors in the latter are working hard.

The commonality found in two companies in the sector of interior products is that the achievement in the use of recycled materials varies between products.

Within the EEE sector, the discussion was mainly around recycled plastics. Producers of large and small home appliances (Company H) and of ICT solutions (Company J) currently do not use much recycled plastics due to the difficulties of quality assurance in relation to hazardous substances. As mentioned earlier, the case of Company J is interesting in that its direction changed significantly due to the entry into force of material-restricting legislation such as the REACH Regulation and the RoHS Directive. Company I has a sourcing strategy (from PET bottles and CDs) for quality assurance.

In terms of range of products, compared to other producers in the same sector, Company I and Company E has relatively limited range. They both have sourcing strategy for specific parts of the products they produce. Company H has a similar approach in that sense: within a rather large product portfolio, the company focuses its application on a special range of vacuum cleaners so far.

Except for rare earth metals mentioned by Company I and J, as well as aluminium (Company I), scrap metal has a well-established market, and companies in general do not find importance in keeping track of the ratio of scrap metals used in their products.

3.2.2 Drivers and barriers for the increased use of recycled materials

At present, there are no strong drivers for the interviewed companies to increase the use of recycled material. Only one company (Company A) claims that there are economic reasons for them to use recycled material in the products today, while another company refers to customer preferences/requirements (Company I).

The rationale is rather common for the companies regardless of the sector they represent. Most of the interviewed companies point at using recycled material is a part of their general sustainability and environmental efforts (Companies B, C, D, H, I, J). Typically, they refer to increased resource efficiency, waste prevention, and responsibility towards society (Companies D, E, I, J). Some companies (Companies D and E) consider increased use of recycled material give positive market reactions as either reinforced brand names and goodwill or better market positions.

A number of companies (Companies A, B, D, H), again representing different sectors, point at potentially stronger drivers in the future. They point at increasing raw material prices and potential scarcity of the virgin materials. In addition, there is an element of knowledge building and technical development that aim at sourcing recycled material of sufficient quality, at better re-processing of recycled materials that enhance the quality of recycled materials, and at identifying applications for recycled materials. The quality referred to here includes not only the reduction of hazardous substances, but may include other properties necessary for manufacturers to use recycled materials.

There are some common views of the barriers for increased use of recycled materials amongst the interviewed companies regardless of the sector they represent. Many point to the uncertainties regarding meeting quality standards (including physical properties, performance, smell, etc.) for the function of the material and difficulties in obtaining homogenous materials. Currently, some of the interviewed companies use recycled homogenous food containers (controlled material) or material from other well-defined products.

The risk of chemical contamination is also mentioned by many (Company A, B, D, E, G, H, I, J) and in particular stressed by the companies representing the toys and electronic industries. This aspect implies a need for frequent and costly tests (Company B, E, F, G, I, J) in order to safeguard appropriate material standards.

Some of the companies that have been using recycled materials in products (Company A, B, D, E) also point at the lack of sufficient amount of input materials at an even supply from reliable sources as a barrier. Moreover, some of those companies, representing material for interior products, clothing and electronic industries, point at the lack of sufficiently good techniques for processing the recycled materials into high-quality products.

3.2.3 Company's approach to secure the quality of recycled materials with regard to hazardous substances, and the rationales for such approach

The companies essentially treat recycled materials the same as virgin materials with regard to requirements for quality and safety. Consequently, the approach for the toy producers is to avoid recycled materials. Other companies that actually use recycled material in products indicate that recycled materials often require additional tests compared to virgin materials (Company B, E, H, I). One complementary approach is to work with the recyclers to identify reliable sources that offer materials that meet the quality requirements (Company B, D, E, I).

Company E shares information with its competitors to build up common knowledge on recycled materials amongst the outdoor clothing companies. Company A has, together with other firms in the flooring sector, organised collection of high quality materials from construction sites and establish a documentation system for built-in materials to help future recycling.

3.2.4 Possibilities and hindrances to increase the use of recycled materials while lowering the risks of hazardous substances

Some of the interviewed companies (Company A, B, D, I), representing different sectors, see the possibilities in the development of new technology and of applications. Company D works with suppliers to shift practices and implement such possibilities. Company A implements such solutions in-house.

A few companies (Company G and J) suggested that the development of a guarantee system for recycled material, either on a voluntary basis or based on legislation, would facilitate this development.

A few companies (Company A and D) indicated that, since recycled materials are often blended with virgin materials when used in their products, some uncertainties regarding the properties of the recycled material could be accepted without jeopardising the product quality and chemical safety. Meanwhile, companies with very high quality and composition requirements, such as Company F, do not see any obvious possibilities to increase the use of recycled material. The difference could be again explained with the difference in the stringency of legal requirement. For some, the inclusion of very small amounts of hazardous substance contained in recycled materials would lead to the contamination of the whole batch of raw materials, while for others, the threshold level may not be very low.

3.3 Approaches, cost and benefit of information management on substances in products

Following the previous section on the use of recycled materials in light of potential residual hazardous substances, Section 3.3 presents and analyses findings in relation to the second main question of the study: What strategies and approaches do manufacturers and distributors have to collect and manage information on substances in products and materials, and what are the benefits and costs of taking such approaches?

3.3.1 Approaches and systems for information management on substances in products

Which chemical information to manage

Amongst the companies interviewed, five companies (all the EEE manufacturers, Company B from interior products and toys, Company D from clothing sector) have their own material restriction list or equivalent (list of substances that are banned, restricted, or those the companies wish to find substitutes for). The companies use relevant legislation such as the REACH Regulation and the RoHS Directive as the basis of their list. Their suppliers should inform the companies of the inclusion of these materials. Company E, a sportswear manufacturer, uses bluesign[52], an industry-wide certification system for textile materials, which incorporates requirements from various legislation and industry's own standards. Company E seeks to source materials that are labelled with bluesign. Company F from the toy sector does not produce its own material restriction list. The company lists up relevant legislation instead and has suppliers declare their compliance to the legislation.

While these companies mentioned above work with a so-called negative list, Company G, a high-end toy manufacturer, defines lists of accepted or approved substances (positive list). The company has established long-term working relationship with its suppliers, who provide the company with full disclosure on the exact material composition of all purchased materials and products under strict confidentiality agreement. Company I, which produces mobile phones, also aims for full material declaration, but the company has not achieved it for the moment.

Means of collecting the information

Regarding the means of collecting the information, Company I and J from EEE sector collaborate with competitors in the same sector and share the same database upon which

[52] For more information on bluesign, see, http://www.bluesign.com/.

information is supplied from suppliers. Company E in the clothing sector uses the certification scheme, bluesign, which is rapidly spreading amongst the companies in the same sector. Company J and E both commented on the efficiency in obtaining information as the reason for working with competitors.

Meanwhile, all the interviewed companies in the interior products sector, those in toy sector, as well as Company H from EEE sector and Company D from clothing sector have established their own system for collecting the information from their suppliers. Company A and G commented on the long-term working relationship with their suppliers. Company B mentioned of its integrated supply chain, and Company F and G have their own manufacturing plants. A feature common to Company A, F and G is that they have relatively narrow materials to work with. Meanwhile, what Company A, B and G has in common is a close relation with their suppliers.

Verification of information collected

Information on hazardous substances provided by suppliers is in principle received with trust. Meanwhile, a number of companies from all sectors conduct random sampling analyses/tests to ensure the quality of the materials/components/products they receive from suppliers. The tests can be conducted by internal staff and/or by an external third party. In cases where the content of information provided is far away from what could reasonably be expected, producers might go back to the suppliers and interview them. Frequency of analyses/tests they conduct differs, depending on the materials, requirement from the customers, expectation from the market and the like.

3.3.2 Cost for chemical information management in products

In all sectors interviewed, it was difficult to obtain concrete information on cost for chemical information management in products. In terms of cost items, many of the companies interviewed (Company A, B, C, E, F, G, H, J) directly or indirectly refer to the *personnel cost* associated with obtaining and managing chemical information. Some companies have personnel working solely on the management of chemical information. For many companies, however, personnel are also engaged in other tasks such as quality management and work related to other aspects of the environment. This makes it difficult to grasp the precise amount of resources spent specifically on chemical information management in products. Another cost item often referred to was testing (Company B, F, G, I, J). The concrete figures per test mentioned by a toy manufacturer (Company F) and an EEE manufacturer (Company J), of roughly 2-3 thousand Euros, are more or less the same. All the companies in the toy sector commented on tests as the main cost item, which corresponds to the stringent requirement related to chemicals in this sector.

3.3.3 Chemical information transfer to professional customers and consumers

It was difficult to find a sector-specific trend under this question.

Company A producing flooring materials, Company C supplying interior products, Company D supplying fashion clothing, and Company I producing mobile phones, claim that they have information on the content of hazardous substances available online. A similarity between Company A and I is that the type of products they produce/sell are fairly limited, compared to, for instance, Company B, C, H, and J. However, a similar trend was not found in the case of Company F and G (toy producers), although the types of products they produce are also fairly limited. In the case of Company G, the restriction on the provision of information to the public has both to do with confidentiality agreements with its suppliers and as well, that consumers

should not be expected to have sufficient knowledge to be able to read and understand chemical information on consumer products. Customers purchasing products from Company G should reasonably be able to expect that the products they buy are chemically safe. Company B also provides information on some chemicals contained in the products even when it is not required by law to do so, however, it does not provide information on all chemicals used in all products. Company E evaluates the overall environmental performance of their products – including the reduced use of hazardous substances – and communicates it to its customers in the form of scores.

The majority of the companies interviewed (Company A, B, C, D, E, F, G, H, J) indicated that they supply information when requested by customers/consumers and/or when required by law. The frequency of them receiving inquiries from their consumers is once/twice a month to once a week.

Except for Company F, the interviewed companies did not mention the difference between professional customers and consumers. Company F has experienced the request of information on a very detailed level from some professional customers, but hardly any of the same level from consumers. The frequency of information request is also more often in the case of professional customers than consumers. Company I, although not specifically in the context of information provision, mentioned that it is its customers (in this case, operators), more than the legislation, that drives its work.

A number of interviewees (Company B, D, E, F, G, J) commented on the difficulties of knowing the "right" information that would be meaningful and helpful for consumers to disclose. Some considered that instead of providing information on the precise amount/percentage of chemicals contained in products, it is more meaningful to let them know that the products they sell comply with all the relevant legislation, and/or what types of measures they take to comply, and how they take such measures.

Company E and F, both selling high-quality and relatively expensive products, indicated that consumers' priorities are on issues of cost, function, looks and the like, and not on the environmental performance of their products. The interviewees of the two companies commented that they fear that the amount of resources they dedicate to improving the environmental performance of their products does not provide them with economic gains.

3.3.4 Information transfer to waste sector

Overall, companies interviewed – irrespective of the sectors – rarely, if ever, receive questions from waste sectors regarding the chemical composition of their products. Even in the EEE sector, in which producers are obliged under the WEEE Directive to provide information related to end-of-life management of their products to waste sector actors and are ready to provide information, questions on chemicals are hardly, if ever, posed. Interviewees from Company H posed questions as to if such information was something that waste sectors would indeed need/want in practice.

Meanwhile, a handful of companies (Company B and E) proactively communicate with waste sectors with the intention to improve the end-of-life performance of their products (e.g. recyclability of new materials).

3.3.5 Rationales for information management on substances in products

The necessity of fulfilling legal requirements (including the company that started its information management system on substances due to legislation) was one of the most stated

reasons why companies work on information management on substances in products in general. Five companies explicitly mentioned this (Company A, C, H, J, G). Another reason also mentioned frequently was to offer/ensure the safety and health of the users of the products (Company A, B, D, G). Three companies (Company A, D and I) commented on better publicity and goodwill building with their customers and societal actors such as consumer organisations as reasons for doing so.

Amongst the answers specific to the sector, two companies in the interior product sector (Company A and C) indicated fulfilment of customer requirements/expectations. Two toy producers (Company F and G) mentioned cost efficiency.

Other rationales for companies to work on information management on substances include: to build relation with customers and suppliers (Company A), reduce environmental problems related to hazardous substances (Company D), the company has the capacity to induce change (Company D), and to be in control of materials (Company F).

Regarding the specific approaches taken by the companies interviewed, two of the companies that collaborate with their competitors (Company E and J) said they chose to work this way because of cost efficiency. Company H, which has its own chemical information collection system from its suppliers, said that the choice is dependent on the overall development of the system.

3.4 Future outlook

In light of the experiences of the companies as well as their views on the existing systems, the study also seeks to understand how the interviewed companies foresee future developments related to the increased use of recycled materials and reduced use of hazardous substances.

3.4.1 Future outlook – Recycled materials

Most companies interviewed, regardless of the sector, believe in the increased use of recycled materials in the near future. The reasons include societal pressure for environmental improvement and resource efficiency, viewing recycled materials as an alternative source of raw materials and potential reasonable prices in the future (Company A, D, E, I). Company H pointed to the increase in recycling as well as increased amount of recyclable materials in products as indirect consequences of the introduction of producer responsibility.

The increasing utilisation of recycled materials goes hand in hand with both technical developments and new material collection systems (Company A). Company B stressed the importance of technical development for sorting and cleaning of mixed materials, while phasing out questionable substances and materials in order to make recycling easier in the future. Traceability (Company C) and better control of raw materials rather than products (Company A, F, G) – vis-à-vis hazardous substances – make recycled materials more useful also in new applications. In the absence of traceability and proper controls on raw materials, there is an obvious risk of large amounts of materials that would, through contamination, need to be down-cycled, or worse, discarded.

Company B highlighted the importance of considering when it is best to recycle or not. For some materials, namely those using products produced in the past as feedstock and that could potentially contain various hazardous substances, recycling may present itself as a worse option when compared to disposal. Company F also pointed that the suitability of using recycled materials differs from products to products.

3.4.2 Future outlook – hazardous substances in products

The interviewed producers or distributors of interior products agree that the reduction or phasing-out of hazardous substances and increasing chemically safe products is an important area to work on. While Company B considers that efforts will certainly continue in the coming 10 years, flooring producer (Company A) considers that phase-out of hazardous substances have been their aspiration for a long time, and it is sufficiently good by now. Difference may be due partly to the difference in the variety of products they handle.

In the clothing sector, both of the companies interviewed commented on the sector-wide initiatives, which they will continue to develop. Company E considers that certification systems at the level of materials is more efficient way of addressing issues related to chemicals in their products than certification at the product level, such as eco-labels. The sector-wide initiative taken by Company D also concerns the reduction of hazardous substances used by their suppliers.

Company F, a toy manufacturer, acknowledges the positive effect of strict legislation in driving its work on chemical management. Meanwhile, the company is critical on the extensive restriction targeting solely on toys and children's products, in light of the fact that the same products that are not specifically meant for children – thus not subject to the same level of restriction – may very well be used by children. The company highlights the importance of having better surveillance that covers not only prominent manufacturers but also numerous small manufacturers. Without better surveillance and subsequent enforcement, it makes it very difficult to compete with small manufacturers, as they would gain price advantage by not complying with legislation. Company G refers to the high cost of testing, which they view as not very productive for producers that have already ensured that the raw materials do not contain hazardous chemicals in their products. Company B comments on the difference in the reporting, registration and testing, and indicates that it would be beneficial to establish common way of, e.g. reporting in various parts of the world.

All the three EEE companies interviewed agreed that discussion on legislation related to hazardous substances are expected to continue, in light of, e.g. the revised RoHS Directive and new candidates on the SVHC list in the REACH Regulation. Companies have views on various aspects of legislation, such as the spread of legislation similar to the RoHS Directive and the REACH Regulation in other parts of the world, additional candidates and importance of targeted (as opposed to non-product-specific) restriction and the like. In the case of Company J, the emergence of the RoHS Directive and the REACH Regulation triggered a shift in focus from the use of recycled materials to compliance with these laws. Company I states that its priority is on recycling, and Company H, energy efficiency.

Across the sectors, Company C and I commented on the difficulties of keeping stringent mechanisms to check the quality of information provided by their suppliers. Company C and G highlighted the importance of trust. Compared to the clothing sector, which despite its long supply chain, uses relatively limited type of materials, the range of products handled by Company C is wide and therefore it would be difficult for a company like Company C to work with material suppliers.

3.4.3 Overall future outlook of the two areas

Virtually all the companies interviewed claim that recycled material must meet similar quality and safety standards as virgin materials or at least that a blend of virgin and recycled material should meet similar requirements. The quality requirements address both chemical composition

and absence of or control of content of hazardous substances and other quality parameters relevant to the function of the product and/or the process conditions.

Although all interviewed companies across all four sectors recognise the importance of the chemical safety issue, the areas in which they place their priorities on the subject differ slightly. Amongst the companies of the toy industry, the issue is related to new, strict, and legally binding requirements that are in place in important markets. The companies have been making much effort in proving compliance with these rules. Companies of the electrical and electronic industry need to meet strict legal requirements as well, but have been exposed to such legislation for a longer period of time and have been building up appropriate chemical information systems.

The companies representing clothing and interior products are careful in controlling the chemical contents of their products but are more progressive in using recycled materials. It could in part be explained by less stringent legally binding requirements as well as the different level of complexity of the products themselves, which may ease the achievement of quality requirements – not only on chemicals but also on various functional properties – on the raw materials. The companies in these sectors also stress the future opportunities for alternative sourcing of raw materials from recycling, for the development of new technologies and applications, and of collection systems for used products. They are emphasising the importance of cultivating the possibilities of sorting and cleaning materials from old and new products, while placing new products on the market made from much better and known materials in the first place. New products with less hazardous materials and full disclosure of their properties would better meet the desired features for materials that could be recycled more easily in the future. However, it should be acknowledged that it is inevitable to mix several materials to achieve certain functionality, thus the need for better technologies for sorting and cleaning.

A general expectation for the future amongst the interviewed companies is the development of new techniques, technologies and practices for making recycled material more useful for high quality products. This development implies, amongst others, that the recycling industry would play a more prominent role as a supplier of raw materials of well-defined properties and chemical compositions.

An expected parallel development concerns the communication of chemical contents of products, components, and materials. A common understanding of the necessity for trust and transparency in supply chains will lead to an increased use of electronic systems and standardised common formats for the exchange of information. The alternative, an increased use of tests and control system, would be very costly. An anticipated result is that the use of recycled materials in new products will become easier in the future.

4 Conclusions

In this concluding chapter, we first present a summary of the overall findings based on the analysis presented in the previous chapter. We subsequently seek to highlight the implications of the findings to policy makers. The Chapter concludes with suggestions on a few areas where further research might be useful.

4.1 Summary of the overall findings

This section highlights the findings from the interviews conducted with ten companies in four different sectors – interior products, clothing and shoes, toys and other children's products, and electrical and electronic equipment (EEE). The views and experiences of the interviewees do not necessarily represent all companies in the respective sectors – the sample for the study was too small to obtain the comprehensive picture for the whole industry sectors. However, in light of the fact that many of the companies interviewed have been known to be active in at least one of the two areas covered in this study (increased use of recycled materials and/or reduced use of hazardous substances), the findings give interesting insights of the companies' experiences regarding opportunities and challenges on these issues.

The companies interviewed have been reducing the use of hazardous substances proactively and have developed mechanisms to manage chemical information in products. All the interviewed companies indicated that they seek to reduce the use of hazardous substances in their products in order to comply with legislation in different regions/markets. Many of them also seek to go beyond the legislation to ensure the health and safety of their customers, and to be proactive in avoiding business risks. Amongst the common reference points referred to include the list of substances identified as SVHC (substances of very high concern) under the REACH Regulation (the Candidate list). A number of companies indicated that when a substance they use in their products is listed as SVHC, they start to explore alternatives since it may trigger authorisation requirements of the substance in the future. Some companies also address a broader range of hazardous substances than those included in the Candidate list.

Substantial differences are observed regarding the ambitions for the increased use of recycled materials amongst the interviewed companies: While the interviewees from the interior products sector and from the clothing and shoes sector indicated their intention to increase the use of recycled materials (one textile company indicated 100% as its goal), two interviewees from the toy sector explicitly mentioned that their companies do not intend to use recycled materials due to very strict chemical safety requirements. The ambition of interviewed companies in the EEE sector varies: one seeks to secure the use of recycled materials from specific sources, another is at an explorative stage, and the third indicated that its priority shifted from the increased use of recycled materials to material safety since the entry into force of legislation such as the REACH Regulation and the RoHS Directive. Plastics were amongst the material streams most frequently discussed by the interviewed companies as, compared to scrap metals, they face difficulties in finding recycled plastics that meet with their quality requirements.

Recycled materials need to meet essentially the same quality and safety requirements as those set for virgin materials: The companies that use recycled materials indicate that their quality and safety requirements for recycled materials are essentially the same as those set for virgin materials.

Main barriers for the increased use of recycled materials include risk of contamination, costs associated with avoidance of such risks, and limited availability: The barriers indicated by interviewees were many, but common ones include the risk of contamination of hazardous substances due to poor recycling processes and old products containing banned or otherwise unwanted hazardous substances. The cost of testing and the lack of traceability of the origin of the recycled materials were also seen as barriers. As the origin of recycled materials tends to vary from one batch to the other, the frequency of tests is higher for recycled materials when compared to virgin materials. In addition, the availability of recycled materials is currently quite limited.

However, the interviewed companies see future opportunities in overcoming the barriers. Increased use of recycled materials depends on the development of cleaner material streams, which require cleaner input materials, the development of better separation/cleaning technologies, and standards for recycled materials: The use of recycled materials currently being retrieved face many challenges regarding their quality. However, some interviewees are hopeful in the creation of cleaner material streams in the future. This requires, amongst others, the enhancement of the quality materials used in the products currently manufactured. Consideration should be made regarding, amongst others, the recyclability and chemical content of the materials. Development is also required regarding the end-of-life phase of products, most notably the need for better sorting and cleaning technologies of mixed materials collected. Further efforts could also be made at the collection stage to avoid the mixture of different types of products coming into one stream. Moreover, standards set for recycled materials could enhance their use, if the standards would guarantee the quality of recycled materials.

While the significance of the presence of chemical legislation is commonly recognised and future development was anticipated, the importance of enforcement on all actors was also highlighted: The presence of legislation is perceived to be significant in improving the quality of material streams. Interviewed companies also anticipate that discussions on legislation related to chemicals to continue. Meanwhile, some interviewees also stated the importance of better enforcement of the existing legislation to all market players, including, amongst others, small importers. It would otherwise negatively affect the companies working proactively in the price competition.

The companies interviewed have taken different approaches in managing chemical information in products. For the companies to be able to take proactive measures in reducing hazardous substances in their products, it is essential to have control over the chemical content of their products. The vast majority of the interviewed companies use a so-called negative list, while one company uses a positive list (allowed substances). One company manages to have full material declaration at the moment, while another strives to obtain that from its suppliers. The majority of companies interviewed have their own systems for collecting information from their suppliers, while two of the EEE manufacturers and one of the clothing suppliers collaborates with their competitors in this area.

Companies who have taken part in an industry-wide system for collection of chemical information from their suppliers indicate that such systems make information transfer less costly, both for them and for their suppliers.

Main cost items for chemical information management in products are personnel costs and chemical analyses, although a concrete cost figure is not available: The main cost items mentioned by the interviewees are on personnel engaged in the management of the information system and chemical analyses, as well as on tests required for quality assurance. The fact that

many of the employees engaged in chemical information management are also engaged in other tasks, such as quality assurance and environmental improvement, makes it difficult for companies to isolate the exact costs.

Chemical information transfer to professional customers and consumers takes place mainly on demand, and very few requests come from the waste sector: While a few companies provide information related to chemical content voluntarily on their website, the majority of the companies provide information to their customers and consumers on demand. Only a few companies interviewed experience difference between customers and consumers. Professional customers ask for more extensive information in such cases. A number of interviewees are undecided as to which way would be most meaningful in communicating chemical information to customers and consumers.

The interviewed companies hardly experienced any requests coming from the waste sector regarding the chemical content of their products. Some companies meanwhile seek to proactively communicate with actors in the waste sector to enhance the environmental performance of their products (e.g. recyclability of their products/specific materials they use).

4.2 Implications for policy-makers

Chemicals in products, waste generation and treatment, and resource efficiency have become universal policy issues due to the globalised nature of economies and trade patterns. Measures need to be taken at all levels; national, regional, and global, to enhance the possibilities for increased use of recycled materials without compromising safety, environment, and health due to hazardous substances.

Importance of legislative drive: The lists of restricted substances developed by the interviewed companies to reduce the risks of hazardous substances and manage chemical information, was based predominantly on their own ambitions and relevant legislation, such as the REACH Regulation and the sector specific legislation such as the RoHS Directive and the Toy Safety Directive. These findings indicate the importance of continuing to pose the legislative driver in reducing the use of hazardous substances, as well as in managing the information regarding chemicals in products, and to stimulate efficient resource use and non-toxic material cycles.

Other policy-measures could influence the cost relations between virgin and recycled materials to stimulate the use of high quality recycled materials and to facilitate recycling techniques.

Develop standardised test methods: The interviewees claim that they essentially put the same requirements on recycled material as they do for virgin material. This considers both similar properties and chemical safety. There is a need to further develop standardised test methods suited for recycled material but that measure the critical parameters. Policy-makers can support the development of such standard methods. The different standard methods required in various geographical regions for measuring similar parameters are both resource demanding and costly. Policy-makers can, when developing standardised methods for recycled materials, improve conditions for the actors by harmonising the methods.

Increase traceability of material content: Material standards could be defined and made traceable (and controlled) for the sake of making materials in new products more convenient to recycle when discarded in the future.

R&D and technical development: Some of the interviewed company representatives pointed out a need for improved technical development, R&D, and knowledge dissemination for the deployment of new methods. For instance, the current opportunities for producers to source

safe and quality assured recycled material are mentioned to be limited by poor recycling techniques. Policy makers can support R&D and technical development in this area to help increasing the availability of useful recycled materials. Dedicated technology-oriented projects (see section 4.3 below on suggestion for further research), with financial support by policy-makers, would help to alleviate a number of issues experienced in this area.

Better enforcement with more thorough market surveillance: There is limited knowledge regarding the bulk of manufacturers' and distributors' work on chemical risk reductions, information management, and their use of recycled materials. A stronger push for policy implementation through surveillance and *enforcement* of current directives is needed to create a level playing field. A possible path could be increased co-operation between the relevant authorities of the EU Member States regarding the enforcement of existing directives and regulations on hazardous substances in products.

4.3 Suggestion for further studies and research

Some of the conclusions mentioned in the previous sections have clear implications on further studies and research. One potential area of research addresses the capacities of policy instruments both for management of hazardous chemicals in products and for using recycled materials in new products. Another area of suggested research aims at developing and gathering the technical and managerial knowledge base for recycling of high-quality materials.

General understanding of chemicals management and use of recycled material in the sectors: All companies of the interview study were selected as companies who have been proactive in either the area of management of chemical information or users of recycled material in their products. The small number of interviewed companies does, as frequently mentioned, not allow for general comparisons and conclusions of how companies of the different sectors, such as advanced micro-electronics and mobile phones, white goods, textiles and shoes, toys, act in relation to the investigated issues. In order to better tailor policy interventions to stimulate efficient resource use and non-toxic material cycles, we suggest a deeper comparative analysis of management practices of companies within the sub-group of an industry sector – an angle could be, amongst others, a comparison between domestic manufacturers/suppliers and importers. Such a study should provide a better understanding of how general the chemical management approaches are implemented in the sectors, and build and enhance empirical knowledge on the use of recycled materials. Interesting questions concern both drivers and trends regarding recycled materials, in particular plastics, in the sectors as well as shared practical experiences between producers located in different geographical regions.

Improved quality of chemically safe recycled materials through assured collection: The design and management of collection schemes and sourcing of recycled material are crucial factors for maintaining high and well defined qualities suitable for further re-processing into new products. It is of paramount interest to keep different materials separate and not mixing in unknown materials and potential hazardous substances.

In order to increase the available material, we suggest further research on how various types of waste sorting systems manage to keep track of the origin and previous use of the collected materials in order to enhance appropriate sourcing. This includes what lessons that could be derived from the collection of food and beverage packages, as PET bottles constitute an important feedstock of recycled materials. Moreover, other sectors, for instance the material collection systems of the EEE sector, may demonstrate solutions that could be transferred to other applications.

A possible approach to tackle the availability of high-quality and safe material is to look into the practices of recycling firms. Some questions may include how recycling firms: a) derive information on material qualities and contents from the brand owning companies, b) organise material collection schemes, c) make systematic material tests and d) keep different recycled materials separate, in order to meet current and future requirements from the producers.

Techniques for sorting and cleaning of recycled material: Interviewees contributing to this study called for technological solutions for appropriate sorting, cleaning, and controlling of collected materials for recycling. There are a number of functioning material recycling systems in different economies, e.g. plastics recycling from WEEE in Japan, textile recycling in several Asian countries. As a parallel track to those mentioned above, we suggest an investigation into the technological potentials of selected schemes for sorting of various materials outside Europe.

Beside the technical solutions, there is also an identified need to develop quality systems and cheaper test methods for hazardous substances in the materials.

List of Abbreviations

AIS	Article Information Sheet
BDE	Bromodiphenyl ethers (flame retardants)
BOM	Bills of Materials
BVD (BMD)	Byggvarudeklaration (Building Material Declaration)
CD	Compact disc
CMR	Carcinogenic, mutagenic, and repro-toxic
ECHA	European Chemical Agency
EEE	Electrical and Electronic Equipment
EPD	Environmental Product Declaration
EU	European Union
DG	Directorate-General
ICCM	International Conference on Chemicals Management
ICT	Information and communication technologies
IMDS	International Material Data System
JAMP	Joint Article Management Promotion Consortium
PET	Polyethylene terephthalate
PAH	Polycyclic Aromatic Hydrocarbons
PLM	Product lifecycle management system
POPs	Persistent Organic Pollutants
PVC	Polyvinyl chloride
R&D	Research and development
REACH	Registration, Evaluation, Authorisation and Restriction of Chemical substances
RML	Restricted Material List
RoHS	Restriction of Hazardous Substances
SAICM	Strategic Approach to International Chemicals Management
SVHC	Substances of very high concern
WEEE	Waste Electrical and Electronic Equipment
XRF	X-ray fluorescence

References

COM (2001) 68 final. *Green Paper on Integrated Product Policy.*

COM (2005) 666 final. *Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and The Committee of the Regions. Taking sustainable use of resources forward. A Thematic Strategy on the prevention and recycling of waste.*

COM (2008)397/3. *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the Sustainable Consumption and Production and Sustainable Industrial Policy Action Plan.*

COM (2010) 2020 final. *Communication from the Commission. Europe 2020. A Strategy for smart, sustainable and inclusive growth.*

COM(2011)25 final. *Communication from the Commission to the European Parliament, the Council, the European economic and Social Committee and the Committee of the Regions: Tackling the Challenges in Commodity markets and on Raw Materials.*

COM(2011)571 final. *Communication from the Commission to the European Parliament, the Council, the European economic and Social Committee and the Committee of the Regions. Roadmap to a Resource Efficient Europe*.

Council Directive (88/378/EEC) of 3 May 1988 on the approximation of the laws of the Member States concerning the safety of toys.

Council Directive (91/157/EEC) on batteries and accumulators containing certain dangerous substances.

Council Directive 92/42/EEC and Directives 96/57/EC and 2000/55/EC of the European Parliament and of the Council.

Council of the European Union (2012). Setting the framework for a Seventh EU Environment Action Programme – Council Conclusions (11186/12).

Council Regulation (EU) No 333/2011of 31 March 2011 establishing criteria determining when certain types of scrap metal cease to be waste under Directive 2008/98/EC of the European Parliament and of the Council

Directive 91/157/EEC on batteries and accumulators containing certain dangerous substances.

Directive 98/8/EC of the European Parliament and of the Council of 16 February 1998 concerning the placing of biocidal products on the market.

Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on end-of life vehicles.

Directive 2001/95/EC of the European Parliament and of the Council of 3 December 2001 on general product safety.

Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment (WEEE)

Directive 2003/11/EC of the European Parliament and of the Council of 6 February 2003 amending for the 24th time Council Directive 76/769/EEC relating to restrictions on the

marketing and use of certain dangerous substances and preparations (pentabromodiphenyl ether, octabromodiphenyl ether)

Directive 2005/32/EC of the European Parliament and of the Council of 6 July 2005 establishing a framework for the setting of ecodesign requirements for energy-using products and amending

Directive 2006/66/EC of the European Parliament and of the Council of 6 September 2006 on batteries and accumulators and waste batteries and accumulators and repealing.

Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing.

Directive 2009/48/EC of the European Parliament and of the Council of 18 June 2009 on the safety of toys

Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products (recast).

Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment. (recast)

Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE) (recast)

Environmental Data Service. (2012, 20 August). *ECHA prepares a further 38 SVHC proposals.* ENDS Environment Daily. [On Line]. Available. www.environment.daily.com [20 August 2012]

European Chemical Agency. (2012). Candidate List table. [On Line]. Available. http://echa.europa.eu/web/guest/candidate-list-table [25 August 2012]

European Commission. (2012). Waste Framework Directive. End-of-life Criteria. [On Line]. Available: http://ec.europa.eu/environment/waste/framework/end_of_waste.htm [25 August 2012]

KemI (2011). *Kemikalier i varor. Strategier och styrmedel för att minska riskerna med farliga ämnen i vardagen.* Rapport Nr. 3/11. KemI: Sundbyberg.

Kogg, Beatrice and Thidell, Åke (2010) Chemicals in Products: An overview of systems for providing information regarding chemicals in products and of stakeholders' needs for such information.

Krämer, Ludwig. (2007). *EC Environmental Law. Sixth Edition.* London: Sweet & Maxwell Ltd.

Peterson, Karolina, Swedish Energy Agency. Personal communication 13 September 2012.

Regeringskansliet. (2009). *The Swedish Environmental Objectives – New Perspectives. Report of the Inquiry on the Environmental Objectives Systems. SOU 2009:83* [On Line] Available. http://www.sweden.gov.se/content/1/c6/13/55/25/8ae6a419.pdf [10 August 2012]

Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94

as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC.

Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directive 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006.

Regulation (EU) No 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products.

SEC (2009) 1198 final. *Commission Staff Working Document. Lead Market Initiative for Europe. Mid-term progress report.*

Secretariat of the Stockholm Convention on Persistent Organic Pollutants. (n.d.). *Questionnaire for submission of information on New POPs in accordance with SC-4/19.* [On Line] Available. http://chm.pops.int/Implementation/NewPOPs/DecisionSC419Informationrequest/tabid/666/Default.aspx [20 March 2012]

Tojo, Naoko, Kogg, Beatrice, Kiørboe, Nikola, Kjær, Birgitte and Aalto, Kristiina (forthcoming). *Prevention of Textile Waste. Material flows of textiles in three Nordic countries and suggestions on policy instruments*. NMR-Temanord series. Forthcoming publication.

Tojo, Naoko and Lindhqvist, Thomas. (2010). *Product-oriented Environmental Interventions. Bundling of effective policy instruments.* IIIEE report 2010:1. Lund: IIIEE, Lund University.

Tojo, Naoko. (2004). Extended Producer Responsibility as a Driver for Design Change – Utopia or Reality? IIIEE Dissertations 2004:2. Lund: IIIEE, Lund University.

Appendix I: Characteristics of companies and interviewees in the study

ID in this study	Headquarter*	Manufacturer and/or distributor	Market*	Number of employees*	Main products (those NOT covered by this study are in parentheses)	Number and Position(s) of the interviewees
A	Nordic	Manufacturer	Global (pure sales organisations in 33 countries)	4 900	Flooring systems w/ different materials e.g. wood, vinyl, linoleum and textile	1, Head of technical services/Environment and Quality
B	Nordic	Manufacturer and distributor	Global (retailers in 26 countries, 79% of sales from Europe)	131 000	Interior products, toys and children's products (furniture, home textiles, kitchen utensils)	1, Sustainability (focused on the use of recycled materials the last two years)
C	Nordic	Manufacturer and distributor	Sweden, Norway, Finland, UK	4 000	Interior products, home (DIY/hardware, tools, electronics, multimedia, hobby).	1, Chemical Coordinator, Dangerous Goods Safety Advisor, Purchase Department
D	Nordic	Manufacturer and distributor	Global (stores in 44 countries, approximately 2/3 of the sales from Europe)	94 000	Fashion clothes, accessories	1, Chemical specialist, apparel, accessories and footwear
E	Nordic	Manufacturer and distributor	Retailers in 19 countries, biggest market in Sweden, Germany, Norway, Japan and Korea	20 in headquarter	High-end sportswear	1, CEO /sustainability /design
F	Nordic	Manufacturer and distributor	Global	300	Toys and children's products	1, Head of quality
G	Nordic	Manufacturer	Global (group in 28 countries)	9 400	High-end toys made of plastics	1, Director of Governmental Affairs
H	Europe	Manufacturer	Global	>50 000	Large and small home appliances	2, Environment
I	Nordic	Manufacturer	Global market actor	8 500	Mobile phones and entertainment systems	1, Senior Environmental Specialist, Corporate Sustainability Office, Q&V
J	Japan	Manufacturer	Global	140 000	ICT Solutions (hardware and software), Business, Social, Infrastructure	2, CSR and Environment

*Based on the information available on the companies' websites. The figures on market and employees are taken from latest annual reports of the companies available on their websites (thus either from 2010 or 2011).

Due to the request of anonymity expressed from some of the interviewees, the level of details of the description varies.

Appendix II: Question items sent to the interviewees

1. Area a: possibilities and hindrance of using recycled materials in light of hazardous substances that may contain in them

   1.1 Ambitions, goals and targets in relation to 1) reduced use of hazardous substances and 2) increased use of recycled materials

   1.2. Current status regarding the use of recycled materials

   1.3 Drivers and barriers for the increased use of recycled materials

   1.4 Company's approach to secure the quality of recycled materials as regards hazardous substances, and the rationales for such approach

   1.5 Possibilities and hindrances to increase the use of recycled materials while lowering the risks of hazardous substances

   1.6 Future outlook

2. Approaches for information management on substances in products, and cost and benefit of information

   2.1 Approaches and systems for information management on substances in products

   2.2 Cost for information management in products

   2.3 Information transfer to customers/consumers

   2.4 Information transfer to waste actors

   2.5 Future outlook

   2.6 Rationales for information management on substances in products

3. Overall future outlook in the two areas for the company

Appendix III: Interview findings from manufacturers and retailers of selected product sectors

In this Appendix, the findings of the interviews conducted with representatives of 10 companies from four product sectors – interior products, clothing and shoes, toys and other children's products, and electrical and electronic equipment (EEE) – are summarised sector by sector.

In order to allow for easy comparison between the sectors, the findings from each sector are presented in the same order. Firstly, the interviewed companies' ambitions, goals and targets of the two main areas of this study – increased use of recycled materials and reduced use of hazardous substances – are summarised. It is followed by the findings on a few aspects related to the possibilities and hindrances of increasing the use of recycled materials. The third part of the sector presentation comprises of five aspects in the area of approaches taken by interviewed companies to manage the chemical information in products. The final section discusses companies' views on the future outlook of the two main areas of the study.

1 Interior products

1.1 Ambitions, goals and targets

1.1.1 Increased use of recycled materials

The flooring manufacturer, Company A, has a wide range of flooring product made from different raw materials. The company has a tradition in environmental management and continues to develop the work in both Nordic and other European countries. The company has not defined a target for its use of recycled material but has an ambition to increase it. Currently about 20% of the input material is sourced as recycled but there are substantial differences between different kinds of flooring products. A certain type of flooring, linoleum, has an old tradition of using sawdust from waste or recycled wood as raw material. Other types of products can include textile fibres and various qualities of plastics that allow for different solutions for using recycled materials. Both process and product developers are responsible for considering and furthering the use of recycled materials of different qualities.

Company B, which produces various types of furniture and interior products from different materials, such as wood, metal, and plastics, places sustainable management of materials as its overall goal. The interviewee from the company stressed that every material has different goals due to different possibilities and current status. If we take wood from home furniture as an example, issues such as where the furniture came to its end-of-life, how the wood from end-of-life furniture has eventually been used (e.g. have they been used as an energy source, and if so, would it be better to use the virgin wood for new furniture and continue to use wood from old furniture as source of energy, than visa versa?), and what type of materials are used (e.g. is the wood impregnated?), need to be considered. Regarding concrete goals, the company has an overall goal for plastics: by 2015, all purchased plastics should contain at least 50% recycled plastics. For paper and steel, goals are differentiated between markets as some markets do not differentiate between virgin and recycled contents.

Company B has developed an internal web-based tool/scorecard that must be used by designers which provides numerical score that suggests the level of sustainability of the products they design. The designers could see how their choice of suppliers and different materials, including the use of recycled materials, would affect the final score of their products. The company aspires to have 90% of its products classified as more sustainable by its scoring system by 2015.

Company C sells a multitude of products from several producers as well as its own brands. The company does not have any defined ambitions regarding recycled material in the products. There are however no particular objections against it. On the contrary, the Company C claims it would like to do more of it and its product managers are investigating opportunities to use recycled materials when doing purchases.

1.1.2 Reduced use of hazardous substances

Company A has build up internal chemical knowledge for many years with the aim of phasing out hazardous substances and substitutes questionable substances with better ones. The company has added environmental consciousness to the brand name and since the products are for use in homes, they must be safe.

Company B has the following four visions concerning the reduced use of hazardous substances: 1. Go beyond the legal requirements to secure health and safety for consumers, 2. Know the chemical content, 3. Work actively with substitutions by replacing substances and materials, and 4. Perform assessments of recycled materials and materials new to the company.

The large number of products in the assortment of Company C makes it necessary to keep track of several EU legal requirements that are the most relevant (including the REACH SVHC list). The objective is to safeguard that all products comply with these laws and it has been a challenge to build up the internal capacity for that. "*There is legislation in place. The trick is to make it work.*" Company C seek opportunities to raise the bar and to phase out other hazardous and questionable substances and materials, such as softeners, paints, and PVCs, with substances and materials with either zero or few known risks. The efforts have targeted PAH and phthalates in particular, used in materials for skin contact and in products for children.

1.2 Possibilities and hindrance of using recycled material

1.2.1 Current status regarding the use of recycled materials

The content of recycled materials in the products of Company A vary amongst the aforementioned different kinds of products and is also affected by the availability of recycled materials. In general, it is easy to send back collected installation trimmings (spills, cuts and unused materials that are still clean after installation of the floor) into the processes for similar kinds of products. Post consumer material is problematic since it is often contaminated with dirt and other adhered materials including polishes, sealers, and adhesives, however, recovered material could be used in certain applications and parts with lower quality requirements in some cases.

For Company B, the level of recycled materials used in a product differs from one to another and ranges from 100% (e.g. particle boards in a certain region) to 0%. It was stressed during the interview that it is important to constantly ask if recycling is the right thing to do from the sustainable management of materials overall.

Except for some metals in certain products and internally recycle materials, currently there is no recycled material in Company C's products. Since material recycling is seen as positive, some supplementary products such as shopping bags and packages are produced from recycled materials.

1.2.2 Drivers and barriers for the increased use of recycled materials

Companies interviewed in the interior product sector mentioned the following as drivers for the increased use of recycled materials.

- Expected rise in the price of virgin materials (Company A)
- Scarcity of resources that requires the enhancement of resource efficiency and prevention of material depletion (Company A and B)
- Corporate culture of not wasting any materials (Company B)
- Contribution to sustainability: the use of recyclables has beneficial environmental effects (Company C)

A number of barriers regarding the increased use of recycled materials, many of which are common between two of the three companies, are also raised:

- Recycled materials not meeting the quality and chemical safety requirements: Company B stressed that in their case, it is not only issues of chemicals that are of concern. Other issues such as smell/odour and strength/durability are amongst the issues where recycled materials may fail. Company A also mentioned the problem of lower or uncertain quality of recycled materials, which would require the company to develop and modify process for reaching appropriate product quality (Company A and B). Shortage of recycled materials. (Company B)
- Risk of Contamination: Company B mentioned that due to the poor recycling process, recycled materials could be contaminated by, amongst others, hazardous chemicals. Company C commented on the very few suppliers currently available who could demonstrate that they control the content, i.e. no hazardous substances, of the materials. Otherwise, the use of recycled materials would lead to increased costs for testing and checking each batch of material to secure quality and chemical content. (Company B and C)
- Logistics and transportation: Company A indicated the problems around organising the logistics and transportation of material collection and of the administration of different material fractions. Company B also mentioned that materials to be collected are spread out amongst various consumers and to collect these materials back into one place is a challenge. (Company A and B)
- Underdeveloped recycling technology and infrastructure around recycling: technology for sorting mixed materials (e.g. different types of plastics, textiles) has not been well developed at present.

1.2.3 Approaches to secure the quality of recycled materials in regard to hazardous substances, and the rationales for such approaches

Company A is reaching for suitable applications for recycled materials. For instance, some products consist of components with lower quality requirements that easily could be produced from recycled material. Tailored collections schemes[53] safeguard that specified qualities of material can be recycled for reuse in essentially the same kind of products. Knowledge on material composition is important to keep hazardous substances and other impurities that could harm manufacturing processes out from the raw materials. The flooring sector has also built up a record system as a database[54] for installations with the aim to keep track of built in materials (see text box). Such information should, amongst others, ease future recycling.

The Swedish flooring sector has a database service called ”Kretslopps-märkning” (*Eco-cycle labelling*). Essentially, it is a service for property owners in which they can keep records of built-in materials in the flooring constructions. Amongst others, the Building Material Declarations for materials used are collected and stored in the database.

In the case of Company B, essentially the same quality requirements are set for both recycled materials and virgin materials. Quality requirements including chemical requirements are set for all the materials, and there are ban lists and follow-up lists. They have verification systems concerning the quality, utilising both internal and external personal resources. Concerning the quality check of recycled

[53] The flooring sector has a system for collection of trimming residues from installations and construction sites (up to 10% of flooring material may be discarded as trimmings). The pieces are then brought back for re-processing.

[54] For more information on the database Kretsloppsmärkning, see http://www.golvbranschen.se/miljo/kretsloppsmarkning

materials, in addition to chemicals, important issues include smell (recycled plastics often smell bad and one cannot use it for certain applications), durability (especially important from safety point of view: if it is a bookshelf, for instance, it is very important that they withstand the weight), and functions.

Regarding collaboration with competitors for information management in the area of the use of recycled materials, Company B has an integrated supply chain and the company does not collaborate with competitors to set up databases for information purposes.

Regarding collaboration with their own suppliers, Company B discusses what possibilities exist to utilise recycled materials, and what it may mean for suppliers (e.g. Do they need to change equipment? How it may affect the working environment? Would it increase land contamination?). The level of collaboration differs depending on the set-up and the type of changes to be made.

Company C is also putting the same chemical requirements on virgin and recycled materials and requesting suppliers to declare compliance with legislation and the company's supplementary demands. Since very few of the suppliers can do that for recycled material, it is not used in applications other than basic products like shopping bags. Currently, Company C is checking every batch of recycled material that is used for producing shopping bags.

1.2.4 Possibilities and hindrances to increase the use of recycled materials while lowering the risks of hazardous substances

As mentioned above, Company A is taking a different route in order to increase the use of quality assured recycled materials: one is to collect well-defined materials, preferably spills of clean products (trimmings) and other material sources from safe origin. Building material records, for instance compiled as material logs or in the above-mentioned "eco-cycle database" may ease material recycling in the future.

Moreover, Company A has promoted the use of Building Material Declarations[55] for many years. When properly used, these declarations provide solid information regarding the content of the products. Moreover, Company A is developing techniques for re-process recycled material and finding suitable applications in products.

Concerning possibilities, Company B indicated the importance of the development of technology for the cleaning and separation for different materials, which would also address the issues of chemicals.

The Building Material/products Declaration (BMD) is a voluntary industry-wide system, developed to convey environmental information, including potential hazardous substances, about building products in a standardised format. In contrast to Environmental Product Declarations (EPD) the BMD is not built on lifecycle assessments.

Regarding hindrance, the issues raised by Company B was the same as the barriers mentioned under Section 1.2.2 of the Appendix III.

Company C is seeking for possibilities to use recycled materials in products (other than packaging, etc.) but is currently hindered by the lack of a guaranteed chemically-safe supply.

[55] For more information on Building Material Declarations, see http://www.kretsloppsradet.com and http://www.golvbranschen.se/miljo/byggvarudeklarationer

1.3 Approaches, cost and benefit of information management on substances in products

1.3.1 Approaches and systems for information management on substances in products

The work on chemical composition in products of Company A has for years aimed at building knowledge on hazardous and risky substances as well as possible substitutes. The work has often been conducted in collaboration with suppliers leading to long-term business agreements. The close contact and dialogue serves as a means to both finding and introducing substitutes and keeping undesired substances out of the products.

Company B claims to seek responsible approaches, consisting of follow-up, testing of the effects of chemical, and when it comes to the use of chemicals, gain sufficient knowledge and information regarding the properties of the chemicals. The specific approaches used are material specifications, ban/restriction lists, and a list on recommendations for chemical substitutions. The level of information taken from suppliers differs from product to product as some are on the product level and others on only the component level.

Company C has an internal organisation for the upstream communication of chemical requirements to suppliers and the supplier are filling in declarations on compliance. The company can do XRF tests[56] of products and co-operate with external laboratories for other kinds of tests. In the case of identified risks associated with using certain substances contained in existing products, the company works with its suppliers in order to find appropriate alternative substances. It claims that there must be confidence in the system from both sides.

1.3.2 Cost for chemical information management in products

According to Company A, the cost for the information system on material composition and hazardous substances is difficult to estimate. That work is part of larger tasks that connect to each other. The different pieces of information are necessary for the cost effective production of safe products.

Although no specific number was given, Company B indicated that the tasks on information management are significant. It is quite complex with multiple phases, and the cost can be quite high. There are thousands of articles to consider, there are tests needed, and the development of laws that need to be followed and interpreted. When tests are completed, follow up is needed to ensure appropriate changes are made. In some cases, external laboratory tests need to be conducted. The tests may be required at the production level and/or at the material level. Some tests may need to be developed since standardised test methods do not exist. In terms of chemicals, they also hire external technicians to check the materials, etc.

Company C has a group of people at the quality department dealing with product performance demands and requirements located both in Europe and in the producing countries (primarily in Asia). However, the tasks of these people include several quality-related aspects. It is thus difficult for Company C to estimate how much time or money that is used for controlling compliance against chemical requirements.

[56] X-Ray Fluorescence used for chemical analysis.

1.3.3 Chemical Information transfer to professional customers and consumers

Company A participates in the building sector initiative of issuing the aforementioned Building Material Declarations. These declarations make information on the content of hazardous material available on-line. In addition, these declarations are used by external assessment service systems (for instance "Sunda Hus"[57]) for their customers. Thus, both their own as well as externally evaluated chemical information are available for customers and consumers. Moreover, the company has a phone line for those who would like to ask for clarifications or discuss chemical issues with the company experts.

"Sunda Hus" is, one of the health and environmental assessment systems for building materials and products including assessment of chemical substances. Currently, the assessment of over 70 000 products from more than 2 000 suppliers and almost two hundred materials are available from a database.

Company B considers the main issue in this area is to find the right level of information for consumers that is useful, understandable, and of their interest. The main principle behind the approach is responsible communication and responsible chemical management. The company provides information on chemicals even when not required by law, although it does not provide general information on specific chemicals for all the products. When asked, they try to respond as much as possible. A question could be raised, for instance, about the content of certain substances that may trigger allergic reaction to certain consumers.

The primary content of information regarding chemical compositions, communicated from Company C to customers and consumers, is that the products sold are in compliance with relevant legislation. It is also possible to obtain on-line information on hazardous substances in the product or to call the Company for additional information on chemicals. It happens sometimes that customers call, mostly from parents of small children and elderly people.

1.3.4 Chemical Information transfer to the waste sector

The information on Company A's products are mostly lost before the products reach actors in the conventional recycling and waste management sector. This is explained by the life time – often several decades – of the products. Such information is rarely asked for, but when it is indeed requested, it is a detective work to identify producer, product and potential composition. When the product is known there could be a Building Material Declaration (some real-estate owners file them) which may be able to provide some information on material composition and potentially hazardous substances. The previously mentioned database common for the sector aims at providing the information in the future when demand for material recycling is expected to increase. The database is not that frequently used, but will be re-launched in order to attract more customers.

As a way of ensuring the quality of materials, Company B has a dialogue with recyclers in relation to different materials. The process of recycling needs to be approved to avoid contamination risk. Concerning how to take care of their own products by recyclers, amongst various products collected for recycling, the products of Company B constitute only a fraction of it. The company has not received questions from recyclers as to how to recycle their products specifically.

[57] For more information on Sunda Hus assessment, see http://www.sundahus.se/services/environmental-data/assessments.aspx

With a view to enhance the recyclability of its products, Company B sometimes sends new products to recyclers and asks if they could recycle them. The company checks product design specific to recycling as well as durability, separability etc. and consider the inputs from the recyclers. The company also conducted a pilot project on plastic recycling in collaboration with actors involved in collection and recycling. At the moment there are limitations in the recycling of mixed products, but it may take another 20 years or so until the products sold now come to their end-of-life phase. Perhaps by that time, better technologies for sorting and cleaning are developed and more recycling can be done.

At present, there is no communication on chemical composition of the products from Company C to the recycling sector actors.

1.3.5 Rationales for information management on substances in products

The main reason for Company A to facilitate a chemical information management system is to offer safe products and to fulfil both customer and legal requirements. Besides the legal aspect, it is a matter of building relations with customers and suppliers.

For Company B, the rationale for information management is to implement the four visions described under Section "Reduced use of hazardous substances" above, which in turn would help them ensure the health and safety for the user of their products, and to be a responsible company.

Company C also points at the legal aspects and customer requirements or expectations: "*there is a pressure from the side of the customers*".

1.4 Future outlook

1.4.1 On the use of recycled materials

Company A sees a future of increased use of recycled materials. There is a need to increase the knowledge in both how to design products and how to produce products with increased content of recycled materials. In purifying/re-processing collected material (in particular polymer material), better knowledge on chemical content will help in protecting the materials from hazardous substances. The company mentions that in general old flooring products are rather safe in the first place.

Company B suggested that the development of new technologies for sorting and cleaning as well as a phase-out of questionable materials and substances as two key enablers for future development in the sector. The use of recycled materials is increasing, and the future growth depends on advancements in technological developments in sorting and cleaning.

Meanwhile, Company B emphasised the importance of considering the most sustainable way of handling materials case by case. Recycling can be certainly good in some context, but sometimes it is better to handle it in other ways. In addition to the example of wooden furniture given under Section 1.1.1 of Appendix III, another negative example includes park benches made out of composite materials from WEEE, including printed circuit boards and plastics from recycled materials. In this regard, one could consider multiple loops for material recycling. Depending on the quality of the recycled materials, different applications that add the most value should be considered; however, if the use is not good regardless of the application, the material should not be recycled.

The Company C representative mentioned that traceability is the key to increased material recycling but that commonly used test methods do not expose sufficient information. Thus, it

is necessary to control the sources/origins of collected materials before it is used in new products.

1.4.2 On information regarding hazardous substances

The flooring sector wants to phase out hazardous substances and has, according to Company A, been doing that for many years. Even if the use of some substances could be seen as controversial, the common view of the sector is that floors are not dangerous or toxic in the first place. The interviewee claimed that the flooring products have been produced, sold, and used for long without causing harm.

Company B considers that it is an extremely important area and that the efforts will be certainly continued in the next ten years. The interviewee stated that the company should always continue reducing the use of questionable substances since it is a moving target.

Concerning legislation, Company B indicated that there are differences in reporting legislation globally on when, how, and what registration and testing need to be completed. Therefore, the slight differences in the requirements tend to eat up the company's time and resources. The company would consider it beneficial to homogenise testing and reporting requirements.

Company C underlined the importance of chemically safe products. The interviewee mentioned the impossible task of testing all products and components, which implies the necessity of trust and communication over several steps in the product chains. Electronic and online communication systems will most likely be developed to meet that need.

1.4.3 Overall future outlook

Company A views material recycling as one important measure for securing supply of raw materials in the future. There will be an increasing competition for virgin materials and prices will only increase. The intention is thus to better utilise recycled materials both through better systems for safeguarding material qualities (including control of potentially hazardous content), developing new techniques for treatment/cleaning of old material, as well as identifying suitable applications for recycled materials in the product development processes.

There are on-going sector initiatives for material collection and documentation systems. Moreover, actors of the sector have used Building Material Declarations for many years. These self-declarations specify material content and potential hazardous substances. A proactive chemicals policy and in-house capacity have been amongst the characteristics of Company A for years and will be maintained.

Company B considers that society is in a transition period at present. Namely, markets are burden by old products that were produced many years ago by many known and unknown producers without, at that time, much knowledge on today's recycling possibilities As a result, this has hinder the increased use of recycled materials as companies find difficulty in ensuring the quality of the content. The clean-up of the old products would take some time, but it is important to set a clear direction and change products so that they are good by default.

Company B considers a key issue in this area to be to develop technological solutions for better separation of various mixed materials. Instead of having consumers sort even more than now (e.g. different types of plastics), we should develop solutions where consumers do the basic sorting, and economically viable solution for further sorting, which enables recycling of specific materials, can be realised.

Company C has answered the challenge of the increasing need to controlling product content of hazardous substances and is currently building up and improving a system for component traceability and supplier communication. These needs are not expected to decrease. Hence, the company anticipates development and increased use of new electronic communication systems.

2 Clothes and shoes

2.1 Ambitions, goals and targets

2.1.1 Increased use of recycled materials

Company D conducted an analysis regarding the environmental consciousness of fibres commonly used in the products of the company. Amongst other outcomes, recycled material of different fibres, mainly cotton, wool, and synthetic fibres, turned out as environmentally beneficial alternatives. Thus, Company D has an ambition to increase the use of such fibres and materials (and reduce the use of environmentally less favourable fibres). This ambition sets the direction for a change but no specific targets for the respective materials have been set.

At the time of the interview, Company E, a high-end sportswear company, was in the process of developing a three-year plan on the increase in the use of recycled materials.

2.1.2 Reduced use of hazardous substances

Company D is involved in different initiatives for the reduction of hazardous substances. In one of them, the "joint roadmap to zero discharge of hazardous substances"[58], Company D and some internationally well-known brands address the use of hazardous substances in the production processes of their manufacturers/suppliers.

In addition, Company D has its own list of restricted substances and sets limit values for finished products. These requirements are communicated to the suppliers and they have contracted to comply with them. The overarching strategy of Company D is that hazardous chemicals should neither be used in production, nor should they be detectable in its products.

Company E has the ambition to convert all of their virgin materials to be certified by bluesign[59], a global third-party certification scheme for textiles (not the final products). Last year about 20% of the materials used in their products were certified by bluesign. They consider that they could increase this to 40-50% by next spring.

2.2 Possibilities and hindrance of using recycled material

2.2.1 Current status regarding the use of recycled materials

Company D is currently trying out several ways of using recycled materials. Different recycling processes give different quality parameters of the final products. Recycled fibres are often shorter than virgin and therefore, in most cases, are mixed with virgin fibres in the clothes.

The current focus is to use recycled cotton, wool, and fibres from recycled polyester and polyamides. The total share of recycled materials in relation to the total material used is still estimated to be small, but it is increasing.

Company D is also running a pilot project where fabrics from discarded clothes, which are then collected, are remanufactured into new fashion products in different designs. This is

[58] For more information on the initiative, please see http://www.roadmaptozero.com/
[59] For more information on bluesign, please see http://www.bluesign.com/

happening only on a small-scale level but has been successful, and is in consideration to be expanded when there is a capacity to do so.

Company E, the sportswear company, has been trying to increase the use of recycled nylon and polyester. Concerning nylon, it uses two suppliers: one in Taiwan and one in South Korea. The raw materials used in the supplier in Taiwan are from industrial (i.e. pre-consumer) waste. Company E does not find it good that the production residues are re-labelled as recycled materials and have communicated to the Taiwanese supplier not to call it recycled materials. The Korean supplier, on the other hand, uses post-consumer waste as their raw materials. The sources of the fibres are mainly from fishing nets, but also include carpets used at home and office spaces. At the time of the interview, the interviewee from Company E was not aware of the potential inclusion of hazardous substances in carpets. The recycled polyester is purchased at Teijin, a Japanese material producer.

Company E has achieved the use of approximately 50% of recycled materials, but the ratio of recycled materials used in single products varies between products. It is used most in backpacks (roughly 30 products) and also 4-5 types of trousers. Recycled nylon is also used in a shirt included in 2013 product line. Recycled polyester is used in two products.

2.2.2 Drivers and barriers for the increased use of recycled materials

Both Company D and E have a number of reasons to strive for the increased use of recycled materials, as found below.

- Recycled materials being environmentally beneficial alternatives: an analysis conducted by Company D indicated that use of recycled materials are environmentally more beneficial than the use of virgin materials in the case of cotton, wool, and synthetic fibres. Thus, the increased use of recycled cotton, wool, and synthetic fibres would lead to the reduced use of environmentally less favourable fibres. The fibre and material sourcing make significant differences in the environmental performance of the company (Company D)
- Part of the general efforts in the area of sustainability (e.g. contribution to waste reduction (Company D)
- Preference of some consumer segments: some consumers appreciate the idea of ecology and recycling and Company D wants to offer them designed fashion alternatives (Company D)
- Long-term brand building: Company D thinks that recycling creates goodwill for the company. In the case of Company E, although the use of recycled materials so far have not brought forward tangible economic benefit in the form of increase in sales, the company believes in the long-term brand building (Company D and E)
- Ethical reason: it is mainly ethical reason that it works on using recycled materials. (Company E).

The two companies interviewed also listed a few barriers for the increased use of recycled materials.

- Recycled materials being more expensive than virgin materials: The cost of recycled materials is higher (despite that, the amount of resource put on the development of virgin materials are quite high). According to Company E, recycled nylon is 20-30 % more expensive than virgin nylon. The cost difference was the same in the case of polyester some 10-15 years ago, although now it is only 2-4 %. The high cost is attributed to small supply and low capacity in the sector (Company D and E)

- Recycled materials not meeting the quality requirements: One important barrier for Company D is related to quality aspects including physical quality, washing properties as well as chemical properties, i.e. excluding banned and restricted substances (Company D)
- Small amount of recycled materials and uncertainty in constant supply (Company E)
- Mixture of materials to increase functionality: though not a direct barrier to the use of recycled materials per se, Company D mentioned that different types of materials are needed to enhance various functionalities (e.g. stretch, waterproof), which may make it difficult to make the materials used in the company's products recyclable. When one designs a product, one does not know the availability of future recycling technologies when the product comes to its end-of-life. The same issue was raised by Company E as an overall future challenge (Company D and E)

2.2.3 Approaches to secure the quality of recycled materials in regard to hazardous substances, and the rationales for such approaches

Company D faces difficulties in obtaining sufficient amounts of safe recycled materials and has launched different experiments with the aim of securing the material qualities. So far, the work is directed towards finding the most appropriate materials from suitable sources for certain applications. For instance, recycled materials, mainly plastics, are also used for accessories, etc.

First, the suppliers have to provide a third-party control of all the recycled materials as a certificate of content. They also conduct risk assessments when placing the orders. These suppliers know that the recycled material should also comply with the Company D's list of restricted substances. Both Company D and its suppliers conduct random tests of compliance and share the results. Pre-consumer plastics are mentioned to constitute a well-defined and the safest source of material. However, plastics that have been recycled from food packages are also considered to be safe.

The quality requirements between virgin materials and raw materials are essentially the same in the case of Company E. Meanwhile, the company has little knowledge on residual hazardous substances in recycled materials and does not have any comprehensive approach in detecting them. The approach the company takes is that when its personnel come to know potential risks of inclusion of a specific hazardous substance in recycled materials they use, it starts to test the inclusion of the substance in question. Even though the recycled materials that are supplied do meet the quality specification, laboratory tests sometimes indicate that the quality is not the same as virgin materials, which suggest that there may be some substances in the recycled materials that are not supposed to be there.

Concerning the collaboration with competitors, the outdoor industry, with the initiative of Company E, established a information and knowledge network related to the environment. Currently more than 100 companies have joined the network. One of the first issues raised was recycled nylons. Company E spreads the knowledge regarding the Korean supplier and now many of the outdoor-goods companies have followed.

2.2.4 Possibilities and hindrances to increase the use of recycled materials while lowering the risks of hazardous substances

Company D has launched both fashion clothes and other products made from recycled materials but its situation could be judged as being in an experimental and knowledge building phase, trying out different concepts in different countries. The possibilities are there

but there is still a lack of capacity both amongst recyclers to supply sufficient amounts of safe materials and amongst the textile manufacturers to use the recycled materials. These hindrances could be shifted into possibilities with knowledge on sourcing safe materials, and it has become a more common practice to use it in the production processes. It will remain too expensive to expand the use otherwise.

As of now, Company E does not find potential residual hazardous substances to be a probable hindrance to their efforts to increase the use of recycled materials. The recycled nylons produced by the Taiwanese supplier is made of production residue, thus the quality of the recycled materials should not be different from the production materials. Concerning recycled nylon from post-consumer materials, they break down the fibres to the molecular level, and extract molecules called caprolactam. This is the same substance that they produce from oil when they develop virgin nylons, thus the company do not expect hazardous substances in the recycled nylons. However, when the company comes to realise potential risk of the inclusion of hazardous substances in recycled materials they use, such as those originated from carpets, the interviewee mentioned that it would start conducting tests. The input materials of recycled polyester from Japan go through a stringent check, which guarantees the quality of recycled polyester.

In the view of Company E, the key issue is to collect enough materials for recycling and sort the collected materials to produce pure materials. The potential for polyester is relatively high as one can use PET bottles as raw materials. However, due to multiple colour, sources, and mixture with other materials, collection of sufficient amount of nylons usable as raw materials for new products face challenges. Waste handling industry should develop means to sort these different materials. In the Netherlands, technology is being developed to sort different types of textiles.

2.3 Approaches, cost and benefit of information management on substances in products

2.3.1 Approaches and systems for information management on substances in products

The structure of the sector, with large branded firms buying products from external manufacturers, allow for different approaches. One approach Company D employs is to work together with other major brands in order to assist the manufacturing industries to exclude or reduce the use of hazardous substances. The group of brands has developed a roadmap with that aim to guide the supplying industries towards zero discharge of hazardous chemicals by 2020.

Beside the above-mentioned future-looking initiative, Company D communicates its chemical restriction list to its supplying/manufacturing industries. Compliance with the list is part of the code of conduct (CoC) each supplier has to sign. All suppliers shall declare that they fulfil and comply with the requirements. This happens when agreements are signed, and not for each delivery. The communication system between Company D and its suppliers is not yet web-based, but will most likely be in the future.

In addition, Company D completes roughly 30 000 random tests annually, conducts chemical audits at the production sites, and takes part in educating the suppliers in their countries on how to comply with the requirements, manage chemicals, labelling etc.

Company E tries to have all the new materials to be certified by bluesign. The bluesign system checks the use of more than 400 chemicals in various stages of production process, and has third-party certification system for each material manufactured by material producers. The list of unfavourable chemicals is constantly updated. Bluesign also produces something called blueguide, which provides information on better alternatives. As bluesign certifies the materials and not the final products, the certified materials can be used by a number of final-product manufacturers. The interviewee from Company E claims that the material-based certification, instead of product-based certification, has made the spread of the system quite first.

If Company E cannot convince its suppliers to certify their products with bluesign, the company provides a list of chemicals found in bluesign and has the suppliers declare that the materials the suppliers deliver do not contain the listed chemicals. This has happened with suppliers in Switzerland and in Japan. In both cases, the suppliers had already established stringent quality control systems, and the quality assurance provided by bluesign certification did not justify the cost associated with the certification.

2.3.2 Cost for chemical information management in products

The interviewee from Company D could not estimate the costs for the operations of the chemicals information system.

According to the interviewee from Company E, in a small company, like Company E with 20 employees, roughly 50% of the time spent by the personnel in the design assessment team (4 members) are spent on environment-related work.

2.3.3 Chemical Information transfer to professional customers and consumers

Consumers can ask for the presence of SVHC candidate list under the REACH Regulation and find information on restricted chemicals on Company D's website. However, there is no specific information on chemicals in the products that are easy to obtain. A desired measure would be to educate and increase the knowledge about the chemicals management amongst the sales personnel. Thereby, they could answer questions from the consumers. However, to give the type of training needed for the sales personnel to answer such questions is not so easy.

According to the interviewee from Company E, bluesign is a powerful tool for sourcing, but virtually no consumer knows about it, thus Company E has not used it as a communication tool so far. Company E seeks to communicate its products' environmental performance by the use of numerical evaluation system. There are various criteria (e.g. biodegradable, bluesign, 70% recycled materials, recyclability, strength/longevity) and based on the aggregated score of the respective products, an overall score is given. However, the company's research on consumers indicates that consumers go for products with characteristics such as aesthetics, value, usability and function etc. and that environment considerations come rather low on their list. Nevertheless, the interviewee from Company E is of the opinion that the company's good will does matter, and that even when consumers purchase products that have scored low on the company's evaluation system, it is in the long run good that the consumers know that they are purchasing from a company with good environmental values. The company receives questions about the environmental performance of their products as often as once a week, and tries to answer as much as possible.

2.3.4 Chemical Information transfer to the waste sector

For Company D, the only information that currently could be passed to downstream recycling companies is contained on the tag attached to the piece of clothing. That tag is unfortunately lost when the product is worn out. There is currently no established communication with the recycling industry.

At the time of the interview, Company E was in discussion with its supplier of recycled nylons regarding the recyclability of its backpack. Nylon used in the company's backpacks is mixed with polyurethane to provide a waterproofing function. The company sends its backpack to its supplier and check the recyclability. The company also discusses with another recycling company that so far produces biogas from cotton used in military and hospitals: it would like to know the feasibility of production of biogas from cottons used in their products as well.

Company E also tries to set a time for discussion with collection entities, whom the company believes is the party that shreds and separates various types of textile materials.

2.3.5 Rationales for information management on substances in products

Chemical safety and related information management is necessary both for the sake of providing safe products that do not cause harm or risk causing harm for the consumers wearing the products and for the serious environmental problems that are related to use and discharge of hazardous substances at the production plants. Company D is, due to its size, both exposed to the public debate and has capacity to induce changes in the meantime. Thus, the rationale and responsibility of Company D to influence and control the use of substances and materials found in its products have multiple aspects.

Company E commented that for a small company, there is insufficient manpower and resources to check 10-15 different weavers and monitor their performance, or to retain in-house competence and specialists in the area of chemicals. The company considers that provision of support to bluesign certification system, by demanding the materials to be certified, is a cost-effective way of securing the quality of the materials in its products.

2.4 Future outlook

2.4.1 On the use of recycled materials

According to Company D, pressure from the side of environmental NGOs will most likely remain in the future. Other external drivers go against the use of recycled material since it is more expensive and requires extensive quality controls. However, Company D also refers to future scenarios of decreasing supply of virgin materials and increasing prices even if that is not the current situation.

Company E believes that the use of recycled nylons and polyester will continue to grow. The company has the ambition to use 100% recycled materials, and it is envisioned that it could change up to 80% of their materials to recycled materials in 2-3 years.

2.4.2 On information regarding hazardous substances

Phasing out hazardous substances is a priority for Company D and is the reason why it is engaged in sector-wide initiatives to build awareness, understanding, and knowledge amongst the manufacturing industries. This is a long-term commitment and the work will continue.

Considering the rapid spread of bluesign over the last 2-3 years, Company E considers it as the way to go. The interviewee from Company E believes that the environmental impacts of virgin materials will be better handled with bluesign than, for instance, eco-labelling schemes. The interviewee believes that because various types of eco-labelling schemes are often local (e.g. Swedish, Nordic, EU), the labelling will not carry much meaning for customers in, for instance, Asia. Moreover, the labelling system is product-oriented (each product needs to be certified) and the fact that one product is certified does not help the improvement of the environmental performance of other products. In this regard, he considers bluesign to be better, as it certifies the materials.

2.4.3 Overall future outlook

The use of harmful chemicals by the textile industry is an issue that has been stressed for several years. Company D is working with other major brands with the aim of securing/improving the situation in both textile production of and in products in the long-term perspective. The work is on-going and will not lose its relevance in the foreseeable future.

The size of Company D is also a reason for taking initiatives in testing recycled material in new products. Increasing knowledge on environmental and social implications of sourcing different fibres, in combination with an ambition for improved resource efficiency and of securing or broadening the availability of raw materials in the future, are seen as reasons for the sector to exploring various opportunities on recycled materials. Company D is trying several different types of fibres and materials as well as textiles. However, the urge for using recycled materials must not jeopardise chemical safety considerations. Hence, Company D is foreseeing the development of methods for both using recycled material and securing qualities of the materials.

There is also a desire to offer conscious consumer segments relevant products, including product made from recycled or otherwise environmentally sounder fibres, such as organic alternatives.

Company E currently considers that the development of recyclable products may not be as optimistic as the increase in the use of recycled materials and reducing the use of hazardous substances in virgin materials. Products use various materials, and in order for recycling of these different materials to happen, they need to be collected and materials need to be sorted. A company alone cannot do this, and the company considers that this would require state intervention. In the view of the interviewee from Company E, it would take 10 years or longer for the recycling industry to find good process for this.

Company B, which produces, amongst others, home textiles, commented on the importance of considering what type of policy instruments are useful for what type of products. The application of a producer responsibility approach in textile area, in the same way as what has been done for EEE and packaging, may potentially simply increase administration cost without much environmental gains. Collection, reuse, and recycling systems for textiles may need to look very different compared to the set-up for the system for EEE. In addition, it is also important to ensure that when materials are separately discarded by consumers for recycling, the resources are not incinerated, as it would reduce the credibility of any collection/recycling systems otherwise. A due consideration should also be made on the existing second-hand market as well.

Company E also commented that the fashion industry, which would use 98% of the textile materials for clothing, has started to wake up, and that is encouraging for the promotion of the two areas.

3 Toys and other children's products

3.1 Ambitions, goals and targets

3.1.1 Increased use of recycled materials

Company F, a toy producer and retailer of toys and other children's products based in the Nordic region does not allow any recycled materials to be used in its products. Reasons for not allowing the use of recycled materials is that the company cannot control the content, thus for precautionary purpose related to potential contamination, the use of recycled materials is not a consideration.

The stance of Company G, another high-end toy producer based in the Nordic region, is the same as Company F. The company does not have any ambition to increase the use of recycled materials at present since it would risk introducing unwanted hazardous substances into their products.

Company B, produces and sells not only toys and other children's products but also a wide range of other products, and indicated that it sets different goals for different materials due to different possibilities and current status in different market. The company claims that the overall goal of the company in this regard is sustainable management of materials, and the interviewee from the company stressed the importance of considering "when is recycling right thing to do?" For plastics, the company aims to have half of the purchased plastics contain at least 50% recycled plastics by 2015. However, this figure represents the overall goal for all the plastics used in the company; it was not possible to find out if, and how much, of recycled plastics are/will be used for toys and other children's products. The company seeks to have 90% of their products classified as more sustainable by their internal scoring system by 2015.

3.1.2 Reduced use of hazardous substances

Company F's philosophy regarding hazardous substances is that there should not be any restricted substances in any of the products they produce or sell. For products manufactured by the company itself, the company strives to go beyond legal requirement. Examples of relevant legislation include the EU Toy Safety Directive, the REACH Regulation, and national requirements in the countries to which its products are exported, such as U.S. and Japan.

Company H's overall ambition in this area is, in addition to being compliant with any legal requirement in the markets to which they supply their products, to phase out any substances that are considered to be undesirable following a detailed internal chemical safety assessment based on the exact recipe of the raw materials, using both chemical regulations and various NGO-lists as input.

The work on hazardous substances in Company B has been conducted in accordance with the following four visions: 1. Go beyond the legal requirements to secure health and safety for consumers. 2. Know the chemical content. 3. Work actively with substitutions by replacing substances and materials. 4. Perform assessments of recycled materials and materials new to the company.

3.2 Possibilities and hindrance of using recycled material

3.2.1 Current status regarding the use of recycled materials

As far as the interviewee from Company F knows, there are no recycled materials used in its products. It is relatively easy to verify the non-existence of recycled materials with the toys produced by the company itself. However, there could be uncertainties for some products sold by the retail part of the company, as not all the products sold in the retailer shops the company runs are produced by the company. The requirements for these products are identical but the opportunities for control are different.

In terms of materials Company G uses for its products, the only recycled materials it uses are on-site residuals generated from production spills in their own production process. Thus, it is considered equally as safe as virgin materials. The Company does not use any recycled materials from external sources for its products due to the difficulty of guaranteeing the quality and chemical content. In its view, the use of recycled plastics is suited more for other types of products than toys. For toys, the requirements are strict and there is too high of a risk of contamination. The company does use some recycled paper for packaging materials (packaging is normally not covered by the Toy Directive) since it is considered safe. The company would have liked to test every batch of paper anyway, but it would be too costly to do so.

The interviewee from Company G mentioned that some toy makers potentially could consider using recycled materials made from, for instance, old milk packages, as the requirement for materials used for food packaging is very high (e.g. as regards CMR substances). Although it is considered safe to use the materials recovered from food packaging, it can still be difficult to control the risk for contamination of the recycled material.

The interviewee from Company B indicated that the proportion of recycled materials used in products differ, ranging from 100 to 0% depending on the types of materials. There is no specific figure available for the recycled materials used in toys and other children's products.

3.2.2 Drivers and barriers for the increased use of recycled materials

Drivers indicated by the interviewed companies differ from each other. They are:

- On-going discussion on sustainability (Company F)
- Scarcity of resources (Company B)
- Corporate culture of not wasting any materials (Company B)

The interviewee from Company G explicitly mentioned that currently there are no commercial reasons for using recycled materials since it could jeopardise the safety requirements.

Risk of contamination was a common hindrance mentioned by all three companies.

Other hindrances include:

- Difficulties and high cost of ensuring the quality due to the non-homogeneous origin of recycled materials and consequent necessity of checking virtually all the batches of recycled materials (Company F)
- Very strict requirement on hazardous/potentially hazardous substances that require strict control on composition: since the threshold value are very low, a small contamination would contaminate the whole batch (Company F, G)

- Recycling materials not meeting the quality requirement (the problems include not only the inclusion of chemical contaminant but also smell, durability, etc.) (Company B)
- Shortage of recycled materials of requested grades (Company B)
- Logistics and transportation: materials to be collected are spread out (Company B)
- Underdeveloped recycling technology and infrastructure around recycling: technology for sorting mixed materials (e.g. different types of plastics, textiles) is currently not well developed (Company B)

The interviewee from Company G indicated that the entire industry has to be careful in this area. Company G has a well-developed sustainability programme with high ambitions and realises the benefits of recycling but concludes that in its case, recycling contradicts with the necessary product safety requirements.

3.2.3 Approaches to secure the quality of recycled materials as regards hazardous substances, and the rationales for such approaches

Company F does not use recycled materials in their products, thus there is no specific procedure for quality assurance of recycled materials for that purpose. Nor does Company G. Should Company F use recycled materials in its products, due to the diverse origins and types of materials that may contain in the recycled materials, the company would need to go through the same test procedure used when it introduces new substances to virtually all the batches of recycled materials.

In the case of Company B, essentially the same quality requirements are set for both recycled materials and virgin materials. They have verification systems concerning the quality, utilising both internal and external personal resources. Concerning quality checks for recycled materials, in addition to chemicals, important issues include smell, durability, and function.[60]

3.2.4 Possibilities and hindrances to increase the use of recycled materials while lowering the risks of hazardous substances

For Company F, which at the moment does not use any recycled materials, a potential driver to use recycled materials could be an increase in the price of the virgin materials. The company could imagine a situation where the use of 10-20% of recycled materials in one batch of new materials may be considered. However, due to the very high risk of contamination that could result from mixing recycled materials, the interviewee from Company F expressed hesitation in this possibility.

Company G indicated that a possible solution to increase the use of recycled materials may lie in a guarantee/warrantee system. In this system, the suppliers of a material need to know the origin of the material (which requirements apply to the products in which the materials have been used previously) as well as the purpose or type of product for which the material will be used. If they know the requirement for the original materials and the requirements for the end-use, the suppliers could possibly declare if their material meets relevant requirements. However, a producer would then have to fully rely on the supplier's declaration, which is not always seen as a desirable situation.

Company B, on the other hand, indicated the development of technology for cleaning and separation for different materials, as well as phase out of questionable substances in new products, as key enablers.

[60] For information on how Company B collaborates with competitors and suppliers, please see Section 1.2.3.

Hindrances anticipated by the companies are essentially the same as what was expressed as barriers under Section 3.2.2 of the Appendix III.

3.3 Approaches, cost and benefit of information management on substances in products

3.3.1 Approaches and systems for information management on substances in products

Company F has its suppliers sign, in the master purchase agreement, that they follow REACH Regulation, RoHS Directive, Toy Directive, and other relevant legislation. This master purchase agreement is signed for each product and for each new factory.

As a way of verification, Company F has established a test protocol for chemical materials. The materials in question are tested by a third party. In addition to materials, the company also checks some of the sample products (in this case the company has internal staff working). The company conducts re-test for final products every second year, and attempts to use more or less the same paint for all products. They conduct 2-3 tests for every colour on the final product level. For products put on the US and Japanese market, in addition to the company's own test procedure, products need to go through re-test by the specific test institutions accredited by the respective national authorities.

Some generic children's products sold in Company F's retail sector are not produced by the company itself and they do not have direct means to check the input materials (e.g. paint, plastics). In this case, the company checks test documents on each product provided by the third party, and conducts some random check on their products.

As a toy brand, Company G has a rather unique situation since the company owns the production units and has long-term contracts and thus certain contacts with its suppliers of dye stuff, ink, raw materials, etc. In contrast to many others, that use lists of restricted and declarable substances, Company G has a defined list of accepted or approved substances, which is well known amongst the suppliers. These long-term relationships build trust and the suppliers give full disclosure and exact compositions of all purchased materials and products under strict confidentiality. That means that just a few experts at Company G receive the disclosed information. The information is not commonly shared within the company's information system. Hence, these experts can control the contents against the list of approved and accepted substances and give feedback to the suppliers when deviations occur. This arrangement eliminates, or at least diminishes, the need for tests to secure compliance with the requirements. However, Company G conducts its own random tests, too.

Company B seeks to have an overall responsible approach, and has gained sufficient knowledge and information regarding the properties of the chemicals. The specific approaches used are material specification, ban/restriction lists and a list on recommendation for substitutions. The company performs assessment of all the materials new for the company. According to its website, the company pays special attention to children's products and has third-party laboratory testing in various parts of the world to determine whether or not they meet the national and international standards and legislation. The website also states that the company conducts special risk assessment based on children's need, and its co-workers working in the children's product range are enrolled in regular training programmes.

3.3.2 Cost for chemical information management in products

The main cost item for Company F is for testing, which is about 20-30 thousand SEK per item and amounts to 5-6 million SEK per year (roughly 0.6% of the annual net sale in 2010[61]). Approximately 90% of the testing is on chemicals, while the remaining 10% focuses on the mechanical function of the product. The company has two personnel in Sweden and three in China for securing the overall quality and inspecting the materials and products. The cost also includes tests conducted by external experts. In addition to the cost borne by the company, there are costs borne by its suppliers, which are not included in the figure above.

Company G finds it difficult to define and estimate the costs of the chemicals information management system. It includes the personnel with certain expert competences for evaluating substances and communicating with the suppliers as well as the random tests. On the other hand, the close collaboration with suppliers and the size of the company makes it possible to get raw material with requested compositions, which sometimes are purpose made, at a reduced price. The cost of the system should also be seen in relation to the huge costs of the requested third-party tests for selling toys in the US. For Company G these cost could exceed one million euro.

Cost information of Company B is provided in Section 1.3.2 and is not repeated here.

3.3.3 Chemical Information transfer to professional customers and consumers

Company F often receive demands on the documentation (e.g. test report of all the SVHC) from business customers rather frequently (roughly once a week). The list today consists of 84 restricted substances, even including some substances that are not applicable to some toys, and it is very expensive to test all these. Meanwhile, despite the high level of attention focussed on chemicals in toys on behalf of authorities and NGOs, the interviewee from Company F does not feel that consumers share the same level of concern. The interviewee observed that, in the end, it is the price of the products that matters most for its consumers and very few questions on chemicals in products have been raised (once or twice a month). Meanwhile, the company foresees a bigger demand on information in the future at the point of sale. A possible approach the company considers is not to talk about the containment of certain substances, but rather about what the company does and how the company does it to secure the quality of their products. The interviewee from Company F considers that consumers would most likely be satisfied by knowing that there are systems in place, and that things are under control.

Providing consumers with information on chemicals in the products is, according to Company G, a relatively new question. The current position is that it is likely to be more productive to explain that the products meet the requirements rather than giving chemical compositions. A full disclosure would anyway not be possible.

Company B considers the main issue in this area to be to find the right level of information for consumers that is useful, understandable, and in their interest. The main principle behind the approach is responsible communication and responsible chemical management. The company provides information on chemicals even when not required by law, although it does not provide general information on specific chemicals for all the products. When asked, they

[61] Calculated by the author based on the information on the net sale of 921.4 million SEK provided at the company's website.

try to respond as much as possible. A question could be raised, for instance, with the containment of certain substances that trigger allergic reaction to certain consumers.

3.3.4 Chemical Information transfer to the waste sector

Company F indicated that it has contracts on specific types of waste (packaging, plastics, cartons, EEE, batteries) in countries such as Sweden, Norway, Finland, and Germany where specific treatments of these waste are required. The interviewee of the company did not refer to other types of interaction with downstream actors.

Downstream actors in the waste management and recycling industries rarely ask questions on the composition of the products. Company G indicates that it would be a good idea to communicate such information to a certain point (avoiding disclosure of proprietary information) in order to make it easier for the recyclers to sell the material.

Company B has been interacting with recyclers and collectors of waste for various purposes such as to ensure the quality of materials they use in their new products, to enhance the recyclability of its products, and explore possibilities for using recycled plastics (see Section 1.3.4).

3.3.5 Rationales for information management on substances in products

The two rationales that Company F mentioned were: 1. to be in control of the materials, and 2. to be cost efficient.

For Company G, the product – a toy – must be safe and free from hazardous substances. That is necessary. Another reason is that a well-working information management system could help avoiding otherwise higher costs.

For Company B, the rationale for information management as done in their company is to implement the four mind sets described under Section 3.1.2 of Appendix III., which in turn would help them ensure the health and safety of the user of their products, and be a responsible company.

3.4 Future outlook

3.4.1 On the use of recycled materials

Company F considers that the approach to take would be to control the quality of raw materials, instead of final products, seeing great importance in the management of material supply chains. The company does not foresee an increase in the use of recycled materials. Company G, who controls its raw materials and therefore knows that the finished products are compliant, also indicated that use of recycled materials other than in packaging material would be unlikely in the near future.

Company B also regards that the cleaning of the material flow is the key, and shows scepticism in always viewing recycling as something positive for the environment. The company stresses the importance of evaluating whether or not recycling is the best option for material management on a case-by-case basis. The company meanwhile expects an increase in the use of recycled materials, though it depends a lot on the technological development for the sorting and cleaning of mixed materials.

Company G sees that the current material-requirements set forth in legislation are very strict, and that they lead to various tests needed for various materials, or a complete control of the

recipes of the raw materials. This leads to a clash of the two objectives of enhancing the use of recycled materials and ensuring the quality and chemical safety of the materials.

3.4.2 On information regarding hazardous substances

Company B considers that it is an extremely important area and that the efforts will be certainly continued in the next 10 years. The interviewee mentioned that the company should always continue reducing the use of questionable substances since it is a moving target.

Despite acknowledging that it is good to have legislation and to add new substances based on evolution of knowledge, the interviewee from Company F questioned the extensive application and focus on toys. For instance, certain substances that are prohibited to be used for pens and pencils for children are not restricted in pens and pencils for adults, which is questionable, as there is no guarantee that children do not use these pens and pencils produced for adults.

Company F also pointed to the weakness in the enforcement of legislation to the small but many importers – its competitors – whose performance do not go through proper surveillance. This in turn allows their competitors to offer less expensive products in the market, as they in effect do not ensure the quality of the products with various tests. The interviewee from the company mentioned that from a large player's point of view, risk of hazardous substances would be more effectively reduced via properly checking the products of all the other actors, including the numerous small actors, rather than heightening the requirements. In this regard, the interviewee suggested that it should be good to have systematic control for all the products that come into the market.

Company F also referred to the difficulties of following all the new development in legislation governed by different authorities. From recent legislation, there is an increasing need to test, document and control chemical compositions. Company G views these tests as very costly and viewed as less productive for producers that already work wisely. In order to avoid such costs there should be a reasonable structure for tests in place and, not least, an ability to trust suppliers and sub-suppliers.

Concerning the legislation, Company B indicated different aspects of legislation that vary globally (See Section 1.4.2. of the Appendix III) and would consider it beneficial to have homogeneous way of e.g. reporting.

3.4.3 Overall future outlook

Company F considers that the approach would be to control the quality of raw materials, instead of final products. The company will continue on with quality control, but does not foresees that it will start to use recycled materials due to the prohibitively high cost to secure the required quality.

According to Company G, there must be a common understanding of why there are demands for information and restrictions of hazardous substances. This is not always clear amongst the actors in the sector. There are still different regimes in the view of information sharing. Consequently, a process leading to increased transparency is foreseen. This increased transparency is underway with new electronic information sharing systems. An example is the Chemical Management Database currently developed by the Hong Kong Toy Council:. Suppliers feed in information in the system on substances etc. while purchasers can be given access to and use the information. The system works in a similar way as the IMDS system for the automotive industry.

Company B sees the current situation as a transition period, with a huge amount of old products with mixed and non-clean materials becoming waste, and appropriate separation and cleaning technologies lacking. The company considers that the development of technological solutions for separation of various mixed materials, together with the continuous aspiration of producers to select cleaner and non-questionable materials, would enhance the development of the two areas.

The use of post-consumer recycled material is according to the view of Company G not an issue for the moment. The reason is primarily the chemical requirements that have been placed on the sector in recent years. Many manufacturers are struggling in establishing a suitable system and the capacity to comply with legal requirements in different regions. The future is expected to focus on building systems for the communication regarding the chemical composition and/or absence of restricted and hazardous substances in products and to elevate the lowest level of the sector in general.

4 Electrical and electronic equipment

4.1 Ambitions, goals and targets

4.1.1 Increased use of recycled materials

All three companies aspire to increase the use of recycled materials, but to varying degrees, and only Company I has a numerical target at present.

Company H is currently at the stage where the company is exploring different possibilities without setting specific targets.

Company J used to have a strong focus in the increased use of recycled substances in its environmentally sound product development strategy. As early as the late 1990s they had already developed cases that contained recycled plastics in the middle layer. However, since the coming into force of legislation restricting the use of hazardous substances such as the RoHS Directive and the REACH Regulation, the overall focus and direction of the company's environmentally sound design strategy changed. It became difficult to strive for both increased use of recycled materials and reduced use of hazardous substances at the same time. Today, although the company still encourages the use of recycled materials in general,[62] no numerical target is set. Instead, priority is placed on the security of material quality and other means of achieving 3R (e.g. increased durability, resource efficiency, and ease of dismantlement).

Company I in its own environmentally sound product criteria requires the use of recycled materials in general. Along with the information on its chemical management/substance control systems, the company provides thorough on-line information on the recycling of their products as well as use of recycled materials in its products. There is also a specific target set for each product on the inclusion of recycled plastics contained in its product. The target is defined as a per cent of post-consumer recycled plastic in relation to total plastic parts in the product.

Concerning metals, Company I mentioned that except for certain qualities of aluminium, metals such as copper, gold, and silver have an established path for recycling and are refined regardless of whether it is recycled or virgin material. Therefore, these materials are less relevant for requirements and/or targets concerning recycled content. A similar statement was made by Company H regarding the use of steel and other metals.

4.1.2 Reduced use of hazardous substances

All three companies interviewed have been closely following the development of relevant legislation such as the REACH Regulation and the RoHS Directive, and when feasible, go beyond the legislation.

In the case of Company H, when new substances start to appear or are anticipated to appear on the candidate list, which may trigger a ban, the company starts feasibility studies regarding

[62] For instance, Company J sets resource recycling as one of the three main building blocks of environmentally sound products, and promotion of recycling (3R) is explicitly mentioned there. The overall ambitions on environmentally sound product development include the increased use of so-called eco plastics, which consists of the use of recycled materials, avoidance of halogenated materials, and increased use of plastics based on bio-based materials.

phase out and/or possible acceptable substitutions. The selection of the materials are based on the relevant legislation as well as what is anticipated to be covered by the REACH Regulation in the next ten years. The lists are updated annually. The Company mentioned that, with the anticipation of the addition in the SVHC candidate list, what is on the company's material restriction list is significantly more than what is included in the SVHC candidate list of the REACH Regulation.

Company I has been known for its progressive and preventative chemical strategy. The company provides thorough on-line information regarding its system on substance control and chemical management, together with, amongst others, information on recycling of its products and use of recycled materials. The company's restricted substance list is based on legal requirements, that of the customers, NGO/SIN (Substitute It Now!), and the company's own judgement. This search for information prepares the company for future requirements. As the interviewee of the company puts it, "*it is a matter of having "sensible ears" to academia/research, debate, foresights etc., and of demands, desires and possibilities to phase out and replace with better substitutes.*" Amongst the substances the company has phased out includes PVC.

Company J seeks to grasp the types and quantity of materials that affect the environment thoroughly, and to reduce their use. The procurement of the components, products, and packaging materials needs to follow the procedures described further in Section 4.3. In terms of substance to be covered, the basic stance of the company is to ensure the full compliance of legal requirements. The company follows the development of relevant legislation such as RoHS and REACH, not least what is added in REACH's SVHC candidate lists. Once new SVHC candidates are added, the company checks the relevance to its products, possibility of using alternative substances and the like. Meanwhile, the company goes beyond the legislation in some areas. For instance, the company forbids the use of PVC in cases, and seeks to reduce the use of all types of brominated flame-retardants. An example of a recent substitute includes the use of drying agent that does not contain cobalt (II) chloride. However, unlike Company I, the products of Company J include those that are intended to be used outdoor for as long as 50 years. Components of these products may still contain PVC due to its durability, recyclability, and the like.

4.2 Possibilities and hindrance of using recycled material

4.2.1 Current status regarding the use of recycled materials

All the three companies interviewed are using recycled materials, though to different degrees. All three use steel recovered from scrap and/or other metals (except for the case of aluminium mentioned below) and because most metals have well-established markets for recycled materials with established quality assurances, companies find little utility in keeping track of the amount of recycled steel and or/metals in their products.

Regarding recycled plastics, the source that Company I uses are specified to be PET bottles and used CDs, as they have well defined qualities. Not least, used food containers are considered safe since they must comply with food safety standards. The typical parts using recycled plastics are the cases/back covers but could also include all other parts such as frames. It is the task of the product developers to find and decide the most suitable solutions for each new product model. In the case of Company H, recycled plastics are used mostly in a special eco range of vacuum cleaners. There, together with the high content of recycled materials, they include other design concepts such as low power motor and low noise. The use

of recycled plastics in this area is industrialised. However, in other product areas, recycled plastics are not been utilised at present. The use of recycled plastics has been reduced in the case of Company J due to the fear of contamination by hazardous substances.

Company I uses similar sourcing requirements for recycled aluminium, which is used in, for instance, casing. The very high quality requirements exclude post consumer sourcing, such as old cans. Currently, it is only post industry (pre-consumer) recycled aluminium that is used.

As described above, the overall focus of the environmentally sound product development strategy of Company J has shifted from use of recycled substances to securing the quality of materials. Although recycled plastics are still used, there is no data on the actual quantity at the moment. The company suspects that more recycled materials are used in companies that sell office equipment mainly to business customers. These companies have their own collection, refurbishment, and reuse network and have established a good information management system for various parts of their products.

4.2.2 Drivers and barriers for the increased use of recycled materials

Interviewees from the three companies listed a variety of different drivers and barriers, as listed below.

Drivers:

- Customer requirements: The customers of Company I are the large mobile operators in North America and Europe such as O2, Vodafone, AT&T, and the like. They survey the market (both by themselves and through other actors such as consultants and NGOs) for requirements including aspects related to the use of recycled materials, though requirements are different for different operators. Requirements are extended even to, amongst others, packaging and use of materials certified by Forest Stewardship Council, etc. The operators do eco rating of the telephone providers and make their own environmental declarations of the different models of telephones. The interviewee from Company I considers that the push from the operators drives the environmental performance of the mobile phone sectors and move it ahead from other EEE sectors (Company I)
- Overall sustainability ambitions of the company (Company H and J)
- Owner company's aspiration: The owner company has a desire to keep good environmental profile (Company I)
- Personal aspiration of personnel engaged in environmental work: the interviewee commented on a personal wish to push the environmental work/performance in the company (Company I)
- Being an integral part of resource recycling, one of the three main building blocks of environmentally sound products development strategy (Company J)
- Cost efficiency: if the recycled materials become cheaper than virgin materials (even after including the cost of different performance test), it would make it interesting to use it. The use of recycled materials should be economically viable (Company H)
- Necessity to secure materials, such as rare earth metals, which are currently essential for the development of new products (Company J)

Interviewees from Company I commented that the customers put much more stringent environmental requirements than end-consumers, who rarely request environmental performance. According to the interviewee, the manufacturers have to comply with operators' environmental requirements, and it would probably need measures from the leading

manufacturer(s) to change the quality requirements in order to improve environmental performance further.

Barriers:

- Potential contamination of recycled materials from old products: There is a risk of contamination with banned substances such as lead, cadmium, and brominated flame retardants that were typically included in products put on the market before the coming into force of the RoHS Directive (Company I, J)
- High cost of testing: Cost of testing to make sure that banned substances are not contained in recycled materials is very expensive (one test would cost roughly 300 000 JPY = ca € 3 000) (Company J)
- Lower or uncertain performance of recycled materials: Unlike virgin materials, it is recycled plastics that tend to be contaminated with other types of plastics and additives. As a consequence, the quality performance of the recycled plastics is not as good as virgin plastics: for instance, components made with recycled plastics that contain traces of old rubber is more fragile than if made of virgin plastics. The surface finish of mobile phones cannot be finished to the same level as virgin plastics when using recycled plastics. At the moment, virgin plastics are mentioned to be better performing and longer lasting (Company H, I)
- Cost performance of virgin plastics: Presently, virgin plastics of desired qualities are cheaper, better, and last longer. Cost efficiency is a key driver for the company, and it needs to meet profitability requirement (Company H)
- Limited access to the materials: the offer of the market is limited. As a comparison, what is currently available in the market is probably less than the amount of virgin plastics the company currently uses. One often-stated reason for this limited availability is that plastic residues from shredding (inputs to make recycled plastics) are traded as secondary raw materials to countries outside of Europe (Company H)

4.2.3 Approaches to secure the quality of recycled materials in regard to hazardous substances, and the rationales for such approaches

All the three companies mentioned that essentially there is no difference between the quality requirements set for recycled materials and those of virgin materials.

In the case of Company I, there is no special quality assurance system for recycled materials: just like any other material, suppliers must declare compliance with set requirements. Similarly, Company J mentioned that materials whose substances cannot be guaranteed by suppliers couldn't be used. However, Company I may conduct tests for specific substances contained in the recycled plastics they use. The materials are analysed by a third party to guarantee that they are free from halogens and heavy metals. The analysis could be organised either by Company I or its suppliers. The company may also check the inclusion of REACH-listed phthalates. Some laboratories have developed test kits for REACH-substances, but these kits are expensive. Therefore, it is preferable for the company to work with recyclers and their sourcing of the materials so that they can guarantee compliance with the restricted substance list and origin of the material. Along a similar line, Company J mentioned that the use of recycled materials is limited to what the company could afford to secure their quality.

Company H lists up examples of legal requirements specific to recycled plastics and sets up company's own requirements and recommendations for recycled plastics. There are more legal requirements for recycled materials (including the regional ones such as the one in US)

than for virgin materials. In addition to those legal requirements, company has their own requirement, and suppliers must meet both.

4.2.4 Possibilities and hindrances to increase the use of recycled materials while lowering the risks of hazardous substances

Concerning possibilities, Company J commented on the need of guaranteeing the quality of recycled materials via regulatory measures. This may enable further use of recycled materials.

Hindrances for this are the same as items listed under barriers in Section 4.2.2.

4.3 Approaches, cost and benefit of information management on substances in products

4.3.1 Approaches and systems for information management on substances in products

All the three companies interviewed have a list of substances that includes banned and restricted substances, and have a system in place to communicate the list to their suppliers and collect and manage the information provided from the suppliers. Meanwhile, the concrete systems used in the companies vary, as described further below.

Restricted material list

All the three companies interviewed have their own Restricted Material List (RML) or equivalent, based on relevant legislation such as the RoHS Directive and the REACH Regulation, and other demands coming from society. These lists are publicly available on their websites. The substances listed are those that require special attention (i.e. negative list). The companies' strategies as what to include in the list are described in 4.1.2 of this Section.

Information collection system[63]

Company I and J collaborates with their competitors in collecting data from their suppliers. Company I uses the IPC 1752 standard format/template. Suppliers are currently reporting to the company in PDF form to be included in its own PLM (product lifecycle management) system as Bills of Materials (BOM). The company also participated in the development of the BOMCheck web database system, but does not use the system for the moment. Company J is a member of JAMP (Joint Article Management Promotion Consortium) and utilises its Article Information Sheet (AIS) developed by JAMP to collect information from suppliers.

Concerning the use of restricted substances, an interviewee from Company J considered that the competition amongst competitors is relatively low, and that they often exchange information regarding the substances newly listed on the SVHC candidate lists, their application and the like.

Meanwhile, Company H has its own information management system. According to an interviewee from Company H, unlike IMDS (International Material Data System) used in the automobile sector, there is no commonly used database in the household appliance sector. There is an automated system for suppliers to declare the content of chemicals specified in the restricted material lists (RML).

[63] For more information on various industry-wide information collection systems referred to in this sub section such as IPC 1752 standard, BOMCheck, JAMP and IMDS, see, for instance, Kogg and Thidell (2010).

Company I collects information on the level of homogeneous materials, while Company J, at the component level. In the case of Company H, for REACH SVHCs the information is collected at the component level, while for RoHS substances it is at the level of homogeneous materials. None of the three companies interviewed demand full content declaration to their suppliers: the declaration is essentially limited to what is on their restricted material list (negative list). Company I aims for full material declaration, but currently they have not reached that yet.

Verification of the information provided

All the three companies mentioned that it is principally responsibility of their suppliers to guarantee that the components/materials they supply comply with the material restriction requirement found on the list. None of the three companies interviewed conduct a comprehensive verification of all the information provided by suppliers: it is essentially based on trust.

Company I continues to have dialogues with suppliers regarding their information systems. As described further in Section 4.2.3 in Appendix III, they may have further analysis for specific materials such as halogens, heavy metals, and REACH-listed phthalates.

Company J takes a different approach for the verification of information related to banned substances and restricted substances. For banned substances (e.g. those listed on the RoHS Directive and Annex XVII on the REACH Regulation), they have strict sampling inspections/analysis. The frequency of the analysis is determined by the respective product development departments, depending on the destination, the level of request from customers, and the like. Regarding restricted substances such as SVHCs in the REACH Regulation, the basis approach is to trust the information provided by the suppliers on AIS. Exceptions are when there is an obvious doubt in the accuracy of information, such as the inclusion of brominated flame retardants in metals. The company may then check upstream from the supplier level. Such extraordinary cases usually become the topic of discussion amongst the competitors. In the case of SVHC, the concentration level per products needs to be checked, and new testing and calculation is needed whenever new substances are added. The company therefore connects the material management system in the company with JAMP database, and seeks to automate the system as much as possible to reduce human work. Meanwhile the interviewee from Company J also pointed that at the end of the day the judgement of fraud information can be made only by human; there is limitation in what machines alone can handle.

4.3.2 Cost for chemical information management in products

None of the three companies interviewed could provide a concrete cost for management of chemical information in products. Rather, chemicals management was seen as part of a larger context including all other aspects of material quality and product development.

In Company H, there are two people in the chemical department of one of their product groups in Europe who are constantly working on the management of information supplied by their suppliers. There are also chemical experts in other regions and other product branches, and a total of six to seven experts are working there. In addition, the R&D department and purchasing departments are also engaged. It is difficult to say the total number of people engaged in the information management of chemicals in products. According to an interviewee from the company, the development of the on-line tool required tremendous efforts both in terms of time and resources to make it run.

Company J mentioned that the development of an information management system cost hundreds of millions JPY (millions of Euro), and annual cost for its maintenance and improvement of its function amounts to tens of millions JPY (hundreds of thousands Euro). Additional calculations are needed when new substances are added. In addition, there is cost for various tests and analysis.

4.3.3 Chemical Information transfer to professional customers and consumers

Company H and J mentioned that chemical information is provided when it is required by law (e.g. REACH's SVHC above 0.1% of concentration), or requested from customers or consumers. Concerning the frequency of request from customers and consumers, Company J mentioned that the requests are handled by the respective product departments in Company J, and the interviewees who are in the CSR and Environment Management Promotion Division at the corporate level do not know. It is only very difficult questions that come up to their Division, and its frequency is roughly once a month.

Interviewees from Company J mentioned that just like medicines, the level of risk of chemical substances differ based on their state, quantity, application and the like, which tend not to be correctly understood. They consider that provision of information may only cast negative image to the company. Thus, except for compliance with legislation, they refrain from providing detailed information on chemicals.

Company I meanwhile publishes environmental declarations of its telephones that includes, amongst others, information on chemicals as well as substances excluded from the products. Similarly to Company J, they provide information that they comply with their restrict substance list to their customers and consumers, and provides thorough on-line information on its systems both for substance control, chemicals management, the recycling of telephones, and their use of recycled materials.

4.3.4 Chemical Information transfer to the waste sector

All the three companies interviewed are ready to provide information on features of their products related to end-of-life management, in accordance with Article 11 of the WEEE Directive. Company J has not received any requests from waste sector actors so far, and the interviewee from Company I was unsure about the frequency of such requests. An interviewee from Company J considers that recyclers have various experiences and unless a product with very novel feature appears, such a request may not be made. Company H mentioned that concerning the information on materials and substances, up until now, it has not received any request from the recycling industry about information on materials and substances. An interviewee from Company H observed that while it may be theoretically plausible that the downstream actors wish to have such information, it is uncertain if such information is indeed wanted or needed.

Company J pointed to the examples of information provision of other Japanese companies in the European market. For instance, one company provides information on the methods of dismantlement of obsolete products on its website, and another company has established its own collection scheme, posts an information request form on its website, and provide relevant information. In the case of Company J, however, due partly to the limited number of products it exports to Europe, it concentrates its effort on solid compliance to national legislation of respective European countries.

4.3.5 Rationales for information management on substances in products

Concerning why the companies seek to manage information on substances, Company I stated that it is to comply with legal requirement: without complying, business would be at risk. It also mentioned that so long as it is reasonable to switch, it is better to be proactive to the perceived needs: not taking action would be viewed negatively by e.g. consumer organisations and would provide negative impacts to the business. It is better to find alternatives when and where possible.

Regarding the specific approaches, Company H mentioned that the selection of information management system is very much depending on the overall development of the data system in the company to start with. The company started the development of the data system five years ago because of requirements posed in the REACH Regulation. For Company J, the rationale for choosing to work with the system they have developed is to reduce cost and human labour. The company considers that use of an industry-wide system is more reasonable for the transfer of information on chemical substances in products throughout the supply chain than establishment of individual systems by individual companies, which also contributes to the reduction of workload both for the suppliers and receivers of information.

4.4 Future outlook

4.4.1 On the use of recycled materials

Company H considers that the implementation of the WEEE Directive indirectly influenced the use of recycled materials. The systems established to comply with the WEEE Directive are managing a huge amount of materials. Metals are being recovered, and other materials, such as plastics and glasses, are starting to be collected and recovered. Although the company itself currently does not have strategies to explore the use of recycled plastics, one of the competitors managed to find a solution and started to use recycled plastics, which is cheaper and better than the current practice. The company expects that the use of recycled materials will continuously increase, when the quality of recycled material streams improves in the future.

Meanwhile, Company J does not foresee any increased use of recycled plastics unless the information of their composition becomes clear. However, the company sees the importance of enhancing the recycling of rare earth metals. The collection and recycling system for small WEEE is currently discussed in Japan to enhance the recovery of rare earth metals: the company considers that the achievement of high collection is a key to improve recycling of rare earth metals.

According to Company H, the requirements related to hazardous substances could be a potential obstacle to the further increase in the use of recycled materials, but it is manageable at the moment. Similarly, Company J mentioned that SVHC listed under the REACH Regulation have not made recycling difficult so far.

Company I considers that the company has achieved a sufficient level of recycled material in its products today. The company questions the environmental benefits of including more recycled material in mobile phones: a product of 100 – 150 g, whereof 20 g is plastic. There is a limit for cost efficiency, and the company wonders if it could be better to focus on other products than mobile phones for the increase use of recycled materials.

4.4.2 On information regarding hazardous substances

All the three companies interviewed agreed that discussions on legislation related to hazardous substances are expected to continue and to be lively. Company H and I mentioned of the on-going development (e.g. the revised RoHS Directive, new candidates on the SVHC list of the REACH Regulation). According to Company I, it is well understood by the industry, and the approach taken in RoHS Directive – listing phase out/banned substances is very effective. Company J considers that the REACH Regulation is a well-thought-through piece of legislation, and laws going beyond this will not likely to appear for a while. The company also mentioned that the implementation of REACH Regulation is still at its initial phase, and it will take some time until its implementation is stabilised.

Companies expressed various opinions regarding the content of the legislation, as listed below.

- Information collection from suppliers: REACH does not mandate suppliers to provide information on the chemical content of their products, so long as the products the suppliers provide is for actors outside of the EU, such as Company J. This in turn makes it difficult for final product manufacturers who are based outside of the EU to collect information. Company J thinks the information collection is accelerated if the legislation put requirements on information provision to their suppliers even when their customers are non-EU-based final product manufacturers
- Spread of legislation similar to RoHS and REACH: Company J points to the fact that the restriction of substances governed by the RoHS Directive has been spread to other parts of the world and the same substances are restricted in different parts of the world. It would be good if similar things happen to REACH. Company I stressed that considering the global market of their products, it is desirable to have global agreements on requirements on hazardous substance. Otherwise, it is feared that legislation would put European industry in disadvantageous position as it is not possible to produce different telephones for specific markets in practice
- Adding new chemicals on restriction/ban list: Company H commented that adding new chemicals on the restriction/ban list is possible so long as it is based on scientific knowledge and assessment is made based on facts. The company representative indicated that it is important that the level of restriction is based on the risk posed: depending on factors such as the level of concentration and exposure, the actual risk posed by a substance would be different. The company is of the opinion that decision should not be based only on popular belief and perceptions. Along the similar line, Company J indicated the significance of giving exemptions based on application, and that outright ban of a substance regardless of its application is undesirable unless really needed
- Nature of REACH: An interviewee from Company J commented that the core of REACH is the risk evaluation at the upstream of product chain, rather than information, and that it would be good if the situation evolves with this spirit in mind. The interviewee was critical to the money-making business utilising REACH (e.g. certification bodies, analysts)
- Control of compliance: Company I also commented on the importance of securing compliance with the existing chemical legislation, This is an issue that will be even more important if new legislation will be introduced

Finally, Company H and I indicated that while issues of chemicals are certainly important and will continue to exist, it may not be the main focus of their product-oriented environmental strategy. According to Company H, for the white goods industry the priority is predominantly

on energy efficiency, followed by water, and chemicals comes only after these two. Company I emphasised the need for global agreements and requirements regarding both hazardous substances and product recycling. Imposing legal requirements in EU that are not applied elsewhere could discriminate the European industry. The current situation, when the customers are driving the environmental development, additional legal requirements would be needed less.

4.4.3 Overall future outlook

The sector has been subject for legislation and restrictions on hazardous substances in different geographical regions. The legislative push is still and will remain influencing the industry and, according to Company I, some product segments more than others. Producers of products with rapidly developing high performance requirements along with short use-phases, are viewed as forerunners in environmental improvements since new knowledge, materials, and processes are required to keep pace with, or preferably ahead of, legislative requirements. The short product cycles are also influencing the future outlook for both documentation of chemical composition and recycling. The used products could be recycled as sources for various elements and materials if kept separate from other product categories in the recycling systems. Sourcing of high quality and well-defined recycled material will be a necessary change in the near future. However, Company I does not foresee that small electronic products will be a major user of recycled material.

Both Company I and J indicated the necessity of securing the quality of recycled materials in order to enhance the use of recycled materials.

Similarly to Company J, Company I refers to rare earth metals and the importance of enhancing the quality of recycling (See Section 4.2.2). Company I indicated that in order to facilitate the maintenance of the quality and concentrations of the materials, end-of-life mobile phones should be collected and recycled separately from the rest of electronics.

Company J indicated that the obscurity of the composition of recycled materials pose challenges to the use of such materials, as it would require costly analyses. The company suggests it necessary to have legal requirements in the area of the property and quality of recycled materials. Once we know the composition, the only remaining issue becomes the cost of raw materials. It would then give wider room to consider the use of recycled materials. In this regard, a threshold level set for information provision requirement of specific substances would make it difficult to know the quantity of specific substances mixed in a material. In the long run, it would be necessary to control the information of restricted substances regardless of the quantity within a product/material.

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