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Materials for Application in the IKEA Decoration Range:

An Investigation of New Materials and the Creation of Plant Pot Concepts

Master of Science Thesis in the Master Degree Programme, Industrial Design Engineering

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Gothenburg, Sweden, 2012

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Cover:
Lilla Blå plant pot, a design for the IKEA decoration range. Lilla Blå is a plant pot made of fabric. More information can be found on page 55 in the report.

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Abstract

The aim of this project was to make the IKEA range offer of vases, bowls and plant pots more attractive to customers by finding new materials that allow IKEA to widen their expression within the range. There was also a noticed potential in finding new materials that could improve the quality or lower the costs in the final products. Another aim with the project was to apply a few of the new materials in product concepts in order to highlight the strengths of the materials and to give inspiration for future products.

The work was carried out in two parts. The first part was a material investigation that included a market study, a detailed material analysis and a user experience analysis. The market study resulted in an overview of the materials used in the IKEA decoration range today and in 106 new potential materials. After a first selection the new materials were narrowed down to 27 and the remaining materials were organised into the categories bio composites, bio plastics, mineral composites, textiles, cellulose and concrete. In the detailed analysis the remaining materials were evaluated with consideration to costs, quality, aesthetics, manufacture, environment and safety. Each material received a total score and the materials with the highest scores were a cellulose material called Zelfo, a bio composite called Arboform and fabrics.

The user experience analysis was done with a focus group and it was meant to provide better understanding for the customers' acceptance and preferences for new materials in the products of concern. Five of the new material suggestions were presented to the participants with samples and the participants expressed their opinions in a questionnaire and in a discussion with the group. The common favourite in the focus group was the solid surface material Corian, this mainly because of the expression of high quality. In general the materials most similar to the ones used for vases, bowls and plant pots today got the most positive responses.

The second part of the project was a product development phase. Three materials from the material investigation, that were considered to be the most promising for the IKEA decoration range, made the starting point of the work. The selected materials were Zelfo, wood fibre composites and fabrics. The development work was focused on indoor and outdoor plant pots and it resulted in four product concepts.

Keywords: materials, material evaluation, sustainability, product development, IKEA, plant pots, home decoration, product concepts.

Acknowledgements

Performing this project has been a rewarding experience and on the way I have gained a lot of knowledge that I believe will turn out to be useful to me in future challenges. I would like to thank all of you who have contributed to the results and helped me in the project.

A special thanks to my Chalmers supervisor Anneli Selvefors and examiner Ralf Rosenberg who have listened and given me valuable input and support. I would also like to thank my IKEA supervisor Tommy Pedersen and all IKEA employees who offered their time and expertise to help me get things right about materials, sustainability, CAD and the IKEA way of working.

Also, I would like to express my gratitude to the participants in the focus group and everyone outside IKEA who provided me with information and material samples.

Ida Karlsson
Älmhult, 2012

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1 Introduction

This introduction chapter gives an overview of the entire project. It describes the project background, aim and goals. The chapter also explains the different steps in the process that the project has followed and it gives an explanation of the report structure. Reading the introduction will provide an understanding that facilitates the reading of the following chapters in this report.

This report is the result of a master thesis project that was carried out during the spring 2012. The project is the final examination of the Industrial Design Engineering program at Chalmers University of Technology and it was performed in cooperation with the home decoration company IKEA. The project focused on the IKEA range of vases, bowls and plant pots and, more exactly, on the research work of finding new promising materials for the products within this range.

1.1 Background

The foundation of all IKEA product development is the idea that even with a thin wallet people should still be able to create a beautiful home with functional, safe and healthy products. In order to make this possible it is important for IKEA to minimize costs in all steps of a product's journey, from the initial idea until the product is bought by the customer, and the challenge is to do this without compromising with quality and safety. This philosophy makes high demands on the materials used in all IKEA products. The selected materials highly affect the price, quality, sustainability, aesthetics and logistics of the final product.

1.2 Aim

The aim of this project was to make the IKEA range offer of vases, bowls and plant pots more attractive to customers by finding new materials that allow IKEA to widen their expression within the range. There was also a noticed potential in finding new materials with qualities that can improve quality and sustainability or lower costs in the final products, for example this can be done by reducing the weight of the bigger plant pots.

1.3 Goal

The project goals were the following:

- A coherent map of available materials in the market
- Minimum 3 new promising material suggestions
- A comparison of new materials to existing from a sustainability perspective
- Design concepts that illustrate how three of the new materials can be used. The concepts should also meet the IKEA requirements regarding logistics, costs, sustainability, attractiveness etc.
- An analysis of the relations between material qualities and user values.

1.4 Delimitations

The focus of the project lied on finding new/alternative materials to use for vases, bowls or plant pots. The created concepts were examples of how the new materials can be used for products within this range. The main purpose of the concepts was to elucidate the strengths and possibilities of the new materials. No cost calculations were made for the final concepts.

The material suggestions were adapted to the IKEA way of production, meaning large series.

1.5 Process

The project process was divided into two parts; material investigation and concept development (see figure 1).

The material investigation started with a broad material research phase called market study. In this phase the focus was mainly on physical material qualities and the goal was to get an overview of materials suited for pots and vases. In the next step the findings were categorised and a scope selection was made. The most interesting materials were taken to the detailed investigation where sustainability, quality, life length, manufacture, costs, weight, dimensions and market possibilities were researched. In the evaluation phase the materials were compared to each other and to existing pot/vase materials.

Recommendations were given for each material group and the three most suitable materials were selected for part 2.

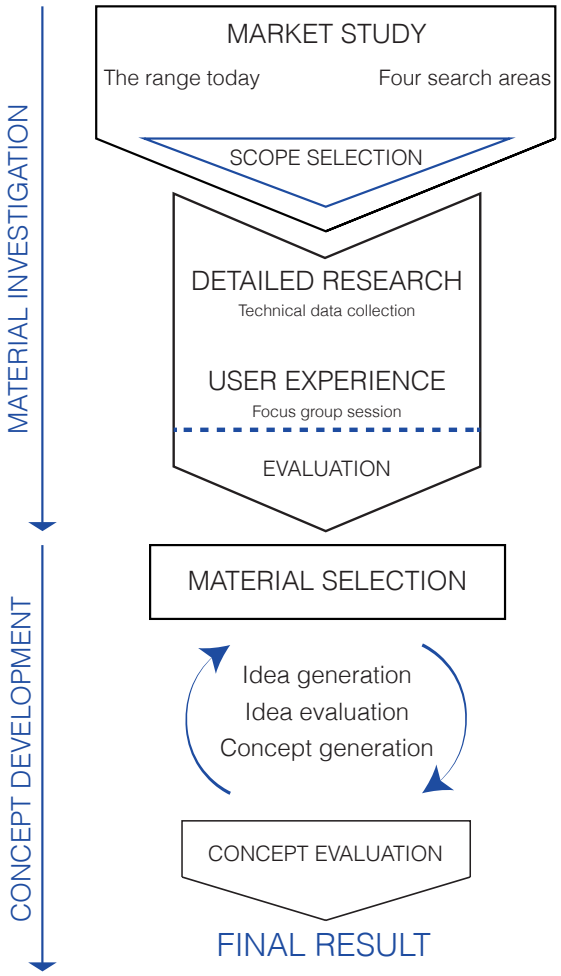

Figure 1: *Project process*

The second part of the project started with idea generation. The limitations and requirements given by the selected materials were already quite defined from part 1. After the idea generation all ideas were shallowly compared and evaluated and the best ones proceeded to the concept development phase where they were further developed. Finally, the concepts were evaluated to see whether the stated goals had been fulfilled or not.

1.6 Time plan

The Gantt chart in figure 2 shows the time frame for each phase of the project. The material investigation was given one week longer than the concept development and the most time consuming part was the detailed material analysis. Some phases, like the detailed analysis and the user experience research, were executed parallel with each other in order to use the time more efficiently. The weeks in the Gantt chart represent the project weeks. The report was a living document under constant development during the entire process.

1.7 Report structure

The structure of the report follows the working process to a high extent. Just like the process, the report is divided in two parts where the first part presents the work and the results from the material investigation and the second part presents the work procedure and results from the concept development phase. The theory chapter is a good introduction to the later chapters. It explains the foundation for the analysis and the development work and gives a better understanding of the prerequisites and decisions made in this project. Therefore, all theory for both parts is presented in chapter 2-4 of this report.

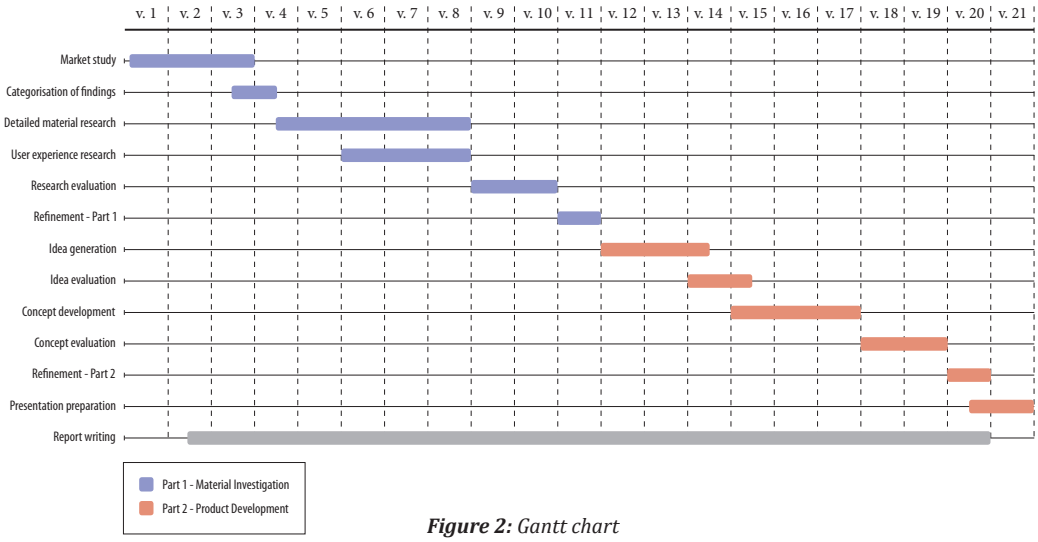

Figure 2: *Gantt chart*

2 Methods

This chapter explains the theory behind the methods used in the project. The chapter includes all methods and tools that have been used during both parts of the project. The methods are presented in groups regarding their specific purposes. Some of the methods were adapted to better fit their particular intention in this project. How each method was used is described more in detail in the later chapters about the implementation of the project.

2.1 Planning methods

Planning methods are used in the start-up of a project when a project plan is made. Planning methods are useful when setting the frames for a project. It is important to make sure in the beginning of a product development process where it is intended to lead and what the time frame and available resources are (Österlin, 2010).

2.1.1 Gantt-chart

A Gantt-chart is used to plan and distribute the time between each phase in the product development process. The different phases are placed along a timeline where the start, end and duration of each phase can be identified. To save time, it is also possible to work with parallel phases. This is called Concurrent Engineering (Österlin, 2010).

2.1.2 Flow-chart

A flow chart is a type of diagram illustrating a process with its various stages. The flow chart often consists of boxes or bubbles representing the stages and arrows connecting them to show the order in which they are executed. Flow charts help visualize complicated processes and can be used to document, explain, analyse or manage a product development process.

2.2 Data collection

For data collection there are many available methods to choose between, some examples are interviews, observations, surveys, experiments and literature study. The methods can be either qualitative or quantitative but there is no obvious distinction made between the two groups (Lundequist, 1995).

2.2.1 Literature study

Scientific projects are commonly initiated with a literature study in order to collect an overview of available research results within the area of interest. The literature study should preferably provide apprehension about where the frontline of the research is today and point out research areas that might be relevant to investigate further. It can also influence the definition of the problem background of the project as well as give a more profound knowledge of interesting methods, tests, experiments and current ideas and conceptions within the field (Lundequist, 1995). The information can be found in books, articles, internet and databases.

2.2.2 Interviews

Interviews are used to collect data from and about respondents by asking questions. Interviews can be held with open or closed answers where open answers are formulated by the respondents themselves and closed answers provide the respondent with alternatives (Lundequist, 1995). There is also a difference made between structured, semi-structured and unstructured interviews.

2.2.3 Focus group

Focus groups are used to collect opinions and preconceptions from the target group about a theme, e.g. a new or planned product. The focus group involves about 5-15 participants and is lead by a moderator. There are few pre-formulated questions in a focus group and the questions asked by the moderator should be open because the intention is to create a discussion between the participants. The moderator is responsible for keeping the discussion focused to the subject and ensuring that all participants are heard (Johannesson, H., Persson, J-G., Pettersson, D., 2004).

2.2.4 Market study

A market study can be used to learn more about current research, competitors and existing technology within a specific field. The study is conducted by gathering information from stakeholders, retailers and communities. The compiled information can have many different usage areas. It can be presented with diagrams, figures or kept in a knowledge base and be used for marketing, the creation of business strategies or for product development.

2.3 Analysis

There are many methods that can be used for analysing, both to analyse situations, markets, products or future products. This chapter describes the methods used for analysis in this project.

2.3.1 Specification of requirements

Specification of requirements is a document listing all requirement or demands the development/ research process is supposed to consider, in other words, what is required from the future product or, in this case, material. The requirement can be organized into categories regarding function or sorted after importance. The list of requirements can change during the process as new priorities are made and new functions and requirements are discovered. It is therefore a so-called living document that updates during the course of time. The list of requirements can be used as a starting-point for the product development process or as a checklist for the evaluation or for comparison of the product/material concepts. In order to perform a correct evaluation it is important that the criteria are clear, correct and somewhat measurable. The requirements can also be weighted with numbers regarding their relative importance. Often a distinction is made between needs that have to be fulfilled and wants that are preferably fulfilled (Johanesson, Persson and Pettersson, 2004).

2.3.2 Function analysis

When designing a product it is important to reflect about why the product exists, what its main purpose is and in what ways this can be achieved. A function analysis is a line-up of a main function, part functions and support functions. The main function is the reason why the product exists, the part functions are other functions that are necessary for the product to fulfil the main function and the support functions are supporting a higher function but they are not essential. The functions should be described shortly with a verb and a noun and they should not incorporate preconceptions about how the problem should be solved. The function analysis can be used as a lens or building bricks for the development work (Österlin, 2010).

2.3.3 LCA

Life Cycle Assessment (LCA) is an umbrella term for methods used to analyse and estimate a products environmental impact during the product life cycle (Johanesson, Persson and Pettersson, 2004). To make a complete LCA of a product is a comprehensive and complicated work. It is also possible to use simplifications of the methods to find out where in the life cycle the product has highest potential for improvement (Österlin, 2010).

2.4 Creativity

Creativity is to find new combinations or solutions to a problem. Conventional thinking restrains creative thinking, existing and established solutions should instead be questioned. The creativity process can take time but there are methods to help it become more efficient. One of those methods is Brainstorming.

2.4.1 Brainstorming

Brainstorming is a creativity method invented by Osborn in the 1930s. Brainstorming should be performed in groups of 3-6 persons and the intention is to stimulate each participant into producing as many ideas as possible in a short amount of time. Unconventional ideas are welcome and combining or developing generated ideas is encouraged. One rule during the session is that no criticism is allowed, in order to prevent inhibition. It is preferred if the participants are of different backgrounds to increase the versatility among the ideas. The brainstorming session can be organized in different ways, for example ideas can be passed around to the next participant who continues to develop the idea or the session can be divided into short intervals with frequent breaks to prohibit idea exhaustion (Österlin, 2010).

2.4.2 Osborn's idea spurs

Another method that can be used in combination with brainstorming is Osborn's idea spurs, a list of random words with the intention to trigger changes to the existing ideas (Österlin, 2010).

2.5 Visualization

Visualisations are used with various purposes, it can for example be to help creative thinking or to evaluate ideas. Visualisations are also a tool to present ideas to other parties or they can be used for testing and verification. When selecting visualisation method the goal and time frame should be taken into consideration.

2.5.1 Sketching

Sketching is a relative quick and simple tool resulting in two-dimensional sketches. Sketching is commonly used by product developers and designers who use it to explore, visualize, communicate and document their ideas and thoughts (Österlin, 2010).

2.5.2 Physical Models

Three-dimensional physical models are a more descriptive way of illustrating a design. Physical models are used to evaluate shape, functions and solu-

tions. It is also a tool to visualize and promote a product to external parties (Österlin, 2003).

2.5.3 CAD-Models

CAD, computer aided design, is used for building three-dimensional models with a computer software. Most times CAD-models are a faster and more economic way of simulating and testing a product than making a physical model. Today there are several different CAD softwares to assist in idea generation and product development. The CAD-models can be used to try different shapes, colours and materials as well as various constructions and their strength (Johannesson, Persson och Pettersson, 2004).

2.6 Evaluation

In the product development process there are many methods to evaluate generated ideas, compare them and to make a selection of the most suitable ones to proceed with. In most cases, the evaluation is most successful when it is objective and highlights the arguments for the selection. An evaluation often refers back to the requirements specified for the product. Some examples of methods that can be used to make a selection are (Johannesson, Persson och Pettersson, 2004):

- Selection by intuition/experience
- Pros and cons list
- Tests by prototyping or simulations
- Heuristic decision making
- Formalized decision making
- Selection matrices

2.6.1 Selection matrices

Selection matrices are a systematic evaluation method to determine a total value of each concept. Some advantages with the method are:

- The decision process is documented
- Different perspectives are integrated in an efficient way
- Decisions are based on criteria from the specification of requirements
- It gives an overview of a large amount of information
- It gives support in complex decision situations

The procedure of evaluation by selection matrices has many appearances. Most times, the concepts that are not fulfilling the demands are eliminated before the start of the evaluation. The remaining concepts are thereafter organised in a matrix where they are valued considering each specific requirement. The valuation can be done by rating the concepts relative each other or by the use of reference solution. If the criteria have various importances they can be weighted to have matching effect on the final score. Another option is to use an elimination matrix where the inappropriate concepts are eliminated (Johannesson, Persson och Pettersson, 2004).

3 IKEA the company

Since IKEA was the job initiator for the project it was important to understand the company's background, vision and values, both to get a mutual view of the project goals and to be able to develop product ideas that fit the IKEA identity. This chapter gives a brief introduction to the company IKEA; how it is organised, what IKEA strives for and how it started.

3.1 Vision and business idea

The IKEA vision is to create a better everyday life for the many people. With their business idea and vision IKEA have chosen a large target group and is trying to meet peoples many different needs, tastes, dreams, aspirations and wallet sizes and to help people who want to improve their homes and their every day lives. The IKEA range is wide in more than one way; it is wide in function, meaning that it includes anything needed to decorate a home from full kitchen interiors to children toys. The range is also wide in style meaning; no matter personal taste there is something for everyone. This combination of low prices and wide function and style range makes it possible for everyone to create a nice personal home with IKEA products (IKEA, 2012).

"Our vision is to create a better everyday life for the many people"

Low prices are the cornerstone of the IKEA vision, business idea and concept because with low prices their products become available for everyone. Even though low prices are important IKEA are careful not to let it compromise with the quality of the products. Therefore, IKEA always need to find new methods to be cost efficient and innovative. All units play an important part in creating low prices. The IKEA philosophy is that everything can always be done a little better, a little simpler and more cost-efficient (IKEA, 2012).

At IKEA the price tag is always designed first and then the product is developed to suit the price. Designers and product developers work directly with suppliers to start the creation of low prices already on the factory floor by maximising production equipment, optimizing material use, applying technical innovations and best possible design in an early stage in the product development process. Waste minimization, flat-pack transports and self-assembly are just a few ideas IKEA use to lower the final product costs (IKEA, 2012). In every stage IKEA also tries to reduce labour, shipping and storage costs. IKEA products should be designed so they can be packed unassembled. All development within the range is done in IKEA of Sweden in Älmhult. An IKEA product should be attractive, functional and as many customers as possible should be able to afford it.

All IKEA stores are located in less expensive areas and take advantage of the self-service and assembly concept. The stores buy and transport products in bulk. 31 distribution centres located in 16 different countries supply the stores with goods.

3.2 Organisation

Since 1982 the IKEA group has been owned by a foundation called Stichting INGKA Foundation and the INGKA Holding B.V. is the parent company for the IKEA Group (IKEA, 2012). Both instances are based in the Netherlands. The IKEA Group includes several IKEA operations such as the Swedwood industrial group, distribution and warehousing divisions and companies owning stores in countries around the globe. Inter IKEA Systems B.V are the owners of the IKEA Concept worldwide. The IKEA group operates most of the IKEA stores (around 290) under franchise from Inter IKEA Systems B.V. The rest of the IKEA stores (about 40) are operated by franchisees owned outside the IKEA Group. The two last instances named IKEA Services B.V. and IKEA Services AB consist of nine staff units in the Netherlands and Sweden and their task is to support the work of all IKEA Group companies.

3.3 People and environment

For IKEA taking care of people and environment is a prerequisite for doing good business. IKEA constantly strive to minimize all negative environmental impact from their products and materials. All materials should be safe for customers from a health perspective and resources should be used wisely. One sustainability goal IKEA have is to use more re-

newable and recyclable materials in their products.

The IKEA approach to create a more sustainable business is to constantly evaluate every stage of the products' lives and for each one try to contribute with improvements for people and environment. All products, materials and services purchased by IKEA must follow IWAY, the IKEA code of conduct. IWAY was first introduced 2000 and it is based on international conventions and declarations concerning environment responsibility, child labour, working conditions etc. IKEA suppliers are responsible to ensure that all IWAY requirements are fulfilled (IKEA, 2012).

History of IKEA

1920

The founder of IKEA Ingvar Kamprad was born 1926 in Småland, Sweden. He was raised on the Elmtaryd farm close to the village Agunnaryd. The first letters of these places together with Ingvars initials later became the company name IKEA.

1940-1959

In 1943 Ingvar founded the company IKEA. At this time IKEA is selling small products like pens, wallets and watches. The first furniture is introduced in the range 1948. The furniture is a success and the range keeps expanding. 1958 the first IKEA store opens in Älmhult. It is then the largest furniture display in Scandinavia.

1960-1979

During the 60s and 70s the IKEA range grows and the first IKEA store outside Sweden is opened in Oslo. The Oslo store is later followed by stores in Stockolm, Kopenhagen, Zurich and Munich. By the end of the 70s IKEA had stores in seven countries in Europe and also one store in Australia and one in Canada.

1980-1999

IKEA continues with an expanding range and more stores all over the world. The IKEA catalogue is printed in 45 million copies in nine different languages. During the 90s IKEA develops an environmental policy and launches the IKEA web site.

2000-2012

In the 2000s IKEA launches their code of conduct, IWAY, the IKEA Way on Purchasing Home Furnishing Products. At the same time IKEA also introduces The IKEA Way on Preventing Child Labour to ensure that no suppliers or sub-contractors use child labour. IKEA also starts up a series of co-operations with Unicef and WWF.

Figure 3: *Time line over the IKEA history*

4 Materials

This chapter includes theory about materials in general and the most common material groups. The material groups are presented with their most characteristic properties and their manufacture and forming methods. The chapter also includes theory about material selection, material trends and the material life cycle. Most of the information in this chapter has been collected through literature study.

4.1 Categorization of materials

A definition for materials may be: substances of which something is composed or made (Smith, 2004). Historically, humankind was limited to the naturally accessible materials like stone, wood, bones and fur. Since then, needs, engineering skills and product development have evolved and still continue to do so. Today new materials and modifications of existing ones are constantly developed in order to meet the demands of new products. One example of a relatively new material is carbon-fibre-reinforced plastics, which is a strong and lightweight polymer commonly used in sports articles and in the aerospace and automotive fields (Beylerian & Dent, 2005). With the increasing amount of materials a need was created for a categorisation system.

There are different ways to categorize materials. Most engineering materials are divided into three classes: metallic, polymeric and ceramic materials (Smith, 2004). Other material classes that are relevant for this project are textiles, composite materials and nature materials.

Materials can occur in three different states of matter; solid, liquid and gas. They can also be divided into crystalline or amorphous. In a crystalline material the atoms have an organized structure while in an amorphous the atom structure is unorganised. Most materials in nature are solid crystalline, like stone, metals and salts (Falk et al, 2005).

4.2 Ceramic materials

Ceramics are inorganic materials consisting of metallic and non-metallic elements chemically bonded together. The structure of ceramic materials can be crystalline, non-crystalline or a mixture of both (Smith, 2004). Most ceramics tend to be brittle but have high hardness and high temperature strength. They are also wear resistant, reduce friction and have good insulative properties. Some examples of materials that are included in the ceramic family are concrete, glass and tile.

Ceramics are often divided into traditional ceramic materials and engineering ceramic materials (Smith, 2004). For traditional ceramics, aesthetics and basic functionality are of importance and they are commonly used in porcelain ware, bricks and electrical porcelain. Two commonly used traditional ceramics are Stoneware and Earthenware. Earthenware is less strong and more porous than stoneware but also less expensive and easier to work. The engineering ceramics are made of pure or nearly pure compounds like aluminium oxide (Al_2O_3) or silicon carbide (SiC). Engineering ceramics are used in e.g. high temperature areas in the automotive or aircraft industries

4.2.1 Manufacturing methods for ceramic materials

Most ceramic products are manufactured by compacting powders or particles into shapes that are heated to a temperature high enough to bond the particles together. There are three basic steps when processing ceramic materials:

1) material preparation

2) forming or casting

3) firing, to bond particles together

Sometimes thermal treatment by drying is required before the firing. In the material preparation stage particles are blended in a wet or dry state. For less demanding ceramic products like bricks or tiles the ingredients are usually blended with water. The raw materials used in the blend vary depending on the intended use for the product (Smith, 2004).

4.2.2 Forming of ceramic materials

Common ways to form ceramics are pressing, slip casting and extrusion. Ceramics can be formed in dry, plastic or liquid condition and in general there is no need to preheat the ceramic before forming it. Pressing is a suitable technique when many components of small size and close tolerances are made. Slip casting is a unique technique for ceramics and

it is often used when producing dinnerware. The ceramic must be in a liquid state called a slip, the slip is poured into a mould and when sufficient wall thickness has been formed inside the mould excess slip is poured out. When the material is dry enough the mould is removed. As a final step the cast part is fired to attain required strength. The last forming method, extrusion, can be made in a plastic condition when forming single cross sections or hollow shapes. The material is forced through a forming die (Smith, 2004).

4.3 Glass

Glass is an inorganic amorphous melt that has hardened into solid phase without crystallisation. Glass is hard, brittle, resistant to most liquids and heat resistant. It is however sensitive to shock. The most characteristic quality of glass is its transparency. Glass can exist in a variety of qualities and colours (Falk et al, 2005; Smith, 2004).

4.3.1 Manufacturing methods for glass

Glass is often produced from oxygen compounds but other compounds, such as sulphur and selenium, can also be used. The properties of glass can be optimized for its intended application by different combinations of oxides. Qualities like colour, heat resistance and surface structures can be controlled. The most common base in regular glass is sand (SiO_2) and this type of glass is often called silicate (Smith, 2004). Further, there are also glass materials made of organic compounds such as polymers and metal alloys (Falk et al, 2005).

4.3.2 Forming of glass

Glass shrinks in a more controlled way, during transition from liquid to solid, than crystalline materials. This property allows glass to be shaped in a unique way. Glass does not have an exact melting point like crystalline materials do. Instead glass has a temperature interval, usually around 500^0C, where it transforms into solid state (Smith, 2004). For mechanical manufacture, a short transformation range is often preferred and for production of handcrafted glass with many complicated operations a longer interval gives more time to shape the glass before it becomes solid (Falk et al, 2005).

If a glass melt is cooled down very slowly it can start to crystallise. This controlled heating method is used when creating glass ceramics. Crystallisation is also used for the creation of opal glass that is white and translucent but in this case the process is controlled with different additives (Falk et al, 2005).

4.4 Polymeric materials

Plastics are made from polymers in combination with various additives such as fillers, fire retardants and plasticizers. Polymers can be naturally occurring or synthetic macromolecules consisting of chains of repeated units called monomers (Smith, 2004).

Polymers are often divided into plastic and elastomeric materials. Further, plastic materials can be divided into thermoplastics and thermosetting plastics depending on their chemically bonded structures. Elastomeric materials or rubbers are recognised by their ability to be elastically deformed to a large extent when a load is put on them. When the load is removed they will return to their original shape. Thermoplastics require heat to be formable and they can be reshaped many times before there is a considerable change to their properties. Thermosetting plastics on the other hand cannot be reshaped since they are set with a chemical reaction when they are shaped the first time and they will degrade or decompose if heated to high temperatures (Smith, 2004).

Compared to ceramics and metals polymers will soften or melt at relatively low temperatures and they will decompose or burn up if the temperature rises further. Polymers are also not as hard, stiff or strong as most ceramics and metals but the strength and ductility among polymers can vary greatly (Klason & Kubát, 2001).

4.4.1 Manufacturing methods for polymeric materials

The polymerization process can be made in a variety of ways and new methods are constantly developed. Raw materials such as gas, petroleum and coal are used to produce chemicals that are polymerized in several different processes into plastic base materials such as granules, pellets, powders or liquids. These plastic base materials are then further processed into products (Smith, 2004).

Polymers make up the base of plastics but usually other subjects are added to gain the aimed quality. Some of the most common additives are stabilizers, lubricants, pigments, fire retardants, antistatic agents, plasticizers, fillers, reinforcing materials and blowing agents (Klason & Kubát, 2001).

4.4.2 Forming of polymeric materials

Extrusion is one of the most important forming methods for plastics. It can be used to form profiles from a plastic melt. Plastic granules are poured into a funnel and are then transported by the force of a screw through a heated pipe. At the end of the pipe

the granules has transformed into a melt that is pressed through a nozzle with the shape of the preferred profile.

Injection moulding is another common forming method for plastics and the primarily benefit of the method is that it enables relatively complicated geometries to be made in a rational way. Like in the extrusion process the material is melted in a heated cylinder. But in injection moulding the screw moves backwards when the melt is feed. After the preferred amount of melt has been fed, the screw moves forward forcing the melt through a nozzle and into a mould. When the melt has cooled down it is ejected from the mould.

When forming semi-finished products like sheets, pipes or other profiles, the method thermoforming can be applicable. The semi-finished products are heated into a rubber like state and shaped in a mould by the means of vacuum or compressed air. Products made with this technique usually require some kind of after treatment like sawing, clipping, welding etc. (Klason & Kubát, 2001).

4.5 Metals

Metals are inorganic materials composed of one or more metallic elements (Smith, 2004). A combination of more than one metal or metals and non-metals are called alloys. Some examples of metallic elements are iron, zinc, copper and aluminium and some non-metallic elements often combined with metals are carbon, nitrogen and oxygen. Metals have a crystalline structure, are relatively strong and ductile and they are good thermal and electrical conductors (Smith, 2004).

4.5.1 Forming of metals and alloys

A common way to process metals is casting. The metals are melted and various alloying elements are added. Thereafter, unwanted oxide impurities and gases are removed and the melt is cast into a mould. Often the metal is shaped into an ingot from which semi finished products are made. A molten metal can also be cast into the shape of a final product and then only a small amount of machining is necessary. Products made with this method are called cast products and the alloys used to produce them are called casting alloys.

Hot and cold rolling are common methods used to shape metal ingots into metal sheets and plates with uniform cross sections. With hot rolling a greater thickness reduction can be made with each rolling pass and therefore hot rolling is usually carried out first. When hot rolling, the ingot is heated to a temperature around 1200^0C. The sheet is rolled until the temperature is so low it becomes difficult. It can then be reheated and rolled again. Most common is to use reversing rolling mills in a series (Smith, 2004).

Another method commonly used to shape metals is forging. In the forging process metals are hammered or pressed into shape. In hammer forging a drop hammer is used to apply a striking force to the metal surface and in press forging a slowly moving compressive force is used. Forging can be done with both hot and cold metals. Forging can also be done with dies that can be either open or closed. The method is used to make irregular shapes and the process also makes the parts stronger and less likely to break.

4.6 Textiles

Textiles have a wide area of application. Mainly they are used in clothing, household products and furnishing but also in technical applications like protective clothing in medicine and for house and road building. The production of textiles has substantially increased in the same pace as the world's population growth and the growing prosperity in industrialised countries (Eberle et al., 2008).

4.6.1 Manufacturing methods for textiles

The first textiles were made of natural fibres from animals. The fibres were spun into yarns and the yarns were woven or knitted into fabrics (Eberle et al. 2008). Later the same methods were used to produce fabrics from vegetable fibres e.g. cotton and flax. In more modern times man-made fibres were added, made of cellulose or petroleum and new techniques were invented for the production of non-woven fabrics like felt. Non-woven fabrics are made directly from fibres, without intermediate steps of yarn formation or weaving. The webs are given strength by mechanical entanglement of the fibres.

Fabrics are commonly treated with dyeing and finishing. Finishing is mainly used to enhance the appearance of the fabric by colouring or pressing etc. Often a lot of harmful chemicals are used in these processes. A fabric can also be coated with a layer of natural or synthetic polymers if it should be water or dirt repellent (Eberle et al. 2008).

4.7 Composite materials

Composite materials are a mixture of two or more materials. There are different types of composites for example fibrous composites, which are composed of fibres in a matrix, and particulate composites, which are composed of particles in a matrix

(Smith, 2004). Most composites consist of fillers or reinforcing materials and a compatible resin binder. The aim with composites is to combine materials with different qualities to obtain a new material superior the others for an intended function. The range of existing composites is numerous and they can be found in many products today. One example is fibre-reinforced plastics commonly used in the automotive and sport industry (Beylerian & Dent, 2005).

4.8 Nature materials

In this report the term nature materials is used for all materials derived directly from plants or animal sources, e.g. wood, cotton and all kinds of agricultural fibres. Even though most of these materials have been in use for a very long time there are still new alternative ways coming up of how to form and use them. Innovative new ways of forming wood are being developed and natural fibres have started to replace glass fibres as reinforcements in plastics.

4.9 Material selection

Materials are important aspects of all products. With their texture, weight and colour materials influence our perception of objects. All human senses help to evaluate a handled product and many of the stimuli received are directly dependent on the material of the product. The material also affects mechanical properties, quality and price of the final product. The material should therefore be selected with care.

It is however very common for manufacturers and product developers to use well-known, traditional materials for their new products. Standards are trusted and easy to apply but that does not mean they are always the optimal solution (Klason & Kubát, 2001).

It is important to use a systematic approach when selecting materials and constructing a design. A structured and systematic material selection process in the beginning of a project can save a lot of time and money in later stages. One method for material selection commonly taught to technical engineers is selection by analysis where the input is technical requirements (Ashby et al., 2007). The requirements are translated to measurable data used for screening of a material database where those materials that fail to meet the constraints are eliminated. The remaining materials are ranked by their ability to maximize the aimed performance (Ashby & Johnson, 2006; Ashby, Shercliff & Cebon, 2007; Klason & Kubát, 2001).

However, in some product development processes the material selection is not controlled by technical requirements. In these products the expression, aesthetics, novelty and feel of the material are more important qualities (Ashby & Johnson, 2006). In this case selection by analysis is not a suitable method. Instead selection by synthesis might be an appropriate method to apply. Here the inputs are aimed expressions like trendy or humorous. To start with, products embodying these expressions are searched for. The reference products are then used to map typical characteristics of these expressions, for example bright colours, soft elastomeric coatings or simple rounded shapes (Ashby & Johnson, 2006).

Another approach is to use selection by similarity (Ashby & Johnson, 2006). This method might be of interest when established materials ceases to be available or, for some reason, fails to meet the requirements. This could for example be due to new environmental legislation. Preferably, the substituting material should match the incumbent in all respects except the one causing the need to change. The procedure is to capture the attribute profile of the incumbent, eliminating the unwanted attribute and relaxing the constraints on non-critical attributes. The new profile can then be used to screen for alternative materials (Ashby & Johnson, 2006).

The fourth method for material selection according to Ashby & Johnson (2006) is selection by inspiration. The method uses the fact that many good ideas are triggered by unplanned encounters that are inspiring and work as triggers for creative thinking. Interaction with materials, products and images should be used to fire the inspiration. Today, there are many useful tools for this, for example there are material libraries both online and in actual form, there are also many inspiring books, blogs and magazines as well as stores that market good innovative design.

The presented methods can be used in isolation or in combinations by implementing the most useful feature of each. The latter usually gives the most valuable result (Ashby & Johnson, 2006).

4.10 Material trends

The various material families are competing with each other for the existing and future markets. One important factor often considered in material selection is cost. If the cost of a material decreases that material might replace other materials that are currently used in products. Therefore, the availability of raw materials, the costs of manufacturing and development of processes are all affecting the demand for different materials. There is also a constant development of new materials with more attractive

qualities, tailor-made for specific applications. This development together with price changes result in a constant global change in the use of materials. For example one trend has been a rapid increase of polymers and aluminium since 1930 (Smith, 2004). Polymeric materials have already replaced many metals, glass and paper materials and have historically been the fastest growing basic material in the United States (Smith, 2004).

One change in society that also reflects in the material market is the higher demands made concerning environment and sustainability. There are elements and chemicals used in products today that are becoming more regulated or are about to be prohibited by new legislation. Where these elements are used there is a need for more environmentally friendly alternatives.

Other noticed trends are that engineering plastics are expected to stay competitive with metals also in the future since it is predicted to be the least expensive option except for hot-rolled steel (Smith, 2004). Within plastic development different polymers are blended together to create new plastic alloys and since oil is a depletable resource an increase is seen among bio plastics from various sources (Swamy & Balaji, 2010).

Fibre reinforced plastics, and glass fibres in particular, are the main composites used today. For environmental reasons more and more natural fibre-reinforcements are coming up (Taj et al., 2007). The advanced composite materials are important for high-performance applications and are expected to find new applications for example in aircrafts and vehicles in the future (Smith, 2004).

4.11 The material life cycle

In product development today sustainability is a frequently used word. The word is used in many different contexts and the meaning of sustainability has become difficult to comprehend. In the Brundtland commission from 1987 a definition for sustainability was made: "Development that meets the needs of the present without compromising the ability of

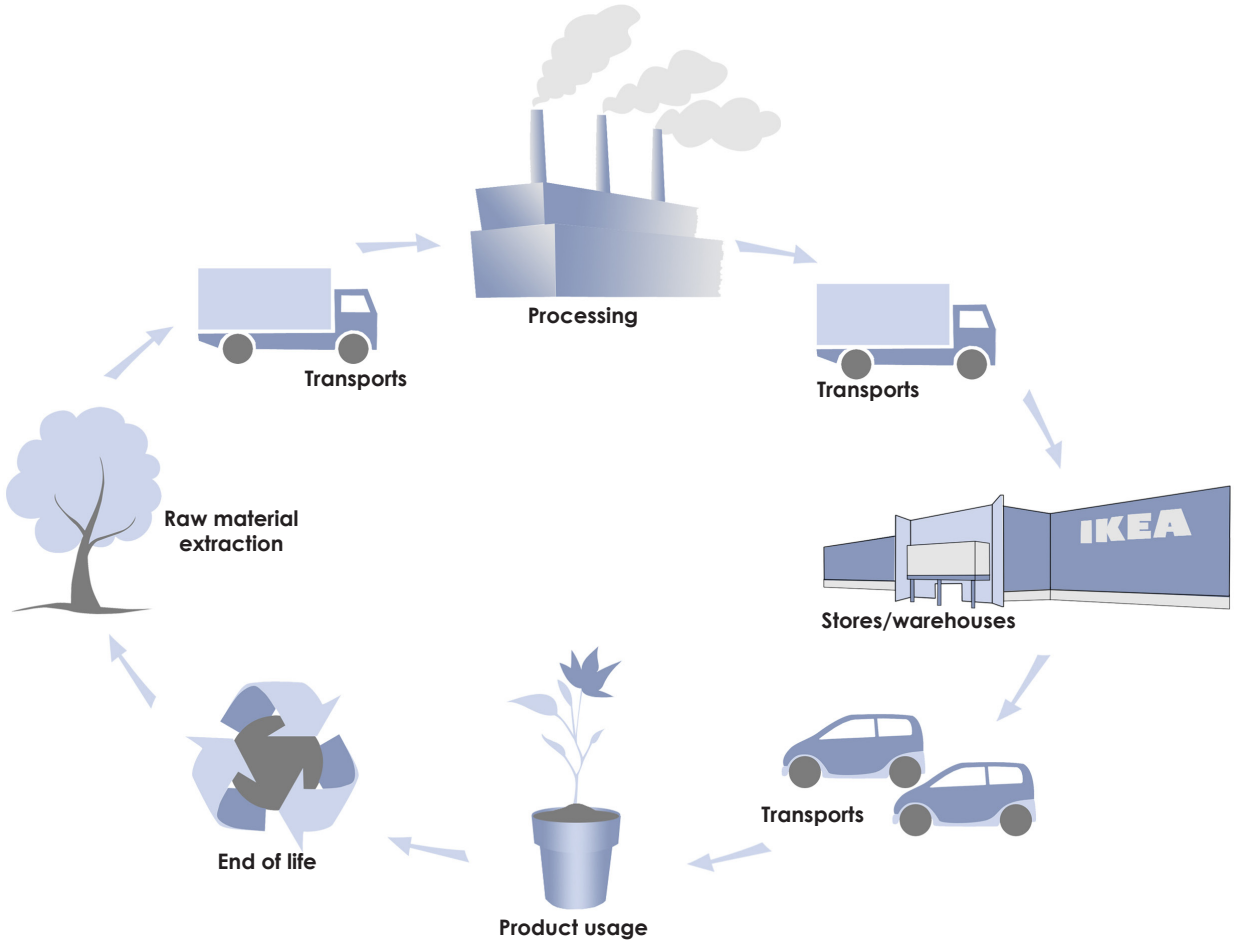

Figure 4: *Illustration of material life cycle.*

future generations to meet their own needs". It is a good start to know what sustainability means but to actually incorporate it into product design is a great challenge and it takes a lot of knowledge and well-suited methods to succeed. All actions and decisions have consequences and it is not always easy to predict these at the start of a product development process. A new material or a design might be very good in some aspects and may seem like a more environmentally friendly option but the consequences of them might result in that the positive effects are overtaken by the negative. However, the chance to create an environmentally better solution will increase with a better understanding of the problems and the material flow in industries today. A concrete method to estimate a product's overall effects on environment is a Life Cycle Assessment, LCA. A LCA is often performed on existing products since a lot of information about production and product usage must be known.

In this project it is not possible to apply LCA due to the many unknown factors in this early stage. It is however possible to compile general information about the various stages a material passes through on its way from raw material until disposal of the product. Having a clear guide of these stages will help evaluate each material with regards to its sustainability. According to Carlson and Pålsson (2008) all industries affect the environment in four primary ways; by the need for resources including material and energy consumption, by emissions to air, water and land, by supplanting the land where the facility is placed, by the waste and wastewater the facility produces. In the following chapter these four ways will be investigated for all required stages in the production/use cycle. A Simplification of the material life cycle is illustrated in figure 4.

4.11.1 Extraction of raw materials

Most production starts with extraction of raw materials. The extraction process is performed in different ways depending on the material type and therefore the impact on nature differs. Metals and ceramics are extracted by mining from the lithosphere, wood and paper require preparation of land for plantation, oils and plastics stem from oil recovery and many food products come from agriculture and farming.

One effect that comes from most raw material extraction, agriculture and farming in particular, is the occupation of land. The local nature is often changed a great deal to be better suited for the purpose. This might harm the eco system and the biological diversity in the area (Carlson & Pålsson, 2008). Agriculture also requires a lot of water that is a scarce commodity in many countries, this is an especially great problem in cotton production. The plantations are also treated with pesticides and manure for better harvests and these substances are taken up by the soil and water around the plantation. Further, the felling of trees increases the carbon dioxide in the atmosphere since there will be less trees to absorb the carbon dioxide and transform it into oxygen (Carlson & Pålsson, 2008).

All extraction requires energy in form of fuel to run the vehicles and equipment necessary for the activity and from this follows CO_2 emissions that cause global warming. Mining causes negative effects like noise, dust and vibrations that are disturbing the surroundings. Another serious problem with the activity of extracting raw materials is that some minerals, metals and oils that are needed for production and energy today are depletable and will end with continued extraction (Carlson & Pålsson, 2008).

4.11.2 Transports

Most raw materials require processing in a few or several phases before they become consumer products. The processing is often executed in another facility than used for extraction and when more than one processing phase is required all those may take place in different facilities. With the globalisation of today this may result in long material transports that consume fuel and cause emissions. To limit the negative impact from transports vehicles that cause less emission, for example trains, can be prioritised when possible. Another way to improve the sustainability of transports is to use LCA or other methods to determine what type of fuel that would be the most sustainable to use for the distances and loads. It is also important not to transport air, meaning that the containers should be efficiently loaded and make most possible use of the space. Further, heavier loads require more energy so by reducing weights of the transported goods will reduce costs and CO_2 emissions (Carlson & Pålsson, 2008).

4.11.3 Processing

During the first processing, the raw materials are often transformed into semi-manufactured products like metal or paper sheets, plastic pellets or product components. In the next refinement phases these semi-manufactured products are further refined with machining, chemicals, assembly etc. The processing facilities require land and resources and it may cause waste material, chemical pollution and emission of carbon dioxide to land, air and water. For each process it is important to be aware of where the largest environmental impact occurs. Some processing facilities are to a large extent automated while others require more manpower. During the process-

ing phase it is therefore also important to take a social responsibility for the situation for the workers in the facility (Carlson & Pålsson, 2008).

4.11.4 Stores and warehouses

When the material has been processed and the components have been assembled the final products are shipped to stores or warehouses to be sold to customers. During the time the product is in a store or a warehouse its environmental impact is negligible in relation to the other stages in the product life cycle. Often the facilities only require energy to maintain the building and for lighting and heating.

When a product has been bought it is often transported to the home of the customer in a delivery car or a private car. This is a very inefficient way of transportation.

4.11.5 Product usage

From a user perspective products can be divided into four categories; the first is products that do not require resources or changes significantly when used, the second is products that are consumed when used, the third category includes products that decrease in quality during use and the fourth requires maintenance and energy to function (Carlson and Pålsson, 2008). It can also be said that a product with long life has less environmental impact since it reduces material use and negative effects from production and transport and it will replace other products. Therefore design and quality can be used to make a product more sustainable.

"A material will never prove to be sustainable and successful in the long term, if aspects such as beauty, functionality and economic issues are not taken into consideration." (Materia, 2012)

In the product usage phase consideration should also be taken to emissions of particles, gases etc. IKEA have clear specifications for allowed smell, taste and use of chemicals in their products.

4.11.6 End of life

At the end of a product's life the product can be reused, recycled, burned, composted or landfill (IVL Svenska Miljöinstitutet, 2011; Carlson & Pålsson, 2008). By burning, waste energy can be obtained from the heat and replace other energy resources like oil, coal or gas. Biological waste can be composted so nutrition is brought back to the soil. It is also possible to use the energy from the degradation process to run cars and buses on. During the product development process it is important to optimise the design for the product's intended waste management (Carlson & Pålsson, 2008).

From an environmental point of view it is in most cases preferred if a material is re-used or recycled as many times as possible before it is burned or composted. By recycling materials energy and resources can be saved and waste can be reduced. However, to get an accurate idea of the impact, compared to the use of virgin materials, consideration has to be taken to effects from transports and recycling processes (Carlson & Pålsson, 2008). Today, many materials are recyclable but there is no existing system to collect them. It will most likely stay that way as long as it is more economic to produce new materials instead of recycling used materials. Many recyclable materials can only be down cycled, meaning their properties will impair in the latter cycles. Mixing different materials with each other or using additives often causes complications in the recycling process. One examples of down cycling is coloured plastics that become dark when recycled. Problems are also noticed with bio plastics and wood fibre composites since they will impair the properties of pure plastics when mixed in the recycling process (Dell, 2010; Forsgren, 2012).

What materials that are considered worth recycling vary a lot between different parts of the world. In Sweden, non-combustible materials like ceramics often end up as land fill while in Asia many ceramics are recycled (Kovak, 2012).

PART 1- Material Investigation

5 Material analysis

The material analysis in this project consists of three parts; market study, detailed analysis and user experience analysis. The three parts are further presented in this chapter. First, the procedure of each analysis is described including methods that were used and the reasoning behind all decisions. Each procedure section is directly followed by a summary of the results and conclusions from the analysis.

5.1 Market study

The material analysis was initiated with a market study (see chapter 2.2.4) where the main goal was to find as many potential materials as possible in order to create an interesting base with a wide variety and many alternative directions for a first selection. To avoid narrowing the search and being forced to put too much time into details the determined search criteria was kept abstract and non-measurable (See chapter 5.1.1). The criteria were used mainly as guidelines and not so much as requirements.

The market study included literature studies by means of books, magazines, blogs and web sites. The web was a very important tool for the study because one main criteria of the research was to find new, innovative materials and a lot of the most resent information is presented on the web and cannot be found in books. Visits were also made to the IKEA stores, to the material library in Stockholm and to the construction fair Nordbygg. The search field for new materials is vast so to make the work more structured, four different search areas were defined (see chapter 5.1.2).

The materials that were found valuable were collected with a picture and a short description. When all the above mentioned search areas were investigated in every media, the collected materials were printed out and organised into categories with sub categories that would facilitate a discussion that could lead to a first selection. Most of the created categories highlighted the quality that somehow made the material stand out and was the reason for why it had been selected in the first place.

5.1.1 Search criteria

The search criteria used to sort out all interesting materials were as follow:

1. **Formability**. It has to be possible to, in some way, form the material into a bowl, plant pot or vase.
2. **Realizability**. The material should exist and preferably be used in some existing products.
3. **Non-expensive**. The material should not be unrealistically expensive.
4. **Novelty**. It should not already be used in the same way by IKEA for plants pots, bowls and vases.
5. **Sustainability**. All sustainability aspects are of interest.

The search criteria were determined based on a discussion with people from IKEA who were involved in the project. The main purpose of criteria 1-3 was to, in an early stage, eliminate all materials that would not be possible to apply in the products of interest. With criteria 4-5 the intention was to add extra value to the selected materials and to exclude all materials that were of no interest.

5.1.2 Search areas

Before the actual material search started, a mapping was made of all materials that are used for IKEA vases, bowl and plant pots today. The reason for the mapping was to obtain an overview of the materials in the range in order to see where there are gaps and in that way find potential areas for further investigation and to ensure that search criteria 4 was fulfilled. For the mapping the IKEA product matrix, including all IKEA products from Apr 2012, was used and the materials were grouped into the categories of ceramics, glass, plastics, metals, nature fibres and others.

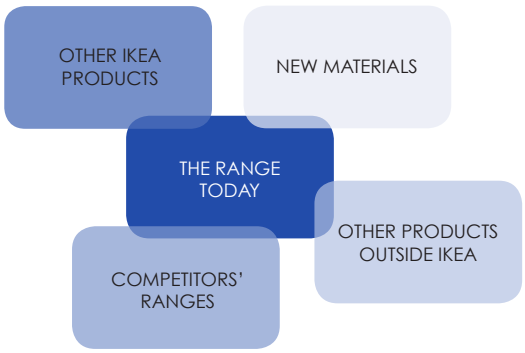

***Figure 5**: Illustration of search areas*

The material market is enormous so to rationalize the study four search areas were determined:

1. Materials in other IKEA products.
2. Vase, bowl and plant pot materials outside IKEA.
3. Materials on the market that has not yet been used for vases, bowls and plant pots.
4. Completely new materials.

The two first search areas were more defined to facilitate the start-up of the study and the latter ones were more abstract (see figure 5).

Figure 6: *Material cards used to evaluate findings from the market study.*

5.1.3 Evaluation of findings

For the evaluation, all materials that had been found were presented on cards with a short text description and a picture (see figure 6). The cards were organised into categories with sub categories to make it easier to go through them. The evaluation was done together with an IKEA product developer. The process of the evaluation was to go through each sub group separately and discuss the material cards with the search criteria in mind. The discussion about each category was ended with a decision of which material suggestions that should be kept to the next phase, the detailed analysis. All the selected materials were considered to fulfil at least search criteria 1-4 and many of them also fulfilled criteria 5. In some cases an entire category was found interesting and was therefore selected, this was the case with bio composites. While other times only one material from a category was kept or an entire category was eliminated. The results from the evaluation are described in the next chapter and can also be seen in the table presented in figure 8-9.

5.2 Results from market study

The result from the mapping of materials used in the decoration range today is presented in full form in Appendix I. The two most commonly used material groups for IKEA vases, bowls and plant pots today are glass that make up one third of the range (32.6%) and ceramics (28.1%). These groups are followed by metals (18%), plastics (9.7%), nature fibres (8.6%) and others (3.0%) (see figure 7).

The market study resulted in 106 material suggestions (see Appendix II). All suggestions were not new materials to the range because some of them were just new alternatives of how to shape or use a known material in a design. The material suggestions were sorted into seven groups created with the intention to facilitate a discussion about them. All groups were also divided into sub groups (see figure 8-9).

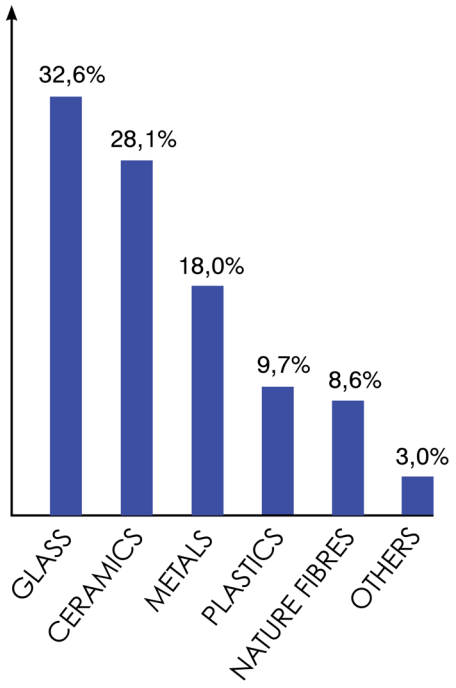

Figure 7: *Materials used in the IKEA decoration range today*

The table below (see fig 8-9) shows all materials from the market study. The materials written in black text were selected for further investigation in the first evaluation and the materials written in grey were valued as less interesting and were therefore discarded. The selection was made as described in chapter 5.1.3.

1. NATURE MATERIALS

Nature fibres

Biotex Flax/PP
Palm leaf
Palm leaf ribs
Banana fibres
Willow
Bamboo
Pandanus leaf

Formable wood

Wodden textiles
3D Veneers
Foldtex
Bendywood
TT Sheet
Birch veneer

2. TEXTILES

Surface treated textiles

Waterproof textile
Polyester
Polypropylene
Beadazzled

Moulded textiles

100% recyclable polyester felt
Moulded felt from Nordifa
Polymer felt from recycled PET bottles

Thread

Thread around seagrass
Zulu Ilala palm fronds
Yarn impregnated with resin and gluten

Form stable textiles

Neoprene
EVA foam
EVA plastic
Coated fabrics
Ecolin

3. COMPOSITES

Bio composites

Liquid wood
Kareline
Natural fibre composite
Whole tree coconut fibre
Durapulp
Bamboo composite
Hiendl NFC

Mineral composites

Moulded sand
TerraSkin
Hi-Macs
Corian
Slate polymer composite
Cristalplant

Fibreglass

Fibreglass GRP
Glass polymer

Carbon composites

Liquid infusion technology (LIT)
PURE

High performance composites

Carbon-fibre-filled Ultem resin family
Fibre-reinforced PA66
Easy flowing PBT
Forged composite

Sustainable high performance composites

EcoPaXX
Palapreg ECO
Arnitel Eco
LNP thermocomp composite
Akulon RC

4. CONCRETE AND FOAMS

Concrete

MPBWC
Quantz
Concrete canvas
Coloured concrete
Ductal concrete
Glass concrete
Creacrete
Rubberized concrete

Foams

Foam glass
Advantic
Ceramic foam
Metal foam
Lightweight concrete

Figure 8: *Findings from material study. Selected materials are written in black.*

5. POLYMERIC MATERIALS

Hard consumer plastics

Polypropylene plastic
Polycarbonate plastic
ABS plastic with acrylic coating
Melamine
SAN plastic
Polyester sandwich

Flexible consumer plastics

Polypropylene plastic sheets
Polypropylene plastic woven
Polyethylene mesh
Polyurethane plastic
Polystyrene plastic
PP combined with TPE

Elastomeric materials

Milk design rubber
Synthetic rubber
Croslite
EVA plastic
Silicone

6. SUSTAINABILITY

Biodegradable materials

Biodegradable polymer
Biodegradable glass
Sugarcane
Biodegradable cellulose
Paper foam

Recycled materials

Ripietra
Newspaper wood
Recycled plastic
Computer keyboard glaze

Re-used products

Biodegradable wash cloth
Water pipes
Noodle cups

7. OTHERS

Paper materials

Denguri paper
Cardboard
PaperStone
Re-Y-Stone

Metals

Glazed metal
Dibond aluminium composite
Metal resin
Transparent aluminium
Steel mesh

Light emitting materials

Bordato illuminated planter
Light emitting film

Glass ceramic

Aluminosilicate

Figure 9: *Findings from material study. Selected materials are written in black.*

5.3 Detailed material analysis

In the detailed material analysis the remaining materials from the market study were further investigated. The aim with the analysis was to evaluate the materials with consideration to how suitable they would be for application in the intended products and to rank the materials in relation to each other and to existing materials in the range. The information that was required for the analysis was mainly collected via interviews with suppliers for the different materials and with material and sustainability experts at IKEA but also from books, articles and websites.

5.3.1 Specification of requirements

For the evaluation part in the detailed analysis, a list of requirements was determined (see Appendix III and chapter 2.3.1). The requirements included the categories price, quality, aesthetics, manufacture, sustainability and safety. All requirements were

weighted with a number from 1-3 regarding their importance, where 1 was the least important requirements and 3 was the most important. Some of the most important requirements were also marked with * which meant that they were demands that had to be fulfilled. The materials that did not fulfil these demands were eliminated from further research. All requirements and their weighing were discussed with a technical engineer at IKEA and compared to the requirements IKEA have specified for products, quality and materials/coatings.

5.3.2 Evaluation matrix

The specification of requirements was utilised to rate the materials in an evaluation matrix (see figure 11 and chapter 2.6.1). The requirements were placed on the y-axis and the materials were sorted into seven groups and presented on the x-axis. The purpose with the matrix was to provide a better overview and facilitate the comparison of the materials. For each requirement the materials could either pass or fail. When they passed they received the score the requirement was worth and when they failed they received an X that equalled score zero. At the bottom row of the matrix the total score of each material was presented.

5.3.3 Supplementing material information

The evaluation matrix was very useful for the comparison of materials but it lacked a lot of information that was necessary to make proper conclusions. Therefore, supplementing information was collected about each material group, highlighting other qualities that also were important but not visible in the evaluation matrix.

5.4 Results from detailed analysis

This chapter first presents the results from the evaluation matrix and thereafter, each material group is described more in detail.

The final score for each material from the evaluation is presented in figure 11 and the obtained top list is presented in figure 27. The material with the highest score was the cellulose material Zelfo with 46 points. Zelfo received full score in all the categories costs, quality, aesthetics, environment and safety. The only requirement Zelfo did not pass was in manufacture because it uses a new manufacture method and is, at present, not as easy to process as e.g. traditional plastics with well known shaping processes. On second place with 43 points came Arboform, the wood fibre composite made from lignin. Arboform can in comparison to Zefo be processed with the same injection moulding tools as traditional plastics but it lost scores due to high material costs and no use of recycled materials. On third place in the top list came fabrics with 41 points. Fabrics mainly received lower scores than the top two materials due to its qualities in the environment category. However, this category will receive different scores depending on if the fabric is made of synthetic or natural fibres. Synthetic fibres are not made from renewable materials but are on the other hand recyclable. In this evaluation the synthetic fabrics are investigated.

Plastic was the highest ranked range existing material and it ended up on a fourth place together with two bio plastics. The existing materials in general scored high in the categories costs and manufacture but lower in environment.

5.4.1 Materials today

As seen in chapter 5.2, Results from market study, the materials in the IKEA decoration range today are glass, ceramics, metals, plastics, nature fibres and others. These materials are strong competitors to the new materials, mainly because they are highly available and their manufacture methods, quality and prices have during many years been optimised to suit the IKEA range. The materials have suppliers in many different locations who can offer a variety of qualities, prices and designs, therefore the options for the existing materials are a lot more diverse than for many of the new alternatives. However, from the evaluation it became clear that there are areas where

Pros

+ Well known and trusted
+ Optimised prises and manufacturing methods
+ High avaliability
+ Wide variety of shape, size and colour

Cons

- Non environmentally friendly production
- Ceramics are not recyclable
- Only nature fibres are renewable and biodegradable
- High density and brittle

Figure 10: *Pros and cons list for materials today*

		Arboform	Arboblend	Arbofill	Hiendl NFC	Kareline	Acrodur, BASF	Natureplast	Arnitel Eco	EcoPaXX	Corian	Cristalplant	Hi-Macs	TerraSkin	Nordifa	Fabric	TT Sheet	Bendywood	Zelfo	Durapulp	Re-Y-Stone	Ductal	Glass	Ceramics	Plastics	Metals
		Bio composites						Bio Plastics			Mineral composites				Textiles		Cellulose					Concrete	Materials today				
Be non expensive to buy	Costs	X	X	3	3	3	3	X	X	X	X	X	X	X	3	3	X	X	3	3	X	X	3	3	3	3
Be non expensive to manufacture		3	3	3	3	3	X	3	3	3	X	X	X	3	3	3	X	3	3	3	X	X	3	3	3	3
Be non expensive to transport		3	3	3	3	3	3	3	3	3	X	X	X	3	3	3	X	X	3	3	3	X	X	X	3	X
*Be outdoor environment resistant (Demand for outdoor products)	Quality	1	1	1	1	X	X	X	1	1	1	1	1	X	1	1	X	X	1	X	X	1	X	X	1	X
Be UV-stable		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Be deformation resistant		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Be water resistant		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	X	1	1	1	1	1	1	1	1
Be waterproof		1	1	1	1	1	X	X	1	1	1	1	1	X	1	X	1	X	1	X	1	1	1	1	1	1
Be corrosion resistant		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Allow shape variation	Aesthetics	3	3	3	3	3	3	3	3	3	3	3	3	X	3	3	3	X	3	3	X	3	3	3	3	3
Nice surface structure		2	2	2	X	2	X	2	2	2	2	2	2	X	X	2	2	2	2	X	2	2	2	2	2	2
Allow colour variation		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	X	X	2	2	X	2	2	2	2	X
Bring novelty within the area		2	2	X	X	X	2	2	X	X	X	X	X	2	2	2	X	X	2	2	X	X	X	X	X	X
Allow size variation	Manufacture	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
*Allow series production		3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Follow social standards		3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Be easy to process		1	1	1	1	1	1	1	1	1	X	X	X	1	1	1	X	1	X	X	X	X	1	1	1	1
Be highly available	Environment	1	X	1	1	1	X	X	X	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Be environmentally friendly to manufacture		2	X	X	X	X	2	2	2	2	X	X	X	2	X	X	X	X	2	X	2	X	X	X	X	X
Be recyclable		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	X	X	1	1	1	X	1	X	1	1
Be 100% biodegradable		1	1	X	X	1	X	1	X	X	X	X	X	1	X	X	X	X	1	1	X	X	X	X	X	X
Use renewable materials		1	1	1	1	1	1	1	1	1	X	X	X	1	X	X	1	1	1	1	1	X	X	X	X	X
Use recycled materials		X	X	X	1	X	X	X	X	X	X	X	X	X	1	X	X	X	1	X	1	X	X	X	X	X
Have low density		2	2	2	2	2	2	2	2	2	X	X	X	2	2	2	2	2	2	2	2	X	X	X	2	X
*Be non toxic	Safety	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Follow legislation for food contact		2	X	X	X	X	X	2	2	2	2	2	2	X	X	2	X	X	2	2	2	X	2	2	2	2
Total score		43	38	39	38	39	35	40	39	40	28	28	28	34	39	41	25	24	46	39	31	25	34	33	40	32

*Demands that must be fulfilled

Figure 11: *Material evaluation matrix*

the existing materials score low and where the new materials are the winners. For example glass, ceramics and metals have high density, which aggravate handling and transportation. Glass and ceramics are also very brittle. Environment was the category in which it was most obvious the new materials have the lead. Most of the existing materials are not made from renewable resources. Ceramics are not recyclable (in Europe) and even if glass, metals and plastics are, IKEA have few products that actually use recycled material. Figure 10 shows a summary of the pros and cons of the materials used today.

5.4.2 Bio plastics

Bio plastics are either bio-based, biodegradable or both (see figure 12). Today less than 1% of all plastics in use are bio plastics (TianAn, 2012). The main holdbacks for the polymer have been the price and the fact that they are brittle compared to oil-based plastics. It is however a growing industry. Starch and PLA (Polyactic acid) polymers have been known for many years and they are still the leaders in the market (Swamy & Singh, 2010). PLA plastics cost about 20 percent more than traditional plastics and most PLA plastics require a controlled environment with the right humidity and temperature to degrade. PHA

(polyhydroxy alkanoate) is a more resent member of the family. PHA's degrade more easily in natural environment but cost more than the double compared to traditional plastics (Dell, 2010).

	Biodegradable	Nondegradable
Bio-based	Starch, PLA, PHA	Bio-PET, Bio-PE, PEF
Non-bio-based	Ecoflex, PBAT, PBS, PCL, PTT, PPC	ABS, PP, PS, PET, Nylon, PE

Figure 12: *The grey boxes define bioplastics.*

The reasons to replace traditional plastics with bio plastics are all environment related because all other properties are either equal or poorer. It is therefore very important to secure that the overall environmental effects from changing to bio plastics actually are positive. Bio plastics' impact on the environment in the different stages of the material life cycle is debated in research and the opinions part. Research that oppose the use of bio plastics argue that bio-based plastics uses GMOs (Genetically modified organisms) and hazardous pesticides during production and they are competing with food production, this mainly concerns plastics made from rapeseed, corn or sugar but all production of bio-plastics require land that otherwise could be used for food purposes (Alvarez-Chavez et al., 2012). Some plastics like EcoPaXX and Arboform claim not to be competing with food production since EcoPaXX is made from castor beans grown on poor soil and Arboform is made of lignin that is a rest product from paper production.

Arguments against the use of biodegradable plastics are that they might impair the qualities of oil-based plastics when mixed in recycling (Swamy & Singh, 2010). On the other hand there are studies arguing that recycled plastic can contain up to 10 percent biodegradable content without obtaining impaired qualities (Karlsson-Ottosson, 2012). Further, there are many biodegradable plastics that will not degrade if the conditions are not optimal (Swamy & Singh, 2010; Dell, 2010) or they will start to degrade when it is not appreciated. Another problem is that biodegradable plastics in consumer products might actually increase the littering in nature because the consumers think it is justified to discard used products in nature instead of in the compost or bin.

The waste hierarchy from IVL Svenska Miljöinstitutet (2011)(see figure 13) shows that the environmentally best way to handle waste is, first of all, to prevent it by consuming less material. Thereafter comes reuse followed by recycling. The next stage is to extract energy by burning and last comes dispose/landfill. It is not determined where waste from biodegradable plastics belongs but it would probably be between burning and landfill.

The upsides with bio-based plastics are that they require less or no oil for production, they can be mixed with traditional plastics in recycling and they are often CO_2 neutral to produce since the plants required to produce them absorb more CO_2 than is emitted during production. In a LCA, bio-based plastics are better than oil based plastics when the waste handling is equal (IVL Svenska Miljöinstitutet, 2011). In a LCA the difference between recycling and combustion decreases with bio-based plastics. Biodegradable plastics can with advantage be used in products that often end up in nature (see a summary of pros and cons for bio plastics in figure 14).

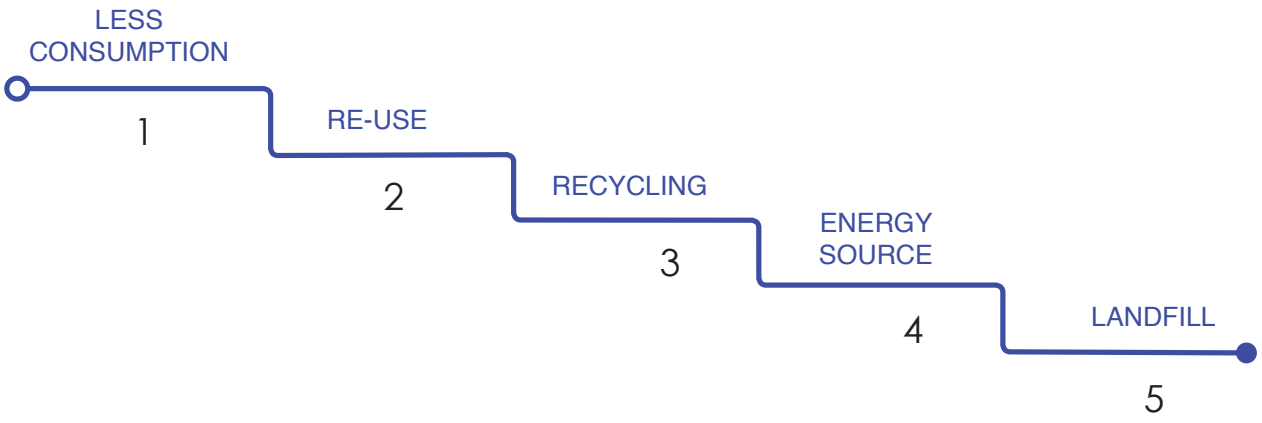

Figure 13: Waste hieracy (IVL Svenska Miljöinstitutet, 2011)

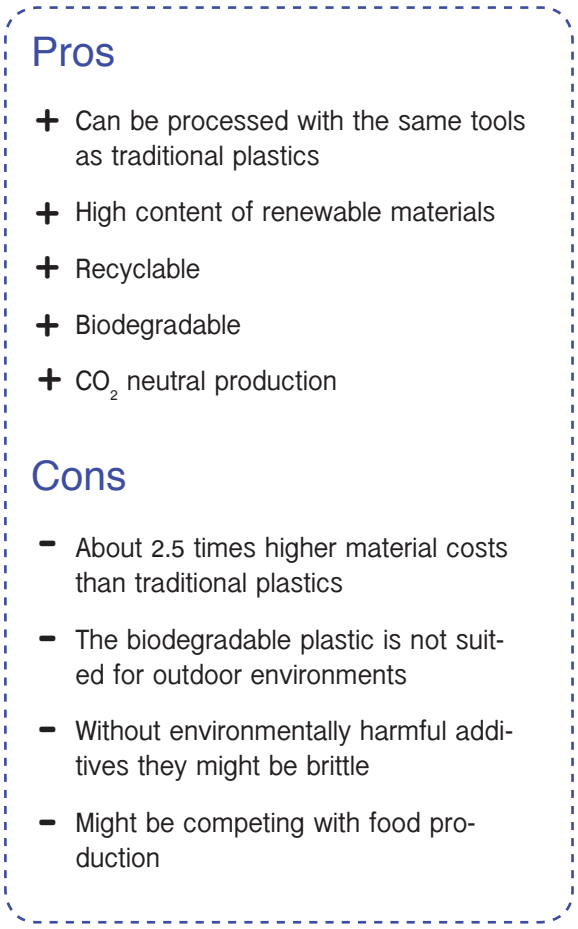

Figure 14: *Pros and cons list for bio plastics*

5.4.3 Bio composites

The meaning of bio composites in this report is plastics (bio plastics or oil-based plastics) mixed with natural fibres such as wood, flax, hemp, kenaf and jute. Most of the bio composites included in the evaluation are wood fibre composites the only exception is Acrodur/nature fibre that is an acrylic resin bonding various types of nature fibres together.

The wood fibre composites have for a long time been more expensive than pure plastics but now it is possible to get them for lower price than many traditional plastics and that makes them strong competitors (Lövdahl, 2012). Wood fibre composites can be formed with forming processes like injection moulding and extrusion and can therefore easily replace traditional plastics. One issue though is that the forming process for wood fibre composites requires more controlled parameters to prevent the moulded part from obtaining an uneven colour (see figure 16). Parameters that might affect the appearance of the part are temperature of the mould, humidity of the wood fibres and the colour pigments' ability to mix with the mould. The size of the wood fibres also influence the appearance, large fibres will be visible in the surface as grains and wood flour will give an even appearance (Lövdahl, 2012). Wood fibre composites have other mechanical properties than pure plastics. The E-modulus and density becomes higher from the integrated fibres. Wood fibre composites can be biodegradable when made from biodegradable plastics. This is the case with one Kareline composite and Arboblend made from PLA and also for Arboform made from lignin. The cheapest and most applied plastic however is Polypropylene. The advantage with wood fibre composites made from traditional plastics is that a high percentage of the material can be made from wood that is a renewable resource. It is also a more sustainable option than glass or metal reinforced plastics when a higher stiffness is requested. One problem however is that wood fibre composites are only recyclable with them selves and cannot be mixed with other plastics. In the evaluation matrix most wood fibre composites were not estimated to bring novelty within the area and the reason was that, when applied in a product, wood fibre composites appear like traditional plastics to the customer. The exceptions for this criterion were the degradable composites that bring a new function to the product that will be visible to the customer. Figure 15 shows a pros and cons list for wood fibre composites.

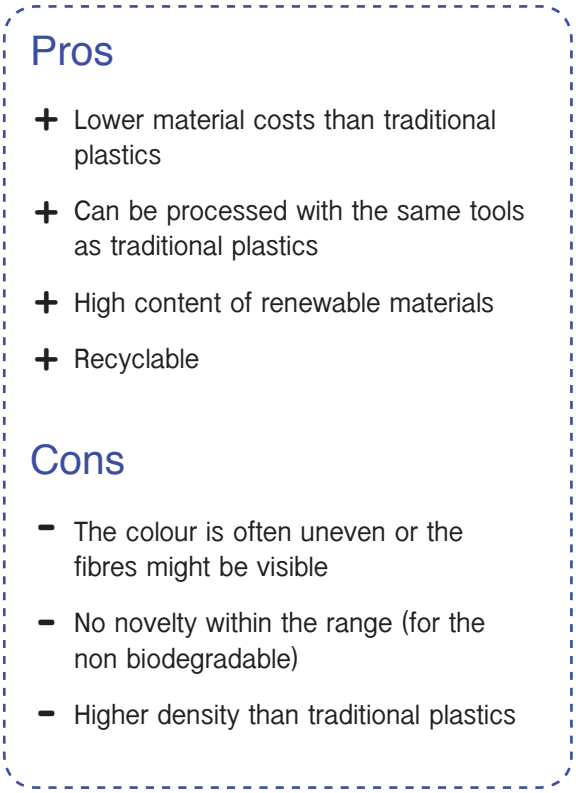

Figure 15: *Pros and cons list for wood fibre composites*

Figure 16: *Parts made of wood fibre composites. When the parameters are not controlled during the process the colours become uneven like in the picture.*

Acrodur/nature fibre on the other hand is a more expensive alternative because of the pre-processing of raw material into fibre-mats and the high prices of nature fibres in relation to wood fibres. Acrodur/nature fibre is formed with a method called deep drawing. The method is best suited for thin objects with large surfaces. Double curved objects can only be made with a limited depth with this method. Acrodur/nature fibre is a lightweight material and, even when coloured, the fibres are visible causing an organic appearance (see figure 17). Acrodur/nature fibre has an even higher content of renewable materials than wood fibre composites. However the nature fibres like flax, jute and hemp are usually less available than wood fibres (Fechter, 2012). Figure 18 summarizes the pros and cons for Acrodur/nature fibre.

Figure 17: *Tray made of Acrodur/nature fibre mat. The fibres are visible even when the material is coloured.*

Pros

+ Lightweight
+ High content of renewable materials
+ Brings novelty within the area

Cons

- Limited design possibilities
- Limited avaliability of some nature fibres
- High total costs

Figure 18: *Pros and cons list for Acrodur/nature fibre*

5.4.4 Mineral composites

The category Mineral Composites includes materials made of minerals and plastic resins. The mineral composites Corian, Hi-Macs and Cristalplant are so called solid surface materials. They are made of about 1/3 acrylic resin, 2/3 minerals and a small amount pigments (DuPont, 2012; Hi-Macs, 2012). Solid surface materials are recognised by their pleasant feel with their smooth surfaces and warm temperature. Some common applications for the solid surface materials today are washbasins, kitchen tops and decoration walls. Solid surface materials can be used in both indoor and outdoor applications and can be shaped into practically any design with thermoforming. Pieces can be joined together with invisible seams, which prevent dirt and bacteria from gathering and makes the surface hygienic and easy to clean. The materials are strong, durable and can be repaired if they get damaged. They have a density around 1.7g/cm^3. When it comes to design, the possibilities are almost endless. The materials are available in a large variety of colours and hues from stone and marble imitations with visible grains to bright white or strong playful colours.

In the evaluation the solid surface materials fell short in the cost and environment categories. The material costs are high and the manufacture process is difficult to automatize since it requires quite a lot manual work after the thermoforming and therefore the manufacture costs are high also. In the matrix the solid surface materials are approved for recycling but they are not melted and formed into new products instead they are used as they are but in new applications, it is therefore a form of down cycling. Further, the raw materials are not renew-

Pros

+ High quality material
+ Avaliable in many colours and patterns
+ Nice to touch
+ Easy to clean
+ Approved for food contact
+ Suited for outdoor products

Cons

- High material costs
- Difficulties with automatic manufacture
- No novelty in the range
- Low scores in sustainability

Figure 19: *Pros and cons list for solid surface materials*

able or recycled. However, it should be kept in mind that a product made in solid surface materials would probably have longer life than many others, which will help decrease consumption. Figure 19 shows the shows the pros and cons for solid surface materials.

Figure 20: *Samples of the solid surface material Corian*

TerraSkin is a material that is very different from the other mineral composites. It is marketed as a more sustainable alternative to paper. It consists of 80% calcium carbonate and 20% polyethylene (TerraSkin, 2012). Calcium carbonate is a mineral that makes up 70% of all minerals on earth and is considered a renewable resource. Since Calcium carbonate is naturally bright white no bleaching chemicals are necessary for the production of TerraSkin. Further, the production requires no water and therefore incurs no water pollutants. In opposite to traditional papermaking no harvesting of trees is necessary and the production only releases half the CO_2 emissions of conventional pulp paper production. TerraSkin is infinitely recyclable with itself and can also be recycled with the plastics PP, PET and PR. If TerraSkin is left outside it will break down in a similar way to eggshells into Calcium carbonate powder. TerraSkin is both water and tear resistant and possesses better printing qualities than regular paper since it does not absorb the ink. Today TerraSkin is used in products like shopping bags and packaging. Because of the reasons mentioned above TerraSkin scored high in the environment category in the evaluation. The disadvantage with the material is that it only comes in sheets, which limits the design possibilities (see pros and cons in figure 21).

Pros

+ Easy to transport
+ Brings novelty in the range
+ Environmentally friendly manufacture
+ High content of renewable materials
+ Recyclable

Cons

- Limited design possibilities
- Might be perceived as low quality

Figure 21: *Pros and cons list for TerraSkin*

5.4.5 Textiles

The textile group has been divided into two sub groups; moulded felt and other fabrics.

Moulded felt is today used as interior in drawers of the IKEA furniture Malm and also for the interior in cars (see figure 22). Moulded felt is made of fusible fibres mixed with needled felt and the combination enables the material to be moulded into three-dimensional forms (Nordifa Engineered Textiles, 2012). Thickness, colour and surface structure of the material can be varied freely. The material stand machine wash and is in some variants outdoor en-

vironment resistant. What might be a problem is that moulded felt products have very few suppliers today. The tool costs are comparable to the costs for plastics and the manufacture process is well suited for series production.

The sub group fabrics is a very broad group and it was not further divided into more specific groups because the choice of fabrics is endless and should be made when the intentions of the future product are known. For outdoor products it would be advis-

Figure 22: *Example of what felt can look like when shaped by moulding*

able to use a surface treated fabric that repels dirt and water. In general, synthetic fabrics, like polyester, are more resistant to dirt and they can also be recycled. On the other hand they are made of oil that is a depletable resource and contributes to the global warming. Cotton fabrics are better suited for indoor products and they have a softer feel than synthetic fabrics. Even if cotton is a renewable resource the environmental problem it causes are many. Some examples are the use of pesticides for the plantations and the large consumption of water.

The main benefit with applying textiles in plant pots, vases and bowls is the facilitation of handling and transportation. In comparison to glass and ceramics the textile pots will take up significantly less space and get less damaged during transports. Textiles are also versatile and highly available. They can be custom made to fit any style, design or price (see figure 23).

Pros

+ Easy transport
+ Easy to put away
+ Homy feeling
+ Well known material and manufacture methods
+ Brings novelty in the range

Cons

- Non environmentally friendly to manufacture
- Will probably need an inner pot not to leak water

Figure 23: *Pros and cons list for fabrics*

5.4.6 Cellulose

The cellulose group includes materials which's main content is cellulose. The properties and appearances between the materials in the category vary a lot. TT Sheet is a thin, 0.7mm, flexible wood veneer that is used together with a support material. TT Sheet can be made of all types of wood and can be glued to any kind of surface. Special treatment makes TT-Sheets suitable for thermoforming or injection moulding. TT Sheets can be used to give a surface the look, feeling and finish of real wood. Today TT Sheets are used in the car industry and for fashion items.

Bendywood is a wood material shaped into railings or lists that can be bent by hand without any heating process. It is made through compressing wood lengthwise until the pieces become about 20% shorter than their original length. In the compressed state the fibres are organised like a harmonica and therefore the wood pieces can be bent without cracking. Bendywood is used in e.g. railings and lists where it can make the installation process easier and save a lot of time. If Bendywood is exposed to water it will go back to its original form.

The cellulose material Zelfo is recyclable, renewable and biodegradable. To produce Zelfo, natural cellulose-containing materials are grinded up with water. Many of the materials used to make Zelfo are normally waste materials. The mechanical properties of moulded Zelfo are similar to those of hardwood. Zelfo can be moulded into three-dimensional products without any resins or binders. The methods used for forming Zelfo are spray moulding and a compressive method using a female and a male mould. Zelfo can be made in sections thin enough to be translucent. With spray moulding the possible thicknesses range between 2-5mm. However, thicker section takes longer to dry. The material is water resistant but not suitable for complete immersion (Shelley, 2006).

Durapulp is another renewable cellulose material that can be used to create three-dimensional shapes. Durapulp is produced in Sweden by Södra and consists of selected cellulose pulp and the biodegradable plastic PLA. Unlike traditional paper products Durapulp is strong, durable and highly water resistant. Durapulp products can be shaped from sheets or by moulding followed by heat pressing. Durapulp can be dyed in strong, bright colours. Today it exists in a children chair (see figure 24) and a table lamp. The material surface has a natural rough look but development work is ongoing to find ways to create new shapes and textures for Durapulp (Södra, 2011).

Figure 24: *Parupu, childrens chair made of Durapulp*

The last material in the cellulose group is Re-Y-Stone. It is a hard, durable and dimensionally stable sheet with a resistant surface. Re-Y-Stone is made from recycled core and décor paper and natural resin extracted from sugar production waste. It comes in dark brown and black colours. The surfaces are decorated with structures with natural appearances (Resopal, 2012). Re-Y-Stone is mainly used as a surface material for walls, floors and furniture. It can be slightly bent but not to any small radii or double curved surfaces. It is manufactured in thicknesses between 0.8-12mm. See a summary of pros and cons for cellulose materials in figure 25.

Pros

+ Uses a highly available raw material
+ Recyclable
+ Biodegradable
+ Environmentally friendly production
+ Diverse
+ Low density

Cons

- Not many manufacturers today
- Not tested in other products
- Design possibilities might be limited

Figure 25: *Pros and cons list for cellulose materials*

5.4.7 Concrete

From the first selection made after the market study three concrete materials remained; Ductal concrete, Lightweight concrete and MPBWC. Lightweight concrete was eliminated during the detailed analysis because it cannot stand dew and frost and for a concrete plant pot outdoor environment resistance is a demand. MPBWC was also eliminated since there is no series production available today.

Pros

+ Strong material well suited for outdoor applications
+ Unique expression

Cons

- Expensive
- Large CO2 footprint
- High density
- Not recyclable or renewable

Figure 26: *Pros and cons list for concrete materials*

The remaining concrete called Ductal is an ultra-high-performance concrete made from a mineral matrix reinforced with metal or organic fibres. Ductal is especially developed for structural or architectural applications. Compared to other concrete materials it has very good qualities in strength, ductility, durability and aesthetics. It can be used to create surface textures and shapes for a wide variety of applications. Ductal can be coloured and moulded and is outdoor environment resistant (Lafarge, 2012). See pros and cons in figure 26.

5.4.8 Top List from evaluation matrix

The results from the evaluation matrix can be seen in the top list in figure 27. The material with the highest score was the cellulose material Zelfo. On second place came Arboform, the bio plastic composite made from lignin and natural fibres and on third place came fabrics. The existing materials are marked with circles. The existing material with highest score was plastic, which came on a shared fourth place.

MATERIAL	SCORE
Zelfo	46
Arboform	43
Fabric	41
NaturePlast, EcoPaXX, Plastic	40
Arbofill, Kareline, Arnitel Eco, Nordifa, Durapulp	39
Arboblend, Hiendl NFC	38
Acrodur + nature fibres	35
TerraSkin, Glass	34
Ceramics	33
Metals	32
Re-Y-Stone	31
Corian, Cristalplant, Hi-Macs	28
TT-Sheet, Ductal	25
Bendywood	24

Figure 27: *Top list presenting the total scores from the evaluation matrix*

5.5 User experience analysis

The third part of the analysis was intended to investigate the users' opinions of the materials and their attractiveness when applied in pots, bowl and vases. For this purpose a focus group was held.

5.5.1 Procedure of focus group session

During the focus group session, the participants were shown material samples of one material group at a time. They were first given a few seconds to look at the samples before they could touch them. The participants were not given any information about the materials. After examining the samples the participants filled in a questionnaire (Appendix IV). The purpose with the questionnaire was to give the participants time to form an opinion about the material and evaluate each material in private before they might become affected by the other participants' opinions. The questionnaire was also used to collect structured data to help analyze the results afterwards. When the questionnaire had been filled in a discussion was held with the intention to hear the argumentation behind the answers and get a deeper understanding of the participants perception of the materials. The same procedure was done for each material group. The questions concerned how much they liked the different colours and patterns, what they thought of the feel and quality of the material and how well it would fit for the products in question.

5.5.2 Participants

Seven participants, with an age range between 22 and 56 years, were invited to the focus group. Six of the participants were female and one was male. On a scale from 1 to 10 the participants valued their interest in home decoration in a range between 5 and 10. The mean value was 7.1. On the question about their interest in plants, flowers and vases the answers spread between 4 and 10. The mean value was 6.1.

5.5.3 Stimuli

IKEA products and material samples were used as stimuli during the focus group. The products were collected from the IKEA vase, bowl and plant pot range. The purpose with the products was to help the participants understand what different types of products that were included in the research and to give them something to refer to in the discussion.

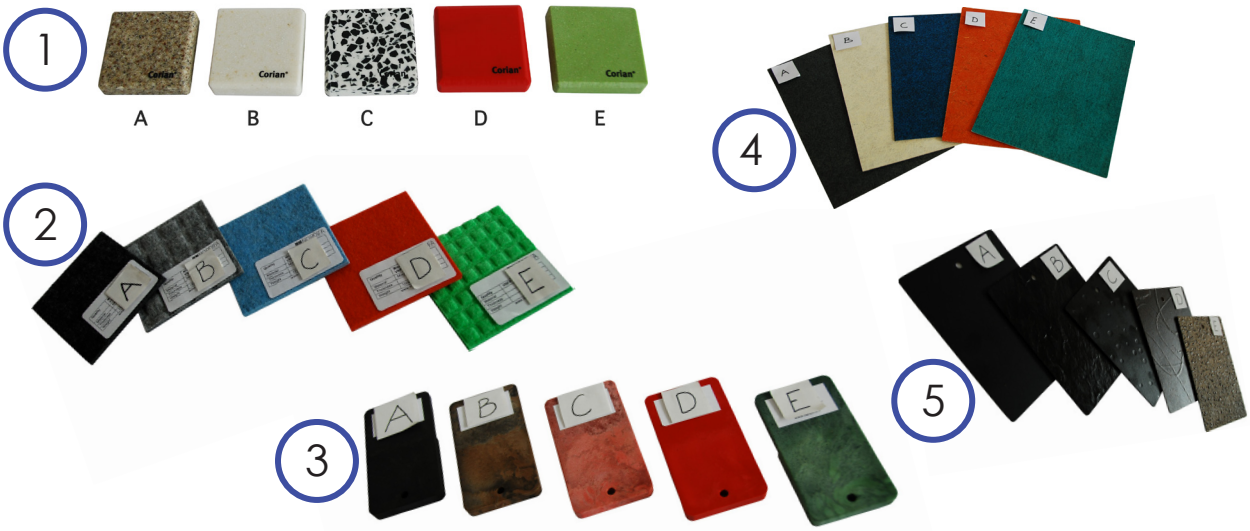

***Figure 28**: Stimuli used for the five material groups. 1. Corian, 2. Moulded felt, 3. Kareline, 4. Re-Y-Stone, 5. Acrodur/Nature fibres*

The products included one indoor pot, one outdoor pot, one vase and one bowl.

Further, each material group was presented with five samples in various colours and patterns/hues (see figure 28). By presenting five samples of each group the participant could see the versatility of the material and give a more accurate valuation. The five material groups that were included in the focus group were:

1. Corian – Solid surface material
2. Nordifa – Moulded felt
3. Kareline – Wood fibre composite
4. Re-Y-Stone – Compressed cellulose
5. Acrodur/Nature fibres – Acrylic resin with various nature fibres

Two of the material groups, Nordifa and Acrodur/Nature fibres, were also presented with example objects showing how they can be formed into bowl like objects. This stimuli was used for the reason that the participants found it hard to visualise these particular materials in any other shape than flat sheets.

5.6 Results from user experience analysis

Both the questionnaire and the discussion clearly showed that Corian was the favourite material group (see a transcript from the discussion in Appendix V and a summary of the questionnaire results in Appendix VI). It got the highest mean value in all inquires. The participants mainly liked Corian because it felt robust, solid and easy to clean which were characteristics they associated with good quality. Most of them preferred the samples A and B because they liked the look of stone. E and D resembled plastics, because of their bright colours, and therefore felt less luxurious. The bright colours were also regarded as seasonal and some participants expressed that the Corian was not suited for seasonal products. B and E have similar grain patterns and this pattern was more appreciated in B because it was associated with stone and therefore fits better with natural colours. The pattern in C stood out from the others and the reactions to this sample were very diverse. The participants either strongly liked it or strongly disliked it. The ones who liked it however, wished to see it in large sized products. Corian was also perceived as a material well suited for outdoor pots. Other products the participants regarded Corian as well suited for was indoor pots and vases.

> "I think it has a nice feeling. If you make a product out of it it feels like it would be of good quality"
>
> *- Participant about Corian.*

The moulded felt from Nordifa could in general be said to be the least liked material for this kind of products. The participants found it a lot more difficult to valuate this material and a lot of confusion was sensed. This was also visible in the results from the questionnaire where the answers were widely

spread and a lot of comments were scribbled next to them. One example was that the participants seemed unable to visualize the material applied in the products in question and instead suggested other products they would like to see it in. One reason for this is probably that the material has not yet been widely used for vases, bowls and plant pots. Only one respondent answered that it could be used in the suggested products and that would be in a pot for indoor use. The other products that were mentioned as suitable for moulded felt were interior in drawers, Christmas tree decorations and glass and pot mats. Many participants agreed that the most colourful samples looked like dishcloths because of the square shape and their pattern. However, the colours and patterns were still well liked. The most popular samples were A and B. They were considered stylish and easy to match. For moulded felt, seasonal colours were a lot more appreciated then they were for Corian. The reason was that the material was perceived as cheaper and easy to put away so it should be used in products that can be changed depending on mood or season. Many comment about function came up like; this is too difficult to clean, it will not stand soil and water or it is not hygienic together with food.

"I like the dark grey colour and the hue of it. It feels stylish. And the others make me think of dishcloths"

- Participant about moulded felt.

The response to Kareline was quite positive. Again, the natural colours A and B were most appreciated. Even though the hue in B, C and E were very similar it was much more liked in B. The explanation was that in B it enhances the look of a nature material like stone or wood while in C and E it only looks like a mistake that is not meant to be. This is interesting since one challenge when producing wood fibre composites is to get a nice and even colour when in fact the hue can be something positive when combined with the right colour. The participants did not seem to mind that the material was pretending to be something that is was not. Instead they were positive to this kind of imitations because it enables expensive looking products to lower prices. Kareline was perceived as a strong material and all participants mentioned at least one product they would like to see it in. The most mentioned products were outdoor pots and bowls.

"Stone is quite expensive. I would imagine you get a better price for something in this"

- Participant about Kareline.

For Re-Y-Stone the reactions were a lot more scattered. Again, the nature imitation was the most liked colour and pattern, namely B that is an imitation of slate. Sample E that resembles granite was also appreciated. There were many disapproval comments about the materials sensitivity to fingerprints and about the backside of the material that exposes the material uncoloured. If Re-Y-Stone was to be used in a product the participants would prefer if the edges and backside were invisible to give the material an impression of better strength and quality. Another disliked feature was the shininess of several samples, which was believed to contribute to a fake or plastic appearance. The lack of bright and light colours was not perceived as a problem for the intended application. The product application that got most responses was outdoor plant pots.

"It feels like they are very sensitive to finger prints. Especially this, C"

- Participant about Re-Y-Stone.

The last material group, Acrodur/nature fibres, was appreciated by some participants for its organic, natural look while other participants rated it as their least favourite because of its "hairy" look and feel. The black (A) and white (B) samples were once again the most liked colours and patterns. The white sample was said to look clean and fresh and some participants liked the way the fibres were visible through the semi-transparent colour. Sample E has a more organised artificial-looking pattern that was not liked by any of the participants. The material was not considered suitable for outdoor applications. One participant mentioned that it looked like it would go back to the natural life cycle if left outdoors too long. The most common answer for product application was bowl.

"You can feel that it is hairy. I like the style but I would never like to have food on a tray like this"

- Participant about Acrodur+Nature fibres.

6 Conclusions - Part 1

In the following chapter the conclusions from the material investigation are presented. Specific conclusions have been made for every material group that was a part of the evaluation. There is also a conclusion based on the focus group session and a final remark of which materials that were evaluated as the most interesting to bring into the second part of the project.

6.1 Material conclusions

In this chapter the conclusions made for each material group are presented. The conclusions can be seen as recommendations to IKEA.

6.1.1 Bio plastics conclusions

Bio plastics are still too expensive to be used in the IKEA range but definitely worth keeping an eye on for the future. Concerning the product category that is in focus in this project, bio-based plastics are of higher interest than biodegradable plastics but their origin has to be carefully controlled to ensure they are not competing with food production or having other harmful effects. Biodegradable plastics are only interesting for applications in products where the biodegradability fulfil a purpose. For example, they can be applied in products that often end up in nature after use.

6.1.2 Bio composites conclusions

Bio composites are of high interest for the IKEA decoration range because of their low price, good quality and high content of renewable material. IKEA have very good internal knowledge about wood fibre composites and are able to develop composites with the preferred profiles and select suitable forming processes. Acrodur/Nature fibres will be more expensive but if the price can be lowered the material will be interesting for applications where an organic appearance and lightweight design is searched.

6.1.3 Mineral composites conclusions

Solid surface materials are interesting for applications in high quality, exclusive, long-life products. It is important that the design support this expression if the customers should be willing to pay the higher price that comes with the material. Since bright colours are perceived as seasonal and trend sensitive it might be preferable to select more neutral colours. A lot of work will be required to develop a more automatic manufacture process.

6.1.4 Textiles conclusions

Textile is a very interesting material for application in the decoration range. The material is versatile and can be used in products with a variety of expressions and stiles. Since it is a material that IKEA is already well familiar with the implementation would be relatively simple. The product prices can be low and transports and handling will be easy compared to e.g. glass or ceramics. Moulded felt is an interesting branch of textiles but it was not appreciated by the participants in the focus group and might therefore be more difficult to introduce in the range.

6.1.5 Cellulose conclusions

In the cellulose group Zelfo is the most interesting material. With its design possibilities, novelty and low weight it has high potential for application in IKEA vases, bowls and plant pots. However, the fact that the material is new also makes it more risky to invest in and unexpected problems might occur concerning e.g. manufacture or quality.

6.1.6 Concrete conclusions

The reason to use concrete would be if the expression and feeling of concrete is very important for the design, otherwise there are better alternatives. This mainly because of the low scores concrete received in the environment category in the evaluation.

6.2 Other conclusions

In this chapter conclusions from the focus group and the selection of materials for part 2 are described.

6.2.1 Focus group conclusions

The general conclusion of the focus group session was that nature materials like stone, wood and bio fibres, or imitations of those materials, are regarded as well-suited for decoration products such as plant pots, vases and bowls. The most liked colours were consequently the most neutral colours like black, white and grey. All participants valued Corian high-

est when ranking the materials. The main reason to why Corian became the favourite was because the participants associated it with high quality and exclusiveness.

In contradiction to the preference of high quality, neutral and long-lasting materials, most participants also agreed that it is fun to decorate the home with seasonal products recognised by bright, strong colours. These products should allow easy dispose or storage. A connection could be noticed between materials associated with a low price and the approval of strong colours.

Another recognized opinion during the session was that the most preferred materials were also the materials most resembling the materials used for this kind of products today. The more deviating materials were not appreciated for this application.

6.2.2 Selection of materials for Part 2

For the second part of the project it was an aim that the three selected materials for the development work should be as diverse as possible since this was believed to lead to more interesting results. The selected materials should also represent the most promising alternatives based on the analysis executed in Part 1. The three materials with highest scores from the evaluation matrix, Zelfo, Arboform and fabrics, made up a good selection since they represented three different material groups. However, Arboform was not considered a suitable material for the IKEA decoration range because of the uncertainness about bio degradability and the high price. Arboform was therefore replaced with IKEA:s own wood fibre composite that has the same appearance as Arboform but is non-degradable and has a lower price.

The results from the focus group were also considered when the selection was made but since the focus group only included five of the materials and there seemed to be a tendency among the participants to prefer the most conventional choices it was decided to mainly base the selection on the results from the evaluation matrix. The evaluation matrix together with the detailed material analysis also gave a much more profound knowledge about the materials compared to the focus group results that focused more on aesthetics and emotion.

The final selection of materials to be brought into Part 2 was therefore; Zelfo, wood fibre composite and fabrics.

Part 2 - Concept Development

7 Introduction - Product development

This introduction to the second part of the project, called the Concept Development part, gives a summary of the aim and goal of the development work. It also repeats the most important conclusions concerning the material selection that were made in the first Material Investigation part, since these conclusions make up the background and very much influence the work in the second part.

7.1 Aim

The aim with the second part was to highlight the design possibilities of the new materials but also to point out the limitations. Further, the created concepts were intended to be inspirational and trigger new ideas and input for the IKEA vases, bowls and plant pot ranges.

7.2 Goal

As mentioned in the Introduction chapter of the report the goal of the second part was to create concepts, of three of the evaluated materials from part 1, that illustrate how the new materials can be used. The concept should also meet the IKEA requirements regarding logistics, costs, sustainability, attractiveness etc.

7.3 The selected materials

The three materials that were selected from the material investigation were the cellulose material Zelfo, wood fibre composites and fabrics. The argumentation for the selection was to a high extent based on the results from the evaluation matrix. The selected materials were regarded as the most interesting and promising materials for IKEA to apply in the decoration range in the future. Zelfo and fabrics were two of the materials that ended up in top three. The third material was Arboform but since the advantages with biodegradability are uncertain and the price for Arboform is too high for IKEA today Arboform was replaced with IKEA's own developed wood fibre composite. The three materials were also selected because they belong to three different material groups and therefore can represent a very broad expression and function range.

7.4 Delimitations

In the second part costs were not included. The reason for that was that they were already investigated in Part 1 and the cost for a final product is very dependent on negotiations with suppliers, transportation arrangements etc. and the product development in this project would not go deep enough to determine these details.

7.5 Development process

The product development process consisted of three parallel paths with focus on one material each. At first the focus laid on all the products vases, bowls and plant pots but later in the process it was determined to only investigate one of them, namely plant pots. When the product focus was determined the idea generation became more focused and for each material the most interesting features were selected and investigated. The three different paths were kept throughout the entire process. The phases Second idea generation and Detailed design included many iterations. The results obtained at the end of the product development were; one Zelfo concept, one wood fibre composite concept and two fabric concepts.

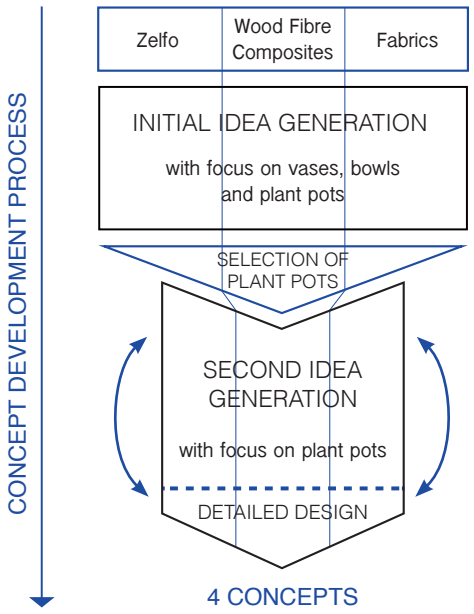

Figure 29: *Illustration of the concept development process*

8 Concept development

The following chapter describes the concept development work of this project. All steps are presented in a chronological order. The paragraphs firstly present how the work was done, what methods that were used and the argumentation behind all decisions and that is directly followed by a short presentation of the outcome of each step.

8.1 Function analysis

The focus for this project was all the IKEA products vases, bowls and plant pots. Since it was not known from the beginning what the resulting product designs would be, a function analysis (see chapter 2.3.2) was made including all the products of concern (see figure 30). In the function analysis a distinction was also made between indoor and outdoor pots since many of their functions differ. All functions were sorted into the categories aesthetics, functionality, expression, construction and safety. For each product a general main function was determined and a main function was also selected for each category. For plant pots the main function was considered to be to cover the inner pot and for vases and bowl the main function is to provide placements for flowers, fruits etc.

The function analysis was used to clarify the main and part functions of each product and to make up a starting point for the first idea generation that would eventually lead to a decision of what product/products to focus on.

8.2 Design guidelines

Before the idea generation was started the prerequisites for each material was stated. They were written down in texts that included information about possible forming methods, colours, eventual limitations etc. Most of the information was collected by discussions with the suppliers.

8.2.1 Zelfo

For Zelfo there are two possible forming methods; spray moulding and compression moulding. For spray moulding a flexible mould is used that is filled with sand. The mould is then sprayed with liquid Zelfo with a technique similar to the one used for car lacquering. When the material is dry the sand is poured out and the mould can be removed. With this technique no consideration has to be taken to draft angles but the design needs an opening where the mould can be removed. The method is not suitable for designs with sharp edges (Hurding, 2012).

The compressing method uses a female and a male mould together with high pressure to form the material into its final shape. When using this method sharp edges can be made but draft angles have to be included in the design. The thickness for a Zelfo design can vary between 2-5mm. A larger thickness requires longer time to dry (Hurding, 2012).

Zelfo is well suited for designs with surface structures/patterns. The pattern can easily be pressed onto the surface before the material is completely dry. The colour options for Zelfo are unlimited and many of them are made from natural sources. The natural colour of Zelfo varies from shades of light grey to beige depending on the raw material. If a lighter colour than the natural is aimed the material has to be bleached with Titanium oxide. It is not possible to combine two colours in one design.

Since Zelfo is very lightweight compared to glass or ceramics it will provide less support when used in a design. The designer should therefore ensure the design has a solid enough base so that the product will not fall. Zelfo can be made waterproof but is less suited for outdoor applications.

8.2.2 Wood fibre composites

Wood fibre composites made of PP plastic and wood fibres can be injection moulded like traditional plastics. However, the process requires more controlled parameters if the result shall have an even colour and not the uneven surface appearance that was explained in chapter 5.4.3. The look of wood fibre composites also depends on the size of the wood fibres. When larger fibres are used the material gets an appearance with visible grains and when the plastic is mixed with wood flour the surface colour becomes completely even (Lövdahl, 2012).

When injection moulding, a design with few parts is preferred since that will lower the tool costs. Draft angles have to be included in the design but they can be very small.

Wood fibre composites are waterproof and outdoor environment resistant. The material can be used in thin-walled designs thanks to its high E-modulus.

	INDOOR PLANT POT	OUTDOOR PLANT POT	VASE	BOWL
Main function	**Cover the inner pot**	**Cover the inner pot**	**Provide placement for flowers**	**Provide placement for fruit, candles or other objects**
Category main function	Be decorative	Be decorative	Be decorative	Be decorative
AESTHETICS	• Cover the inner pot • Present the material in its most attractive way • Be versatile • Offer flexibility	• Cover the inner pot • Present the material in its most attractive way • Be versatile • Offer flexibility	• Present the material in its most attractive way • Be versatile • Offer flexibility	• Present the material in its most attractive way • Be versatile • Offer flexibility
Category main function	Provide placement for plants	Provide placement for plants	Provide placement for flowers	Provide placement for fruit, candles or other objects
FUNCTIONALITY	• Protect table, window etc. from dirt and water • Provide support • Sustain normal use • Sustain water and soil • Facilitate organisation	• Keep the inner pot from leaking dirt and water • Provide support • Sustain normal use • Sustain water and soil • Facilitate organisation	• Provide water for the flowers (not superficial flowers) • Provide support • Sustain normal use • Sustain water • Facilitate organisation	• Provide support • Sustain normal use • Sustain water and soil • Facilitate organisation
Category main function	Express quality	Express quality	Express quality	Express quality
EXPRESSION	• Express personal style • Express IKEA	• Express personal style • Express IKEA	• Express personal style • Express IKEA	• Express personal style • Express IKEA
Category main function	Consider design limitations from manufacture process	Consider design limitations from manufacture process	Consider design limitations from manufacture process	Consider design limitations from manufacture process
CONSTRUCTION	• Facilitate production • Facilitate handling and transportation • Consider material and manufacture costs • Maximise stability • Minimize waste	• Facilitate production • Facilitate handling and transportation • Consider material and manufacture costs • Maximise stability • Minimize waste	• Facilitate production • Facilitate handling and transportation • Consider material and manufacture costs • Maximise stability • Minimize waste	• Facilitate production • Facilitate handling and transportation • Consider material and manufacture costs • Maximise stability • Minimize waste
Category main function	Minimize the risk of injury	Minimize the risk of injury	Minimize the risk of injury	Minimize the risk of injury
SAFETY	• Minimize emission of harmful subjects	• Minimize emission of harmful subjects	• Minimize emission of harmful subjects	• Minimize emission of harmful subjects • Allow food contact

Figure 30: *Function analysis*

8.2.3 Fabrics

Fabrics are a very versatile group of materials, both in appearance and function. It is important to base the decision of fabric on the intended function and context of the future product. With various treatments fabrics can receive water repellent and outdoor environment resistant qualities. Some fabrics are thicker and more stable and can therefore alone give sufficient support for an upright design. Thinner and softer fabrics might need extra support from another fabric or flicelin.

The styles, colours and patterns for fabrics are unlimited and they can be combined freely. It can be good to keep in mind though the shrinkage caused by wash. If fabrics with different shrinkage are combined in one design the shape of the product will probably be damaged in the first wash.

For products in fabrics there are also many decoration details available, like zippers, buttons and lace.

8.3 Initial idea generation

In the first idea generation phase all three materials were investigated for use in all three product categories. The methods used for the work were simple drawings, basic sketch models (see chapter 2.5) and one-man brainstorming (see chapter 2.4.1). Tools like Osborne's idea spurs (see chapter 2.4.2) and home decoration magazines were used for inspiration. All basic geometries were implemented and scaled to various dimensions in order to find interesting shapes. The work was finished after a couple of creative sessions, with a few iterations, when no new ideas came up.

All sketches and models were analysed and a couple of reoccurring features were found. The features for each material were placed in a matrix with the intention to create a tool for the further development, which could be used to easily combine different features into new ideas. The features that were considered to be of highest potential are marked with circles (see figure 32). The reasons to why these features were regarded as the most interesting are explained further in chapter 8.6.

8.4 Decision about product focus

From the function analysis and the results from the idea generation a decision was made to focus on indoor and outdoor plant pots for all three materials. The decision was made because it would be too much work for the time frame to keep developing three different designs for each material and from the first idea generations it was clear that plant pots was a product that would be possible to make of all three materials. Selecting the same product for all three materials would also facilitate the comparison between the final concepts. Another reason to chose to focus on plant pots was that a lot more functions were seen in this product than it was in bowls or vases and that provided a possibility to develop more diverse final concepts.

8.5 Specification of requirements for IKEA plant pots

When the product category was determined a specification of requirements was set up (see figure 31). The specification of requirements would help to point out the aspects to consider for each concept and later be used to evaluate the final concepts. The requirements were organised into the categories functionality, aesthetics and environment. A more detailed specification can be seen in Appendix VII.

Functionality

- Be durable
- Be stable
- Facilitate watering
- Facilitate handling
- Be easy to clean
- Be easy to transport/store
- Prevent leakage

Aesthetics

- Be attractive
- Be versatile in style and function
- Fit many peoples' styles
- Fit the IKEA range
- Bring novelty

Environment

- Be recyclable/separable
- Minimize waste material
- Minimize material use
- Use renewable materials
- Use recycled materials
- Use energy efficient production
- Have low density
- Use environmentally better materials (well managed sources or proven lower environmental impact)

Figure 31: *Specification of requirements fro IKEA plant pots*

	ZELFO	WOOD FIBRE COMPOSITES	FABRICS
SHAPE	Spray moulding • Rounded shapes • Waist Compressing method • Widening shape • Rectangular • Triangular • Circular	Circular Rectangular Triangular Thick Thin Long Short Large Small	Circular Rectangular Triangular Stable Sacky Wide Narrow
COLOUR	Bright • Colourful • Non-ecological Dark • Unbleached • Ecological	Even • Coloured • Black Uneven • Natural colours • Artificial colours Visilble grains	Strong Discrete Combinations
PATTERN	Surface texture	Splines	Traditional Modern Combinations
FUNCTION	Handles Wall mounted Watering Stackable Combination pot	Handles Wall mounted Watering Stackable Combination pot Indoor Outdoor	Inside out Handles Waterproof Outdoor Indoor Stability Buttons/zippers

***Figure 32**: Compilation of the different features that are possible for each material*

8.6 Second idea generation with focus on plant pots

In the second idea generation more descriptive drawings were made and dimensions were investigated with the CAD program Solid Works (see chapter 2.5.3). The features that had been estimated as the most promising in the inspiration matrix were the focus of the work. The specification of requirements was used throughout the work to evaluate the ideas and find areas for improvement.

8.6.1 idea generation - Zelfo

In the idea generation for Zelfo, different surface textures were looked into because this is the feature that makes Zelfo stand out from other materials. Dark colours were also selected since they were more environmentally friendly. Drawings were made of regular and irregular patterns, detailed motifs and 3D surfaces (see figure 33). The most interesting surface structures were then further investigated and tried out on different plant pot shapes with various dimensions. The patterns were also investigated in combination with other colours. The surface structures were mainly investigated with

hand-made drawings and the dimensions were investigated in Solid Works.

8.6.2 Idea generation - Wood fibre composite

Wood fibre composites do not bring any visible novelty in the area since their appearance resembles traditional plastics. To make the design more interesting and add an extra value, an innovative function was therefore incorporated. The function valued as most interesting to develop was a pot with combination possibilities for more than one inner pot (see figure 34). The material's possibility to obtain shifting colour with a natural look caused by the forming method was also regarded as an interesting feature since it was well liked in the focus group that was executed in Part 1. The focus group results also indicated that the uneven colour would come to its rights in a design with large surfaces.

8.6.3 Idea generation - Fabrics

Fabrics offer a possibility that the other two materials were lacking; to combine more than one colour in the same design. This feature can for example be used in a two-sided design that would differentiate the pot from other products since it will be able to change colour by being turned inside out. The two sides can also be used to fold down the top and give the pot a decorative edge. There was also a potential seen in applying fabrics in an outdoor context, for example for wooden decks or balconies (see figure 35).

Figure 33: *Drawings illustrating how surface textures were investigated for Zelfo*

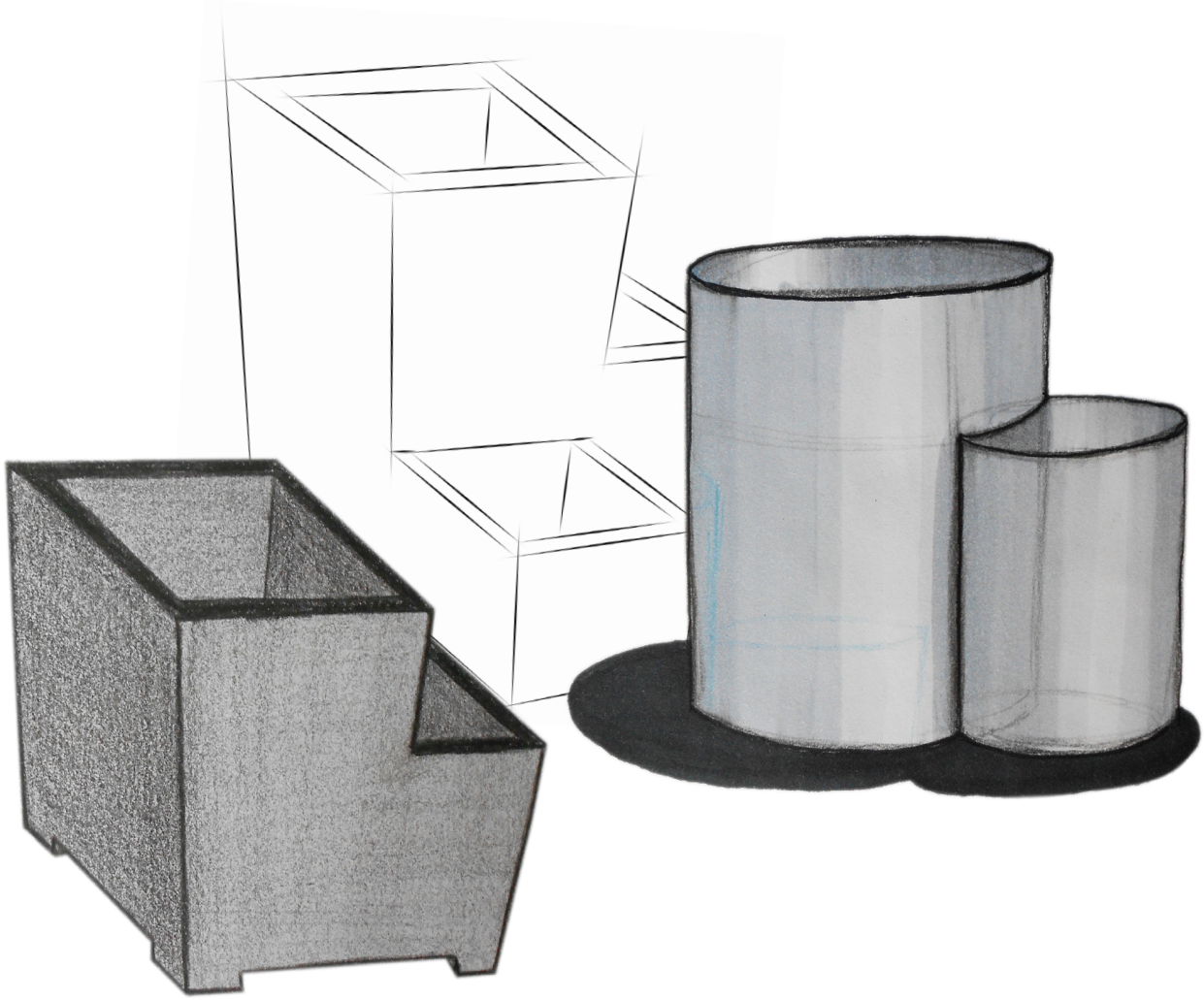

Figure 34: *Sketches illustrating combination plant pots of wood fibre composite.*

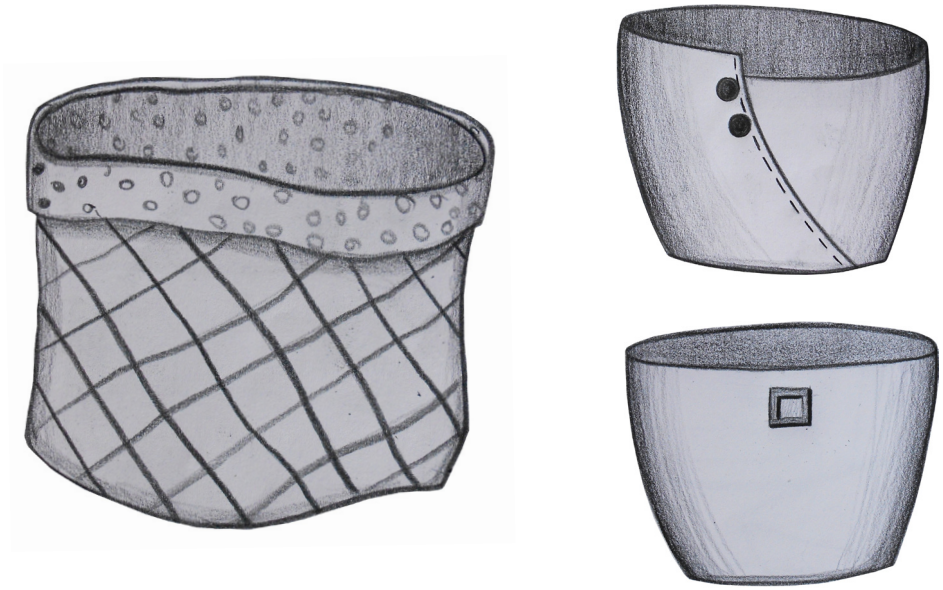

Figure 35: *Sketches illustrating ideas for fabric plant pots*

8.7 Detailed design

When the general features for each material were determined, the detailed design phase started. In this phase the design of each product was developed with focus on construction, function and aesthetics. The goal of the detailed design phase was to make the product designs developed enough to be manufactured without any significant changes required.

8.7.1 Inner pot sizes

When deciding dimensions for the plant pots it was not only important to consider the aesthetics but also the available sizes of inner pots. Most plants today come in inner plant pots, which are placed directly into the decoration pot. If the decoration pot is waterproof it is of course possible to place soil and water directly into the pot too. In order to offer the customer both alternatives it is a good idea to design plant pots that fits the sizes of the inner pots. At IKEA, decoration pots are designed to fit seven different sizes of inner pots with diameters between 105-320mm (See Appendix VIII).

8.7.2 Detailed design - Zelfo

Among all the surface patterns that were created in the second idea generation a dotted pattern was selected for the final Zelfo design. The decision was a matter of taste and was therefore made on personal preferences from a small informal inquiry. The pattern consisted of debased, irregular dots in various sizes (See figure 36). To add an extra dimension to the design a few of the dots perforated the wall completely. The perforating holes were all placed on the upper part of the pot so that the inner pot would not become visible through them. A circular form was selected for the basic shape and the dimensions were further investigated in Solid Works (See figure 37). It was also determined that the pot should fit inner pots of sizes with a diameter up to 140mm and be for indoor use.

Figure 36: *Sketch of what the dotted pattern would look like when placed on a plant pot.*

Figure 37: *Simple models made in Solid Works were used to determine the basic shape of the Zelfo plant pot.*

8.7.3 Detailed design - Wood fibre composites

The main challenge with the combination pot in wood fibre composite was how to facilitate transportation and handling of the product. Since a combination pot is not stackable it would otherwise be rather bulky. It was decided that it would be easier to solve this issue for a design with flat sides, therefore the designs with round shapes were discarded. Three different approaches to solve the problem were investigated:

1. Flat package
2. Tailor-made dimensions to efficiently fill pallets
3. Two-parts solution

The first approach, flat package, would be a design consisting of several parts that would be assembled by the customer (see figure 38). The advantage would be that the product then could be placed in a flat package and more of them would fit onto the pallets used for transportation of IKEA goods.

However, one problem with this design would be the many tools required; one for each part. The plant pot would not be waterproof either since it would leak in the joints. By placing plastic bags inside the

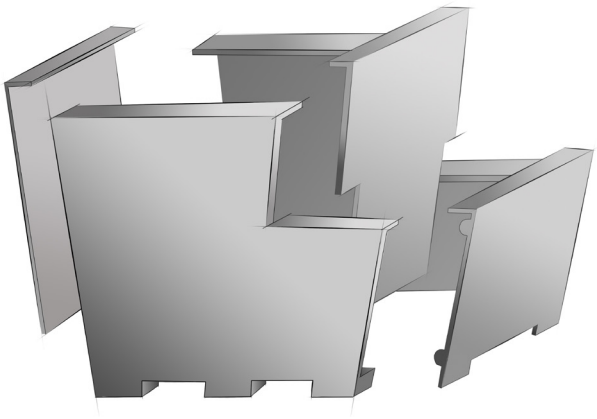

Figure 38: *Construction of plant pot for flat packages*

pot the last mentioned problem could probably be solved but that would make the already complicated assembly even more complicated for the customer. Due to the problems mentioned above the idea was eliminated.

The second approach was to adapt the dimensions of the plant pot to make it possible to place one on top of another (see figure 39) and also adapt the dimensions of the plant pot to efficiently fill a pallet (See figure 40).

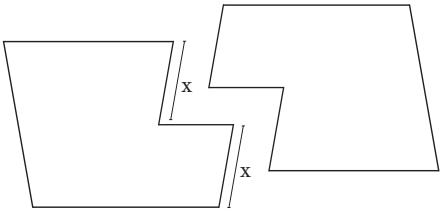

Figure 39: *Two pots in profile. If the sides marked with x are of the same length two pots will fit together like shown in the picture.*

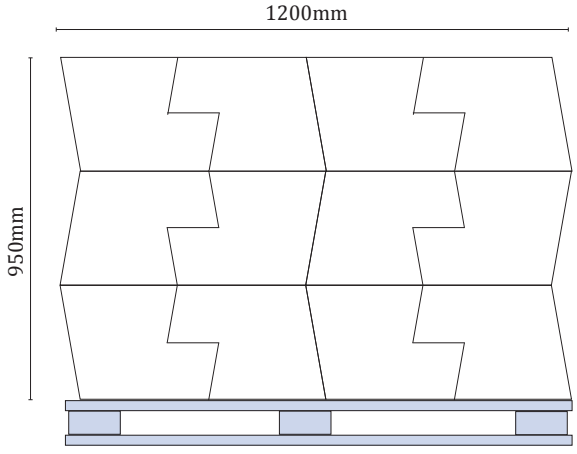

Figure 40: *Illustration of how the dimensions of the plant pot can be optimised for the size of a pallet.*

With this approach another problem occurred; the planned design would not be possible to make in one part because of the angle of the wall between the two pots. To change this felt like a too large compromise with the aesthetics and therefore this approach was also eliminated.

The third approach was to divide the plant pot into two parts; one large square pot and one smaller part that could be attached to the larger pot. The two parts can then also be used on their own (see figure 41). The small part would then fit into the larger pot and the customer receives them in one package.

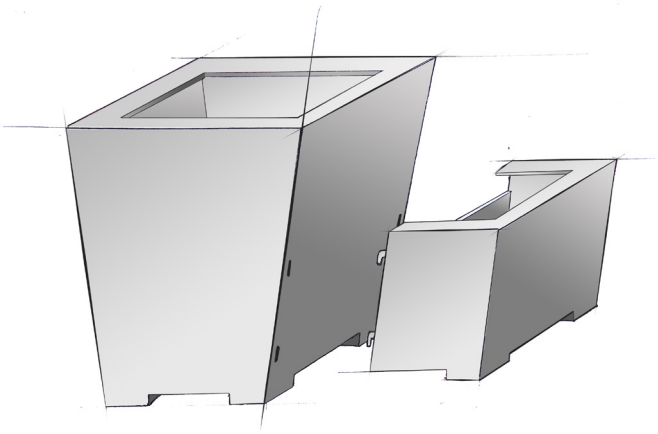

Figure 41: *Construction of two-parts soloution*

The two parts would be possible to make with injection moulding with a few minor changes to the design. It was therefore decided to use this approach for the final design.

The work proceeded with the development of dimensions, thicknesses and aesthetics. The product was intended for both indoor and outdoor use.

8.7.4 Detailed design - Fabrics

For fabrics two different designs were kept from the second idea generation. One was intended for indoor use and inner pots with diameters up to 140mm. The other was intended for balconies and wooden decks and inner pots with a diameter up to 240mm.

The two fabric plant pots were further developed with physical models in actual size. This was considered to be the best way to find dimensions and try out the stability of different fabric qualities and sizes. The models were also used to decide how to construct the plant pot and where to place the seams. A lot of time was spent in textile stores to find fabrics of the right quality with nice patterns and colours.

9 Results from product development

The development work resulted in four concepts; one made of Zelfo, one made of wood fibre composite and two made of fabrics. This chapter presents the four final concepts with descriptive texts and pictures. The chapter also describes the basic idea behind each concept and their intended contexts and usage.

9.1 Luna

Zelfo is an interesting material because it is more environmentally friendly then the materials existing in the decoration range today. Zelfo is very versatile in shape, colour and texture and can therefore be used for any style or design. The concept idea for Zelfo in this report is based on the fact that the material is very suitable for various surface structures. The concept was therefore given a very basic shape that most customers prefer and it was decorated with a dotted pattern on the outside wall. The idea is that the same basic shape can be used for many different plant pots and the product can then be updated by just changing the colour and the tool for the surface structure. In this way a very wide variety of styles can be made without any significant investments.

Luna is an indoor plant pot made of the cellulose material Zelfo (see figure 43). The design of Luna is neat with thin, gracious walls that are possible thanks to the material properties of Zelfo. The wall is decorated with a discrete dotted pattern. The dots are irregularly placed and are of different sizes, which make the pattern more interesting. To add an extra dimension to the pattern some of the upper holes are perforating the wall completely. The reason to why no lower placed holes are perforating the wall is to prevent the inner pot from being visible and also to prevent leakage.

The dimensions of Luna allow the pot to fit inner pots of sizes with a diameter up to 140mm (see figure 42). The pot is waterproof and can therefore also be used with soil placed directly in it. The plant pot will fit well on to windowsills or on tables and sidetables. It is not suitable for outdoor use because the life length will be considerably shortened.

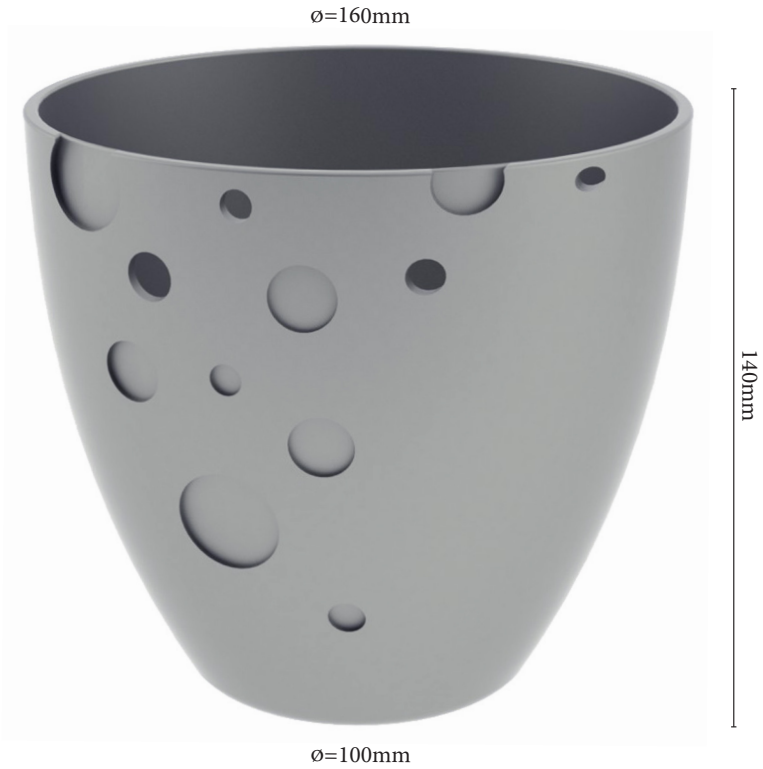

Figure 42: *Dimensions of Luna, a plant pot made of Zelfo.*

Figure 43: *Luna together with plant.*

Luna is made with a compressing technique using a female and a male mould. The material Zelfo is well suited for the symmetric widening shape of Luna. It is also well suited for the intended surface decoration. With its thin wall and the low density of Zelfo, Luna will be much lighter than ceramic pots of responding size. It will also be less fragile and stand transportations and handling better. The shape allows the pot to be stacked which also facilitates transportation and storage. In contradiction to the low weight, Luna is coloured in a grey nuance resembling concrete. Since the colour is slightly darker than the natural colour of the material no bleaching chemicals are required. The neutral colour also makes Luna easy to match with many different types of plants and flowers and it goes well with many personal styles.

The combination of all the mentioned properties makes the Luna stand out from other products and that will probably increase the customers' interest in it in the store.

9.2 Duo

In recent years it has become very popular with gardening and growing plants and vegetables. Also people without large gardens have adopted the trend and use their balconies and windowsills for their plants. Since peoples' living situations vary a lot there is a need for products that can be adapted to fit every environment and which provides the user with options of usage and placement. The plant pot Duo was created with the intention to address this need. Duo has ways to adapt to any household no matter size, style or function and it can easily be rearranged when circumstances change.

Duo is an outdoor plant pot made of wood fibre composite. The design of Duo consists of two modules; one large square pot and one lower rectangular pot (see figure 45). The pots can be used together to create one large pot with two different levels that can be used to create beautiful flower arrangements.

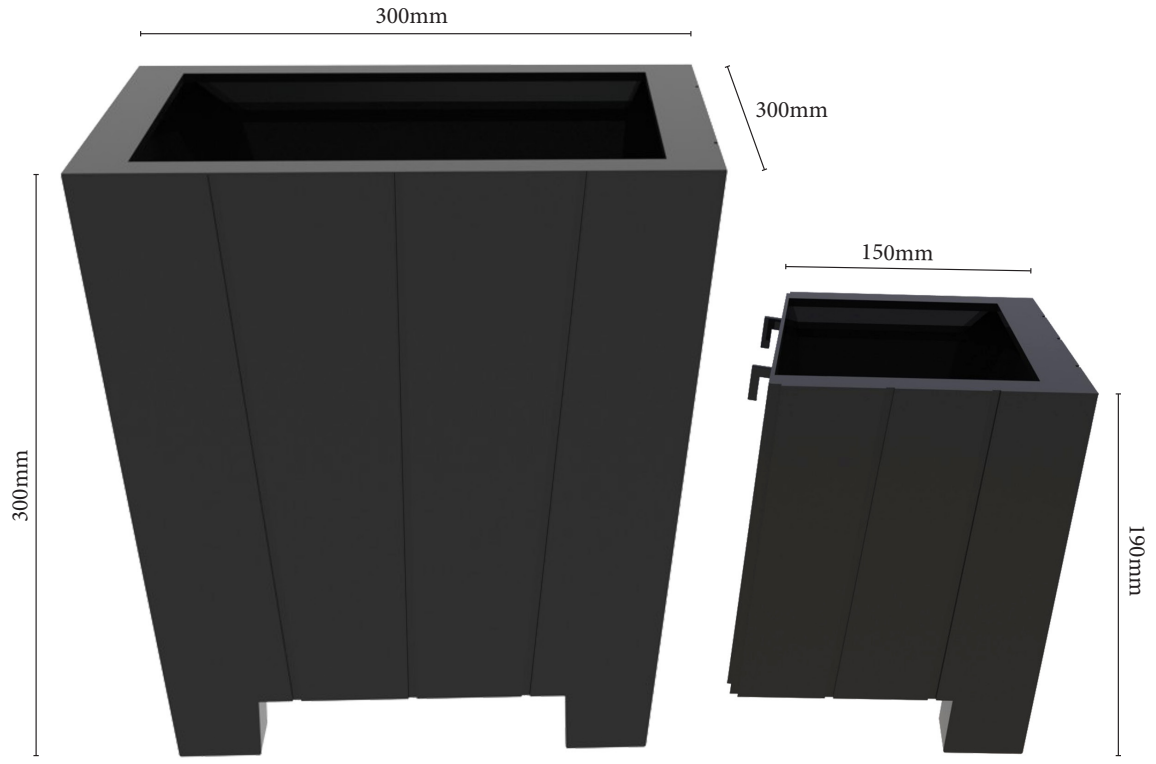

Figure 44: *Dimensions of Duo, a plant pot made of wood fibre composite.*

Figure 45: *The two parts of Duo can be used separate or in combination.*

The pots can also be used separately. The large pot can be placed on the ground and be used for larger plants. The lower rectangular pot can be used together with the accompanying hooks and be hanged on for example a balcony railing or a windowsill. The hooks have been made with the intention to enable as many hanging arrangements as possible. They are therefore quite open to fit onto wide railings and they can also be turned upside down if a smaller list is used.

Duo is suited for outdoor use but can of course also be used to decorate indoors. The large pot of Duo will fit inner pots with diameters up to 240mm and the smaller pot can fit diameters up to 120mm (see figure 44). Soil and water can be placed directly in the pots if more custom-made arrangements are preferred. Both pots are completely waterproof. The large pot has holes in it for attachment of the smaller pot but the holes are small enough not to allow any significant leakage.

For transportation the lower pot can be placed inside the larger pot together with the hooks. This placement allows Duo to be picked up in one single package by the customers in the store. By placing every second Duo upside down when transported on a pallet the product will efficiently fill the space in the containers.

Duo is made with injection moulding. In order to save material but still give the product a more robust expression the top edges of the two pots are provided with a 25mm list that creates an impression of a larger wall thickness. Thanks to the high E-modulus of wood fibre composites the real wall thickness can be as thin as 3mm. The lists are made in separate tools to enable the cores to be ejected when moulding the pot. The lists are then snapped on to the pots before the product leaves the factory.

Duo is much lighter than ceramic plant pots of corresponding size. Even tough the density of wood fibre composites is higher than traditional plastics the weight of Duo will be similar to the weight of a pot of the same size made in traditional plastic because the walls can be made a lot thinner and less material is used.

9.3 Lilla Blå and Sprudla

Fabrics have traditionally not been used for plant pots, probably because of their characteristics of absorbing and leaking water. However, today's surface treated fabrics can be both water and outdoor environment resistant. The benefits with using fabrics for plant pots are that they can easily be transported in flat packages and they are not fragile like glass and ceramics. They have a homey feeling and come in many decorative colours and patterns. They would also be quite easy to implement in the decoration range since IKEA already have many suppliers of fabrics for their other products. Fabrics can be treated with many different chemicals to obtain the mentioned qualities. It is therefore important that the treated fabrics are approved for the IKEA specification MAT 0010.

The patterns on the fabrics used in the following two product concepts are just examples of styles that were considered attractive for the designs. If IKEA were to produce these plant pots they would have to design their own textiles. The construction patterns used for the models can be seen in Appendix IX.

9.3.1 Lilla Blå

Lilla Blå is a plant pot made of water resistant fabric (see figure 46). It has one side with a decorative blue and white pattern and one side in a matching blue colour. The idea with Lilla Blå is that it should be versatile and give the customer the freedom to decide how to use it. The construction of the two sides is identical and that allows the pot to be turned inside out and change colour. Lilla Blå can also be used as it is showing only one side or with the edge folded down revealing the two different colours. In total, four different looks can be created with only one product. Nice arrangements can be created with Lilla Blå when more then one pots are used showing different sides.

Lilla Blå is not waterproof so if a real plant is used in it, a plate has to be placed in the bottom of the pot. Lilla Blå can fit inner pots with a diameter up to 140mm. Lilla Blå can also be used for artificial plants. The product is intended for indoor use and it can also be used to contain other objects than plants and flowers.

9.3.2 Sprudla

Another trend that has been spotted is the creation of living rooms in outdoor spaces such as balconies and verandas. It is popular to spend time outdoors and people decorate their outdoor spaces with sofas, plants, lighting etc. With this trend in mind the fabric plant pot Sprudla was created (see figure 48).

Sprudla is made of fabric with a treated surface that makes it suitable for outdoor use. The fabric on the outside of the pot can be made in different patterns and colours and the inside fabric is made in a matching single colour. The top of the pot is reinforced with a ribbon, which is also used to offer sturdy attachment points for the two handles. The handles facilitate moving and arrangements of the pots.

Figure 46: *Lilla Blå allows four different looks to be obtained with the same pot.*

Sprudla is a large size plant pot, suitable for inner pots with a diameter up to 240mm (see figure 47). Plant pots of this size usually takes up a lot of space in transports and therefore it is very beneficial to make large pots out of fabric that can be sent in flat packages and will not get damaged.

When using Sprudla, the soil can be put directly in the pot but the seams are not waterproof so there will be a small leakage. Sprudla can also be used together with artificial plants or real plants placed in an inner pot when a plate is placed in the bottom of Sprudla. Nowadays it has also become popular to keep plant in regular plastic bags with just a strap around the stem. This kind of plantation can easily be made more decorative when used in combination with Sprudla.

The colour and pattern choice of Sprudla is strong and happy since the product is intended to mainly be used during the summer months. The plant pot goes well with other textiles and efficiently creates an indoor feeling to outdoor spaces. If Sprudla gets dirty it can be washed in machine and ironed.

Figure 47: *Dimensions of Sprudla, a plant pot made of fabric*

Figure 48: *Two versions of Sprudla in their intended context.*

10 Evaluation of concepts

In this chapter the concepts have been evaluated in relation to a reference product from the IKEA range. The idea with the evaluation was to find out how well each concept meets the requirements for plant pots that were set up in chapter 8.5 and to find out what the strongest features are of each concept.

10.1 Evaluation procedure

For the evaluation of the concepts an evaluation matrix was made (see figure 50). The requirements from the specification in chapter 8.5 were used as criteria. In the evaluation all requirements were considered equally important so they were not weighted. Instead the concepts were given scores between 1-5 for how well they fulfilled each requirement. To support the evaluation the IKEA plant pot Papaja, with height 190mm, was used as a reference product (see figure 49). Papaja was first given a score for each requirement and the concepts were then given a score in relation to the Papaja score. All the concepts have been evaluated with their intended us-

Figure 49: *The IKEA plant pot Papaja was used as a reference product in the evaluation.*

		PAPAJA Ref. product	LUNA	DUO	LILLA BLÅ	SPRUDLA
Be durable	FUNCTIONALITY	3	4	3	2	1
Be stable		2	3	5	2	3
Facilitate watering		2	3	4	1	1
Facilitate handling		3	3	2	4	3
Be easy to clean		3	2	2	1	1
Be easy to transport/store		3	3	1	5	5
Prevent leakage		5	5	5	1	1
Be attractive	AESTHETICS	3	4	5	4	3
Be versatile in style and function		1	1	4	3	2
Fit many peoples' styles		5	4	5	3	3
Fit the IKEA range		3	3	3	3	3
Bring novelty		1	3	4	4	4
Be recyclable/separable	ENVIRONMENT	1	4	3	2	2
Minimize waste material		3	3	3	1	1
Minimize material use		3	4	1	3	2
Use renewable materials		1	5	4	3	3
Use recycled materials		1	5	1	1	1
Use energy efficient production		1	3	1	1	1
Have low density		2	4	1	5	5
Use environmentally better materials		2	5	3	2	2
Total score		**48**	**71**	**60**	**51**	**47**

Figure 50: *Concept evaluation matrix.*

age in consideration so when comparing durability for example, Duo is evaluated for outdoor usage and Luna for indoor usage. A minor user test was used to make the evaluation of the aesthetic properties less subjective. In the user test the respondents were asked to rate the products after their preference. In Appendix VII a list with more defined requirements can be found.

10.2 Evaluation results

In the concept evaluation Luna was a clear winner. Luna mainly won over the other concepts in the environment category where it got 33 points, which can be compared to Lilla Blå that came on second place with 18 points. Most of the environment scores were actually thanks to the material properties of Zelfo and not the design itself. Luna was also the winner in the functionality category but here the margins were a lot smaller to the second and third place where Duo and Papaja were found.

Duo came on second place in the total evaluation and the three remaining plant pots received quite equal total scores. In the aesthetics category Duo came on first place followed by Lilla Blå.

Luna and Duo were considered more neutral in style and would probably have a broad target group. Sprudla and Lilla Blå are highly identified by their colours and patterns and since these are quite prominent in the created concepts these plant pots were either very much liked or not liked at all. Duo was appreciated by all respondents in the user test and was well liked both for its style and function.

11 Conclusions - Part 2

This chapter includes conclusions and recommendations for each plant pot concept. The conclusions are mainly based on the results from previous evaluation chapter and experiences from the development work.

11.1 Luna

Luna is an interesting option to the traditional ceramic plant pots since it is made of a more sustainable material. The neutral shape and colour makes Luna suited for many personal styles and homes. If a more edgy look is preferred the plant pot can be given a stronger colour or a surface structure that makes it fit into a more narrow style group. For IKEA it would definitely be of interest to take advantage of the easy and relative cheap way of updating the look of the product by replacing the tool creating the surface structure since it is a way to achieve completely new product expressions by small means.

It should be taken into consideration that Zelfo is a new material on the market and therefore there is uncertainness to the quality and price of the final products. Due to this it is recommended to start production in a small scale to try the success of the product and if the outcome is positive Zelfo could be used to replace existing materials.

11.2 Duo

Duo was an appreciated concept thanks to its functionality, adaptability and neutral expression. With the right marketing and strategy Duo could probably become successful and reach a broad target group. What differentiates Duo from existing plant pots is the idea of multi-functional modules and that idea could also be applied in other new products if there is an aim to give the product more diversity in its usage.

It would also be possible to make Duo in traditional plastic instead of wood fibre composite and the product would practically look the same to the customer and provide the same user value but on the other hand the product would then receive lower scores in the environment category in the evaluation.

11.3 Lilla Blå

Lilla Blå has a more narrow target group than Luna and Duo. This is mainly due to the pattern of the fabric that gives Lilla Blå its style expression but also due to the fact that the product is made of fabric, which is not a traditional material selection for plant pots. However, there seem to be customers who would appreciate a new and different expression within the plant pot range and among those, Lilla Blå could probably become very popular assumptive the customers can identify with the style of the pattern. For IKEA it is interesting to consider fabric plant pots due to the advantages of the facilitated handling and in the case of Lilla Blå the possibility to create versatility by turning the plant pot inside out. The colour and pattern of the plant pot should be selected to in the best way suit the IKEA range strategy.

11.4 Sprudla

Sprudla, just like Lilla Blå, probably has a more narrow target group. Again, this would be due to the unconventional use of fabric and also the strong colours the concept possesses, which can be difficult to match in some homes. The main benefit with Sprudla and the reason to why it could probably sell well even tough the narrow target group is because it addresses the need of easy storage and handling for large outdoor plant pots. Outdoor plant pots are commonly seasonal products that should not take up too much space when stored during winter. Again, the patterns and colours should be selected to match the IKEA range strategy.

12 Discussion

This chapter brings up reflections about parts of the project. The reflections concern both things that went smoothly and stages in the work where obstructions occurred. Further, the chapter discusses the validity and value of the findings from the project and if there are results and analyses that might be lacking and therefore would be subjects for future research.

12.1 Aim and goals

The aim, to make the IKEA range offer of vases, bowls and plant pots more attractive to customers by finding new materials that allow IKEA to widen their expression within the range, is partly a long-term aim that stretches beyond the time frame of this project. It is something that should be followed-up and evaluated in the future when and if IKEA decides to implement the new materials that were found in this project and when sells numbers for the products made of these materials can be obtained. However, what can be said in an evaluation at this stage is that the results from this project are promising and the suggested materials have large potential to become successful and widen the expression of the IKEA decoration range.

There was also an aim to find new materials with properties that can improve the quality and sustainability or lower the costs of the final products, for example by reducing the weight. According to the results from the material evaluation matrix in chapter 5.4, this aim has been reached. Some materials for example Zelfo, the winner of the evaluation, fulfils all the requirements mentioned above.

When it comes to the project goals, all of them have been met. A mapping was made of the available materials in the market, as seen in Appendix II. However, the compiled list of materials is perishable and will not be of interest in the future if it is not continuously updated. Off course another categorisation of the materials can be used too. No investigations have been made to find out weather the categorization used in this project was the most appropriate or not.

The most important goal can be said to be that the work should result in minimum three new promising material suggestions. That goal was well fulfilled and this was noticed at the end of part one when a material selection was made for the following concept development, among the evaluated materials there were so many interesting candidates that it was difficult to select only three of them.

The comparison of the new materials to the existing from a sustainability perspective was done as a part of the material evaluation and the concepts of three of the materials were created in the second phase of the project. As seen from the concept evaluation in chapter 10, the concepts highly consider the IKEA requirements regarding logistics, costs, sustainability, attractiveness etc.

The last goal, to analyse the relations between material qualities and user values, was done with the focus group. The results from the focus group were satisfactory for the purpose but what was lacking in this research was a more quantitative study. See chapter 12.3 for further discussion about the focus group and its results.

12.2 Process and time plan

The process that this project followed was to a high extent determined in the planning phase of the project, only minor changes had to be done along the way.

The market study was considered to be the most logical way to start but it was a challenge to figure out how to cover such a broad and abstract area. For this, the search areas really helped as well as the fact that one interesting finding usually led to another.

When the first selection was made, together with an IKEA product developer, a better understanding for what IKEA were actually searching for was obtained at the same time. Up to this stage that had been a little diffuse so by having a discussion about more than hundred materials it became very clear were IKEA:s interests mainly laid. It was also seen as a necessary step to narrow down the selection after the market study to be able to go deeper in the detailed analysis. It was a good idea to run the detailed analysis parallel with the user experience analysis because these parts supported each other and it also saved a lot of time.

When the first part of the project was finished a very solid base was given for the concept development phase. This base definitely made the development wok run smoothly and by running three parallel development processes at the same time the creative work never got stuck. When the inspiration was low it was possible to switch to one of the other materials.

When it comes to the time plan, this was also determined in the planning phase of the project. The time plan was pretty much followed through the entire work, at most it could differ with a few days at the end of some stages. The time plan both helped to speed up the work when it was falling behind and to force more efforts when a task felt like it was finished but there was still time remaining to go further with it.

12.3 Methods and their implementation

The methods used in this master thesis were mainly selected on experience from previous projects and most of them were slightly modified to better fit the task. For example the two evaluation matrixes used in the detailed material analysis and the concept evaluation did not have the exact same setup and they also had two different scoring methods.

The methods used for data collection met their purpose well. The interviews were efficient when information was gathered from material experts and suppliers. They were kept informal which made the situation more relaxed and the interviewees more inclined to talk freely. The problem with this setup though was the documentation, since no recordings were made and few notes were taken. Therefore it was very important to always write down the outcome from the interviews as soon as possible after it had taken place so that information would not be forgotten. The interview results together with the data from the literature study provided a comprehensive foundation for the conclusions that were made.

When it comes to the focus group the two most important questions to ask are:

- were the right questions asked? and
- are the results reliable?

Since the focus group was executed with only seven participants the idea with it was not to get a representative picture of the opinions of all customers, for that a much more extensive enquiry would be necessary. Instead the idea was to understand different customers and their priorities and preferences in order to get new input and avoid autarchic decisions and preconceptions when making the conclusions from the material investigation. For this purpose the results from the focus group turned out to be useful and that can be seen as insurance that the right questions were asked. The information from the focus group discussion was particularly valuable for getting a deeper understanding and to hear the reasoning behind the participants' opinions. Even though only five material groups were included in the focus group enough information was received about the participants thoughts to make estimations of what their opinions would be about the remaining materials too.

The participants of the focus group were not selected to be the ultimate representatives of the entire IKEA target group, meaning no further research was done to find the percentage of age, gender and living standards among IKEA customers. The participants were simply selected because they were regular IKEA customers and they were interested to help and participate. This will off course affect the focus group results. It is not possible to say how much the answers would have differed with other participants. It is also possible that the different shapes and sizes of the material samples that were used as stimuli and the difficulties in visualising some of the materials in actual products affected the participants' answers and these are reasons to doubt the reliability of the results. One should be aware of these facts and use the results from the focus group for what it is, namely valuable input from others than the people directly involved in the project. This was also the reason to why the decision of what materials to bring into the concept development phase was mainly based on discussion with the IKEA product developers and the results from the detailed material analysis. The IKEA product developers know the target group well and have experience from predicting best sellers.

12.4 Results and Evaluations

The downside with evaluation matrixes is, as mentioned in chapter 5.3.3, that they provide a result that is very black and white and that can sometimes be misleading. To prevent this, additional information was given for each material group in the detailed material analysis but then the easily accessed information, that is a strong advantage with evaluation matrixes, is lost. It is however necessary to include this information as well to get a more nuanced idea of the results, especially if it should be used as a base for decisions.

The concepts and evaluation results of this work should be used for inspiration and assistance for future product development. One idea is therefore to take the most interesting features of each concept and freely combine them into new products. Off course the colours and patterns of the concepts can be changed to better fit the IKEA style strategy at the time.

In most product development processes there is a clear goal with the new product, it could be that it should be affordable to many people, exclusive, sustainable etc. In those cases the requirements should preferably be weighted to ensure that the evaluation is accurate for the specific purpose of the new prod-

uct. A weighted specification of requirements would result in a different total score than received in this concept evaluation.

12.5 Conclusions

It has to be considered that the conclusions in this report are personal thoughts that come from the experience of performing this project in combination with previous knowledge. This means that someone else with a different experience might come to other conclusions after reading the report. Therefore, the conclusions should be regarded as guidelines.

12.6 Sources

A lot of the information that was required for this project could not be found in traditional literature. Many of the most recent materials are not well known by anyone but the suppliers and therefore the only information that was possible to receive came from the suppliers. Since the suppliers' goal is to sell their products this kind of information can be quite euphemistic and should be regarded with some criticism. When possible more then one source of information is to prefer and that source should also be neutral. This was not the case many times in this project.

Another source frequently used for the market study was blogs, which is not considered a reliable source for literature studies. They were however necessary to spot the most recent trends and materials and all the information from the literature study that was used in the later phases was followed up with more trustworthy sources.

When researching bio plastics the available information could be very contradicting, which is often the case for questions where stakeholders with different interests are involved. Due to this, independent research was searched for and arguments from both supporters and opponents were investigated.

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Illustrations

All illustrations and photos in this report are made by Ida Karlsson and Gustav Karlsson.

Appendix

The Appendix includes information and documents that have been used during the project to reach the results that are presented in this report. Most of the documents in the Appendix have been summarized in the chapters of the report and here they are presented in their complete form.

List of Appendixes

Appendix I

IKEA range materials today

The following pages show the product matrix that was compiled during the market study with the intention to create a better understanding for what materials IKEA uses in their decoration range today and what products the materials are applied in.

Ceramics

STONEWARE

Bigarrå

Art. Nr:
80141341
70151731
00141340
50155184
20141339

IKEA PS Jonsberg

Art. Nr:
30085253

Livfull

Art. Nr:
90186621
90155634
60155635
70186622

Knopp

Art. Nr:
90185283
10185282

Nöjd

Art. Nr:
90155728
30177035
10155727

Blygsam

Art. Nr:
60177034
80177033

Bladet

Art. Nr:
10075919
70075921

Årlig

Art. Nr:
00155544
40155542
20155543

Oväntad

Art. Nr:
70164149
30164151
50164150
10164152
90164153

Kapa

Art. Nr:
20097015

Jättefin

Art. Nr:
70155913
90155912
10155911
30155910

Tecknat

Art. Nr:
10207646

Orädd

Art. Nr:
20174594

EARTHENWARE

Krusmynta

Art. Nr:
60128840
80128839
30128832

Kapris

Art. Nr:
50128124
20128125

Kanel

Art. Nr:
00128126
80128127

Havtorn Färm

Art. Nr:
70144769
50144770
30144771
10144772

Karens

Art. Nr:
70067997

Havtorn

Art. Nr:
90123997

Kardemumma

Art. Nr:
20217305 70173733
50173734 20173735
20182283 00173736
00165802 20165801

Papaja

Art. Nr:
60187368 20187365
80187367 60187373
00186654 40187374
70186655 20186653
00187366 40186652

RED CLAY

Åkerbär

Art. Nr:
00186574

Mandel

Art. Nr:
70165808
90118849
30165810
60165804
30165805
90165807
10165806

Rönnbär

Art. Nr:
50118846
60155923

Glass

IKEA PS Brunn

Art. Nr:
50141371
90147757

Jubel

Art. Nr:
70186127
50186128
70216252

IKEA Stockholm

Art. Nr:
90138630
70138631
90184028
50141093

IKEA PS 2012

Art. Nr:
10195479

Stjälk

Art. Nr:
70150562
40152845

Djärv

Art. Nr:
90155733
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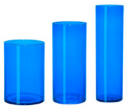

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Älsklig

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Bladet

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Cylinder

Art. Nr:
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Kanist

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Tajt

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Snärtig

Art. Nr:
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Vasen

Art. Nr:
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Solstråle

Art. Nr:
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Persika

Art. Nr:
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Somrig

Art. Nr:
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Pålitlig

Art. Nr:
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Plastics

POLYPROPYLENE

IKEA PS 2012

Art. Nr:
20198439

Nektarin

Art. Nr:
30153845
50153849
70153848
10153846

Grapefrukt

Art. Nr:
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Ovanlig

Art. Nr:
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80186706

POLYETHYLENE

Valnöt

Art. Nr:
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10128116

Oxbär

Art. Nr:
90132204
60132205
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Östlig

Art. Nr:
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40231089
20231085

RECYCLED PET

IKEA PS

Art. Nr:
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IKEA PS Fejö

Art. Nr:
30130284
30117188
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Nature fibres

BAMBOO

Paranöt

Art. Nr:
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Hultet

Art. Nr:
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Vinäger

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RATTAN

Rågkorn

Art. Nr:
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Pekannöt

Art. Nr:
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BANANA FIBRES

Pjäs

Art. Nr:
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SEAGRASS

Jordnöt

Art. Nr:
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Salmbär

Art. Nr:
50186618
10186620

WATER HYACINTH

Fridfull

Art. Nr:
60168379
90155870

Metals

ALUMINIUM

Angenäm

Art. Nr:
00186569
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60186571
20186568

Dimmig

Art. Nr:
30186577

Hasselnöt

Art. Nr:
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40186614
10186615
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Sorglös

Art. Nr:
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GALVANIZED STEEL

Skör

Art. Nr:
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Skurar

Art. Nr:
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20186101
90186094

Försommar

Art. Nr:
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40186794

Husön

Art. Nr:
40048632
20048633

STAINLESS STEEL

Socker

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20179959 10155671
30155665 90155672
90155667 80228122

Rosépeppar

Art. Nr:
00207642
80207643
60207644

IKEA Sthlm

Art. Nr:
90110061
90184052

Skör

Art. Nr:
60212551

STEEL

Sockerärt

Art. Nr:
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80148465
10148464

Yrsnö

Art. Nr:
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Livat

Art. Nr:
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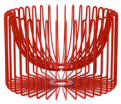

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Others

CONCRETE REINFORCED WITH GLASS FIBRES

Sparris

Art. Nr:
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SOLID ACACIA

Bjurön

Art. Nr:
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70101010
70066097

SOLID ASPEN

Kalasa

Art. Nr:
90186112
50186109
20196708

Appendix II

Results from market study

The following table shows the materials that were collected during the market study. The materials were sorted into categories with sub groups based on function or raw material content.

1 Nature materials

Nature fibres	
Biotex Flax/PP	The Swedish company Oxeon are specialized in composite weaves with flat ribbons that make the weaves stiff and gives them a smooth surface. Biotex Flax/PP is developed together with British Composites Evolution.
Palm leaf ribs	In the IKEA box Motorp palm leaf ribs are used with support by cardboard.
Willow	The IKEA box Branäs uses braided willow covered with acrylic paint and lacquer.
Pandanus leaf	The IKEA box Bladis uses braided pandanus leaf which gives an impression of leather.
Palm leaf	The IKEA box Kottebo uses palm leaf with support from cardboard.
Banana fibres	The IKEA bin Näsum uses banana fibres braided in a different way than it is used in the vase, bowl, plant pot range
Bamboo	The IKEA Ceiling lamp Böja uses bamboo in a similar way as in the pot Paranöt but in a different colour.
Formable Wood	
Wooden textiles	Wooden textiles are thin wooden pieces attached to a textile base. The material can be formed in many different ways and can be produced as washable or fire-retardant versions.
Foldtex	Foldtex is composed of at least two layers of which one is stiff and the other is flexible. The material is shaped by cutting the stiff layer and forming hinges. Foldtex can be customized by various material combinations.
TT Sheet	TT Sheet is composed of flexible wood veneer attached to a support material. It can be made of and type of wood and is suitable for thermoforming and injecting. The material can also be sewn or embroidered.
3D veneers	3D veneers can be bent in two directions with a method similar to deep-drawing of metal sheets.
Bendywood	Bendywood can be bent in a cold and dry condition and in most cases it can be done by hand. It is made from green wood blocks that are compressed and subsequently dried.
Birch veneer	The IKEA box Mien is made of light birch veneer covered with clear nitrocellulose lacquer.

2 Textiles

Surface treated textiles	
Waterproof textile	Waterproof textile can be used to make pots that are flexible and can be folded and put away. There are textiles which are durable and can be used for both indoor and outdoor pots.
Polypropylene	The IKEA box Lidan is made of a polypropylene textile that is soft flexible and water resistant.
Polyester	The IKEA box Skubb is made of polyester with inserted polypropylene plastic.
Flexible Glass Bead Wall covering	Beadazzled is a wall covering made of tiny glass beads attached to a flexible base material.
Moulded textiles	
100% recyclable polyester felt	The chair Kola Light Wood, designed by Mikko Laakonen, is made of 100% recyclable polyester felt.
Moulded felt from Nordifa	The Swedish company Nordifa manufactures products in moulded felt. The material can take nearly any shape and colour and surface structure can be varied. The felt can even be two-sided.
Polymer felt from recycled PET bottles	Restore basket by Mika Tolvanen is made of polymer felt from recycled PET bottles. It is made in China and comes in three different colours.
Thread	
Thread around sea grass	The design firm Glimpt has developed stools made out of thread fixed around rolls of sea grass. The stools are manufactured in Vietnam.
Zulu Ilala palm fronds	Palm fronds are collected, pulled into strips and dyed before they are weaved into baskets in a traditional South African way. http://www.basketsofafrica.com/palm.html
Yarn impregnated with rosin and gluten	Bins and newspaper baskets under the name Moa, design by Eva Marguerre and Marcel Besau, are made of yarn impregnated with rosin and gluten. http://www.besau-marguerre.de/
Form stable textiles	
Neoprene	Neoprene is most commonly used in wetsuits. It is isolating, stretchy and padded. Lately it has also been introduced into other product areas and is for example used in wine bottle protection and computer bags.
EVA plastic	EVA (ethylene vinyl acetate) plastic is used in the IKEA place mat Pannå. EVA plastic is a polymer that approaches elastomeric materials in softness and flexibility.
Ecolin	Ecolin is an environmentally friendly sound absorbent material combined by flax fibres and corn starch. The material can be pressed into shape together with a fabric to get a nice surface.
EVA foam	The IKEA computer bag Upptäcka is padded with EVA foam. The material is often called expanded rubber or foam rubber and is used as padding in a lot of sports gear.
Coated fabrics	Coated fabrics consist of one woven and one non-woven textile with the surface covered with a coating or a resin in order to provide the fabric with some additional property.

3 Composites

Bio composites	
Liquid wood	Liquid wood is made of lignin, left from the paper industry, mixed with fine natural fibres from wood, hemp or flax and other natural additives e. g. wax. From this plastic granulates are produced that can be melted and injection moulded. The final product can look like highly polished wood or like common plastics. The substances are also highly recyclable.
Natural fibre composite	By needle punching 50% natural BAST fibres and 50% polypropylene thread into a mat and heating and pressing the mat into a mold an environmentally friendly fibre composite is created.
Durapulp	Durapulp is a Swedish composite consisting of wood fibres and bio plastic. The material is manufactured by Södra and is placed between plastic and cellulose. It is strong and water resistant.
Hiendl NFC	Heindl NFC are making natural fibre composites consisting of synthetic polymers and renewable raw materials. The plastics can be produced using injection moulding and extrusion methods. A variety of property profiles can be created and the materials have a very high solidity, rigidity, formability. They are light weight and have surfaces ready for use.
Kareline	Kareline is a third generation natural fibre composite. It can be used for injection moulding and extrusion. The material can be extensively customized. The granulates are available based on PP, ABS, PS, POM and biodegradable PLA matrix.
Whole tree coconut fibre	With a non woven process coconut fibres are combined with thermoplastic to create a strong, durable material used for packaging.
Moulded sand	The designer Nir Meiri has created a lamp shade made out of moulded sand.
Mineral composites	
Hi-Macs mineral composite	Mineral composite is a thermoplastic that can be shaped into both single and double curved surfaces. The composite is a mixture between PMMA and aluminium oxide. The material is delivered in sheets can be glued together with invisible seams
Slate polymer composite	Slate polymer composite is made of ground slate cast into moulds to give the appearance of natural slate. It is lightweight and does not absorb moisture.
TerraSkin	Terraskin is an environmentally friendly paper mixed of mineral powder and non-toxic resin. It will start to degrade under proper conditions. TerraSkin is water resistand, strong and durable
Corian	Corian is made by DuPont and is composed of 2/3 natural minerals, 1/3 acrylic polymer and pigments. It can be shaped into practically any design and has a nice easy to clean surface.
Cristalplant	CRISTALPLANT is made of a high percentage of mineral extenders from nature and high-pureness polyester and acrylic polymers. It is 100% recyclable and has a nice smooth surface finish.
Fibreglass	
Fiberglass GRP	Fiberglass is a strong and lightweight material that is easy to shape. It is less brittle than carbon fibre and far less expensive.

Glass polymer	Glass polymer can be injection moulded, blow moulded and extrusion blow moulded. It is a tougher alternative to glass. It is not fit for outdoor markets due to low UV-resistance.
Carbon composites	
Liquid Infusion Technology (LIT)	LIT from Talon is a new way to produce cheaper carbon composite products. Carbon composites are stronger and lighter than steel and the surface can be made in a variety of ways.
PURE	PURE fabrics and sheets can be formed directly into parts with thermoforming. The advantages with PURE are properties like lightweight, high impact, high stiffness and easy processibility.
High performance composites	
Carbon-fibre-filled Ultem resin family	High-performance compound based on aerospace carbon fibre technology and Ultem polyetherimide (PEI) resin developed by Sabic Innovative Plastics. Offer weightsaving up to 50% compared to die-cast aluminium.
Forged composite	A synthetic composite material consisting of carbon developed by Lamborghini and Callaway Golf company. The material is one-third as dense as titanium but stronger.
Fibre-reinforced PA66	A thermoplastic for high-aesthetic structural components obtained directly from the forming tools.
Easy flowing PBT	A material that significantly reduces injection pressure and cycle times during injection moulding.
Sustainable high performance composites	
EcoPaXX	DSM Engineering Plastics have developed this bio-based, high-performance engineering plastic based on polyamide.
Arnitel Eco	The Arnitel Eco family has been awarded a cradle-to-cradle certification for its lower carbon footprint, lower impact on climate change and higher durability due to improved UV-resistance.
Akulon RC	DSM Engineering Plastics have developed these recycle content grades of PA6. The first Akulon RC grades are 30% and 35% glass filled with 50% recycled content.
Palapreg ECO	Palapreg ECO is a thermoset resin composed of 55% renewable resources which makes it the composite resin with the highest bio-based content available on the market today.
LNP thermocomp composite	LNP Thermocomp specialty compounds use curauá fibre and wood flour natural reinforcements.

4 Polymeric materials

Hard consumer plastics	
Polypropylene plastic	The IKEA thermos Behövd is made of hard, shiny polypropylene plastic.
Polycarbonate plastic	The seat of the IKEA chair Elmer is made of semi-transparent, coloured polycarbonate plastic.
ABS plastic covered with acrylic plastic	The IKEA stapler Anständig is made of coloured ABS plastic covered with a thick layer of transparent acrylic plastic.

Melamine	Melamine is a synthetic polymer that is fire resistant and heat tolerant. It is commonly used in kitchenware.
SAN plastic	The IKEA box Lekman is made of coloured, transparent Styrene-acrylonitrile (SAN) plastic.
Polyester sandwich	Polyester can be used to sandwich an unlimited range of materials, one example is beach grass that was used in Nissan's suncube.
Flexible consumer plastics	
Polypropylene plastic	In the IKEA ceiling lamp Fillsta the material is thin sheets of Polypropylene plastic.
Polypropylene plastic	Polypropylene plastic is also used in the IKEA place mat Ordentlig. In this case the plastic is coloured and stripes are braided into a mat.
Polyethylene mesh	In the IKEA chair Färgglad Polyethylene straws are braided into a colourful mesh.
Polyurethane plastic	In the IKEA rubbish bin black Polyurethane plastic is used and gives a resemblance with leather.
Polystyrene plastic	In the IKEA table lamp Aläng Polystyrene plastic is used, with flat stripes braided into a surface which is supported by paper.
PP combined with TPE	The baby bath tub from FlexiBath uses hard polypropylene moulded in combination with a thermoplastic elastomeric material and in that way creates a bath tub in hard plastic that is possible to fold up flat.
Elastomeric materials	
Milk Design rubber	Lace by Milk Design is made out of rubber and is a very aesthetic way to transform an old glass jar into a vase.
Synthetic rubber	Inreda from IKEA is made out of synthetic rubber
Croslite	Croslite is the foam resin used in Crocs. The material changes shape when exposed to heat and will therefore shape after the foot.
EVA plastic	In the IKEA slippers Sommarvind EVA plastic is used which gives an impression similar to Croslite. EVA is actually a polymer but almost as soft and flexible as an elastomeric material.
Silicone	Silicone is a very soft and flexible material that is easy to shape and comes in many colours. It is used in the IKEA product Spöka.

5 Concrete and foams

Concrete	
MPBWC	Mountain Pine Beetle Wood Concrete (MPBWC) or Beetlecrete is a blend of wood chips, cement and water. Like concrete it can be shaped using forms or moulds and it is only half the weight of ordinary concrete. Beetlecrete can also be formed using ordinary woodworking tools.
Concrete Canvas	Concrete Canvas or Concrete cloth is a flexible concrete impregnated fabric that hardens on hydration and forms a thin concrete layer.

Ductal concrete	Ductal concrete contains metal fibres that provide it with the ability to flex. Ductal is known for its thinness, resistance and aesthetics.
Creacrete	Creacrete is a concrete based material that is highly dense and compact allowing it to be shaped into thin walled objects. With a special processing it is also possible to give it a glossy surface that is new to concrete.
Quantz	Quantz is a cement bonded material that is strong like steel with characteristics of ceramics. It is cost efficient and ecological. Unit thickness from 2mm.
Coloured concrete	Syndecrete offers a wide range of concrete colours both with powder and liquid pigments.
Glass concrete	Concrete made with recycled glass aggregates has a translucent appearance. It also has better thermal properties and long term strength than ordinary concrete.
Rubberized concrete	Rubberized concrete is made of recycled tires and is today used in rubber sidewalks at Coast Guard Island, California.
Foams	
Foam glass	Foam glass is a lightweight, opaque glass material. It is made of granulated glass mixed with a chemical agent such as carbon or limestone. Foam glass floats in water. Its main uses are for thermal and sound isolation.
Ceramic foam	Wall flame, the ethanol fireplace from Radius has ceramic foam inside its combustion chamber. The material is lightweight and fireproof.
Lightweight concrete	Lightweight concrete has many names some examples are foamed concrete, cellular concrete and aerated concrete. The material is a concrete made with an addition of an air-entraining agent. It is easy to work with and can be processed with ordinary woodworking tools.
Advantic	Advantic is a lightweight foam made with glass, polymer or ceramic microspheres embedded in a resin matrix. The material has low density, high uniformity and high strength.
Metal foam	AlCarbon make products consisting of a metal foam core with a coating of carbon, plastic or metal.

6 Sustainability

Biodegradable materials	
Biodegradable polymer	EcoGen is a biodegradable polymer made of the injection mouldable, biodegradable material Enmat. The polymer will decompose in compost or soil without giving away any harmful subjects.
Biodegradable glass	The glass institute in Växjö has developed a method that makes it possible for glass to decompose in 15 years. The glass material is also free from toxics.
Sugarcane	Sugarcan bowls are made of 100% reclaimed, renewable and compostable material. It is a good alternative to plastics and polystyrene.
Biodegradable cellulose	The Kami collection from Ett la Benn offers post, vases ang home lightning made of 100% biodegradable cellulose, a very light and solid material made with simple air drying.

Paper foam	The Swedish PaperFoam BV is manufacturer and supplier of PaperFoam which is a foamed packaging material based on potato starch or tapioca starch and natural fibres.
Recycled materials	
Ripietra	Ripietra is completely made of recycled materials, 55%polyethylene from urban waste and 45% of wood from industrial processing waste. The material looks like natural stone and is also 100% recyclable.
NewspaperWood	NewspaperWood is layers of pressed newspapers and glue. The material behaves like wood and its appearance resembles wood grains.
Recycled plastic	Axion Polymers offers Axpoly PS13 polystyrene with reduced carbon footprint. Axpoly is made of recovered garment hangers and only creates 17% of the emissions associated with the supply chain of oil-based virgin polymers.
Computer keyboard glaze	Designer Mark Vaarwerk makes products out of materials from our everyday waste. He has for example made bowls out of unexpanded polystyrene glazed with melted computer keyboard.
Re-used products	
Biodegradable wash cloth	The ceiling lamp Malva from Ett la Benn is made of moistened sponge cloth that is air dried on a mould. The material is 100% biodegradable and very lightweight.
Water pipes	I Francois Xavier Ballérys “Pretty Vase Collection” the objects are made of water pipes painted with PVC plastic.
Noodle cups	“Cupnoodle urushi” are regular noodle cups that have been lacquer painted by craftsmen into decorative pots.

7 Others

Paper materials	
Denguri paper	Japanese designer Kouichi Okamoto has made a foldable table lamp out of denguri paper.
Cardboard	The Australian company KARTON manufactures strong and cheap furniture out of cardboard.
PaperStone	PaperStone is a sustainable material made of compressed recycled paper. It can be applied in countertops, window sills, cutlery handles etc.
Re-Y-Stone	Re-Y-Stone is made of recycled core and decor paper and natural resin extracted from sugar production waste. It is hard, durable, tough with a resistant surface.
Light emitting materials	
Bordato illuminated planter	The Bordato illuminated planter is made of rotation moulded polyethylene that is 100% recyclable. The illumination is made with energy-efficient compact fluorescent bulbs.
Light emitting film	Light emitting film based on Electro Luminescent (EL) effect is the only flat light source that produces really bright light. No diffuser is required since the light is perfectly uniform.
Metals	

Glazed metal	Glazed metals look like ceramics but are lighter and posess better finishing. The supplier Dhruv Intl Exports offer all pantone colours in any shape and size.
Dibond, aluminium composite	The aluminium composite Dibond from Glasfiber och Plastprodukter AB is light and stiff. It consists of two aluminium surfaces and a core of polyethylene and can easily be bent with nice radii.
Metal resin	Metal resin is a polyester composite with the same freedom of form as polyester but with the surface of metal. The metal surface feels, behaves and looks like metal.
Transparent aluminium	Aluminium Oxynitride, AlON, is a transparent polycrystalline ceramic. It is marketed under the name ALON by Surmet Corporation. It is four times harder than glass and it can be formed using conventional ceramic powder processing techniques.
Steel mesh	In the IKEA magazine file Dokument is made of steel formed to a mesh coated with epoxy/polyester powder coating.
Glass ceramic	
Aluminosilicate	Aluminosilicate is a glass ceramic that is used in iPhone 4S. Glass ceramics are extremely resistant to thermal chock and have therefore found many applications in cook tops and cooker wares etc.

Appendix III

Specification of material requirements

*To evaluate the materials in the detailed material analysis a specification of requirements was determined. The requirements were used in the evaluation matrix that was described in chapters 5.3 and 5.4. Each requirement was weighted with scores 1-3 where 3 were the most important requirements and 1 were the least important. The requirements marked with * were demands that had to be fulfilled.*

Specification of requirements

Materials for vases, bowls and plant pots

Costs
(3p) Be non expensive to buy (Compare to traditional plastics)
(3p) Be non expensive to process/manufacture (Compare to traditional plastic forming methods e.g. injection moulding)
(3p) Be non expensive to transport (Fulfil at least two of the following criteria: have a density less than 1.5kg/dm^3, be manufactured in Europe, be flexible, be non fragile)

Quality
(Outdoor products *. Indoor products 1p) Products for outdoor use should be outdoor environment resistant (Stand wind, rain, sun, high/low temperatures for two years)
(1p) Be UV-stable (Stand three years indoors in window sunlight)
(2p) Be deformation resistant (Stand normal transportation and handling by the user)
(1p) Be water resistant (Splash proof = not absorb water being splashed on it)
(1p) Be waterproof (Keep water inside without leaking or absorbing it)
(1p) Be corrosion resistant (Stand IKEAs dish washing test for the specific material group)

Aesthetics
(3p) Allow shape variation (Enable 3D forming)
(2p) Have nice surface structure (Follow the convention for vases, bowls and plant pots)
(2p) Allow colour variation (Minimum 5 colours)
(2p) Bring novelty within the area (The material should result in a product that differentiates from the existing products in the range)
(1p) Allow size variation (0mm-500mm)

Manufacture
(3p)* Allow series production (ranges up to 100 000)
(3p) Follow social standards in the manufacture process (According to IWAY)
(1p) Be easy to process (Take less than 12h)

Environment
(1p) Be highly available (not use raw materials that are limited or competing with the food industry)
(2p) Be environmentally friendly to manufacture (Low CO2 emissions and low leakage of chemicals to air, soil or water)
(1p) Be 100% recyclable
(1p) Be 100% biodegradable
(1p) Use renewable material (Minimum 50%)
(1p) Use recycled materials (Minimum 50%)
(2p) Have low density (Maximum 1.5kg/dm3)

Safety and health
(3p)* Be non toxic (According to IKEAs specification IOS-MAT-0010, Chemical Compounds and substances)
(2p) Products that might be used together with food should follow legislations/restrictions for food contact (According to IKEAs specification IOS-PRG-0021)

3=Very important, 2=Important, 1=Preferred

* =Demand

Appendix IV

Focus group questionnaire

A questionnaire was used in the focus group to collect the participants individual opinions about each material group. The questionnaire looked like follows. The second page here in this Appendix was repeated five times, once for each material group.

Fokusgrupp

En undersökning av kundens upplevelse av materialförslag
för IKEAs sortiment av blomkrukor, skålar och vaser

Var vänlig fyll i nedanstående uppgifter om dig själv

Ålder: _____

Jag är ☐ Kvinna ☐ Man

Mitt intresse för heminredning är (Sätt ett kryss på linjen nedan)

Mycket litet ⊢——————⊢——————⊣ Mycket stort

Mitt intresse för växter/blommor/vaser är (Sätt ett kryss på linjen nedan)

Mycket litet ⊢——————⊢——————⊣ Mycket stort

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PPU – Institution for Product and Production Development
CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden 2011

Material 1

1. Skulle du vilja köpa dekorationsprodukter (krukor, skålar, vaser) i de visade färgerna för att inreda ditt hem?

- ☐ Ja, jag gillar alla färgerna
- ☐ Nej, jag gillar ingen av dem
- ☐ Jag gillar några av dem (Skriv bokstaven på de materialprover du gillar)

---

2. Skulle du vilja köpa dekorationsprodukter (krukor, skålar, vaser) i de visade mönstren/färgskiftningarna för att inreda ditt hem?

- ☐ Ja, jag gillar alla mönster/färgskiftningar
- ☐ Nej, jag gillar ingen av dem
- ☐ Jag gillar några av dem (Skriv bokstaven på de materialprover du gillar)

---

3. Vad tycker du om känslan av ytstrukturen på materialet?

Jag tycker inte alls om den — Jag tycker mycket om den

4. Hur skulle du uppskatta tåligheten på materialet?

Mycket ömtåligt — Mycket tåligt

5. Vad är ditt helhetsintryck av materialet?

Jag tycker inte alls om det — Jag tycker mycket om det

6. I vilken/vilka produkter skulle du vilja se det här materialet? (Det är tillåtet att sätta mer än ett kryss)

- ☐ Blomkruka för inomhusbruk
- ☐ Blomkruka för utomhusbruk
- ☐ Vas
- ☐ Skål
- ☐ Ingen av dem

Samtliga material

Rangordna de fem materialgrupperna efter hur attraktiva du tycker att de skulle vara i dekorationsprodukter (krukor, skålar, vaser) för ditt hem. Använd siffran för respektive materialgrupp. Placera det material du minst skulle vilja se i de nämnda produkterna längst till vänster på linjen och det material du helst skulle vilja se i de nämnda produkterna längst till höger på linjen. Placera ut alla siffrorna 1-5.

Av de presenterade materialen vill jag i minst utsträckning ha detta material i en dekorationsprodukt i mitt hem

Av de presenterade materialen vill jag i störst utsträckning ha detta material i en dekorationsprodukt i mitt hem

Övriga kommentarer:

Tack för din medverkan!!

Appendix V

Focus group transcript

The discussion held in the focus group was recorded and made into a transcript. The transcript is presented below. It is only avaliable in Swedish.

M: Moderator,
1,2,3,4,5,6,7: Participants

Material 1 – Corian

M: Då börjar vi med material 1. Jag att visa prover här. Det här är samma material som kallas grupp 1. Jag har med mig 5 varianter. Titta på dem, känn på dem och fyll i första sidan.
M: Då kan vi börja diskussionen. Vi börjar med färgen. Var det någon som fyllde i att ni tycker om alla färger?... Nej Om jag då frågar vilka färger tyckte ni om och varför?
2: B tycker jag om. Den passar det mesta väldigt neutral tycker jag. Och C är lite roligare och D var fin färg.
1: Men de här går att få i vilken färg som helst? eller är det vissa färger?
M: Det här är bara ett par exempel.
4: Jag skulle välja alla utom C. Jag tycker inte alls om C.
1: Jasså, jag tycker bäst om C
6: Då måste jag titta här och se den igen
M: Kan ni säga något om varför? Du som verkligen inte tyckte om den varför tycker du så och ni som gillar den varför gör ni det?
4: Jag har svårt att se den på en produkt eller kruka jag skulle nog inte tycka om hur den produkten skulle se ut. Jag tycker det är för plottrigt.
1: Jag tycker om det
6: Det kan nog jag tycka också. Jag gillar det faktiskt också jättemycket.. svartvitt. Jag skulle mycket väl kunna tänka mig en större fyrkantig… eller kantig kruka, viktigt med kanter på den. För att markera den ännu mer den här kantstrukturen som är där, alltså i. Och jag skulle kunna tänka mig en större kruka också.
M: Så hellre en stor än en mindre produkt?
6: Jag är inte så mycket för små produkter så jag är mer för stora produkter. Det skulle passa väldigt bra hos mig. Mm absolut.
3: Jag tycker att den såg lite smutsig ut.
5: Jag gillar inte heller den faktiskt.
4: Det tycker jag med, den såg smutsig ut.
7: Jag tycker att det var skön känsla i den. Om man gör en produkt utav det så känns det som om det är mycket kvalitet i den.
6: Mm, det tycker jag också.
6: Den är robust på nåt sätt.
M: Om vi går vidare och talar om mönstringen eller färgskiftningen som vi kallar det då. Då har vi ju redan nämnt den här () tror ni att den skulle funka även i andra färger än svartvitt?
1: Det tror jag. Jag vet inte.
3: Jag kan se den i vitt och rött. Det hade varit häftigt.
1: Eller rosa och rött.
M: Vilken färg skulle vara bas och vilken skulle vara kornen om man säger?
3: Vitt som bas och sen byta ut de svarta pluttarna mot rött. Då hade jag nog tyckt bättre om den för nu är det lite för mycket kontraster för mig. Medan rött hade vart lite så här häftigare.
M: Är det någon annan där ni vill säga något om färgerna och mönstren?
5: Jag tycker om A och B i båda. De är lite naturliga.
6: Ja det är lite granitstruktur.
7: Utomhus skulle det nog vara jättefint tror jag.
6: Ja
1: Men jag tycker inte att det känns passande för en kruka eller vas för att den är så natur.
5: Men det tycker jag.
1: Som en kruka men tänk en hel kruka i natur.
5: Och sen lite naturliga växter i. Fint.
7: Ja grönt till brunt är vackert i och för sig.
6: Ja en stor kruka och sen ha gräs eller höga gräs hade varit fint till det.

1: Jag ser det mer som plattor eller köksbänk.
M: Styrkan eller nyansen på färgen, är det något ni tycker om?
1: Den svartvita. Jag tycker de andra är för matta och blekfärgade. Fast det kommer ju alltid nya färger med vår sommar höst och allt det där ju.
Tror ni att man skulle kunna ändra något på dem så att färgen och mönstret skulle bli snyggare?
6: Då tycker jag att den () skulle man ändra ännu mer till granitstruktur. För det har ni i plattor och så. Det finns ju i bänkskivor. Lite ännu mer granitstruktur skulle jag tycka. Den ser ju lite ut som marmor.
2: Den tycker jag är fin.
6: Ja den är ju riktigt fin.
2: Jag tycker inte om det svartkorniga i den här gröna.
1: Nej det är sant
M: vad är det du inte tycke om? Skulle den vara finare helt slät enfärgad eller med mer korn?
2: Mer slät tycker jag. Eller kanske vitkornigt mönster i den bara inte svartkornigt.
1: Jag tycker det känns lite billigt. Som att det inte räcker till hela..
2: Smutsigt
1: Det tänkte jag inte på när jag såg den först.
7: Känslan blir lite plast när man ser den sen när man känner den känner man att det är lite sten.
5: Det tyckte jag om den röda med att den känns lite plastig.
2: Den röda känns mer som slit och släng. Jag vill ha något som jag tycker är roligt en stund som dekoration.
6: Så tänker jag också. När jag köper någonting med färg på så tänker jag att det ska jag ha en månad kanske två max. jul så (röda) sen den här (svartvit) den tycker jag ser väldigt läcker ut. Dyr ut om vi säger så.
5: Den är nog så att antingen gillar man den eller så gillar man den inte.
M: Just den här röda och gröna det är ju bara två färger som jag valde ut har men om man tänker sig samma ton, mörkhet och mönstring men i andra färger tex. lila eller blått tror ni att ni skulle tycka bättre om dem?
1: Mm mörklila, de mörka kornen fungerar nog bättre om det är mörklila färg i bakgrunden.
M: Om vi går över till att tala om känslan på dem..
1: Mycket bra
M: Håller ni alla med?
Flera: Ja
1: Det känns ordentligt och lyxigt
7: Ja men det gör det
M: Vad tror ni det är som gör att ni alla verkar vara överrens om det då?
1: Solid
7: tyngden
Flera: Ja precis
Ni tittade ju på dem en liten stund innan ni rörde vid dem. När ni fick känna på dem kändes de som ni hade förväntat er?
1: De två i alla fall
7: Ja de som ser ut som sten. De andra blev lite så där, det kan nog vara en plastimitation eller så där.
Flera: Mm
M: Om ni skulle uppskatta kvalitén på det här materialet vad skulle ni säga om det då?
6: Jag tror det är tåligt
Alla håller med
M: Vad är det som får er att tycka det?
7: Ytskiktet känns lite diskbänk som det är lätt att torka av så är det rent sen.
6: Ja precis, jag tycker också det känns lite som diskbänk.
M: Skulle ni säga att ni använder mest utseendet på materialet eller känslan när ni bedömer kvalitén?
1: Både och
3: Känslan
Okej och om man tänker sig att man använder materialet i en produkt och ni står i butiken och bedömer den här produkten, är det bra kvalitet? Kommer den att hålla? Vad är det ni tittar på då framför allt?
1: Den ska ju inte se billig ut
7: Det är lite priset tror jag också. Om man ser något så kanske den är lite dyrare så kommer man fram så är den väldigt racklig så är det ju inte tilltalande så den här skulle nog kännas bra med rätt pris.
M: Är det några andra aspekter som ni tycker är viktiga för att kunna bedöma kvalitén? Det vi tittar på nu är ju utseende och känsla men om man tänker på design tex tjocklek, du nämnde ranglighet är det något särskilt ni tänker på om ni ska köpa tex. en vas eller en blomkruka?
6: Det som jag har råkat ut för några gånger när man har köpt en vas det är att man har vatten i den för det har man ju i en vas

Material 2 – Formpressad filt

M: Kändes det här lite svårare?
Alla håller med
M: Vad tror ni det beror på?

1: Att man inte riktigt vet vad det kan användas till
7: Ja det känns ju inte som något klassiskt material som man sett innan i krukor
M: Vad tänker ni på för produkter om ni ser det? Du nämnde julprydnader. Är det något annat som kommer i tankarna när ni ser det här?
4: Underlägg
5: Ja och lite att skydda i skrivbordslådor och lådor
4: Som botten i lådor
5: Ja lite så
3: Förvaringslådor tänker jag
Flera håller med
3: Men inget sånt som man kanske har framme som fint
Flera: Nä
1: Förutom vid jul
4: Förutom om det är barnrum
M: Barnrum varför det?
4: Då tänker jag mest på det här färgerna
M: så det är färgen du förknippar med det?
4: mm
M: Om vi börjar tala om färgerna igen. Vad tycker ni om dem? Var det någon som tyckte om allihopa?
3: Jag tycker de är helt ok
5: Ja, det tycker jag med. Det beror på vad man ske ha det till
7: Jag tyckte mer om de starka färgerna. Att man skulle kunna ha de som säsongsprodukter i så fall.
M: Menar du D och E då?
7: Ja A, D, E. Jag tyckte de här var lite för beiga.
1: Det är jul och så har man något rött till
7: Ja det är sant
2: Jag tycker bara om A
1: Vilken är det?
2: den
1: Ja
M: varför gillar du den?
2: Jag gillar den mörka gråa färgen och nyansen i den. Den känns stilren och de andra får mig att tänka disktrasa.
Flera håller med
M: Har det att göra med mönstringen också?
1: Ja men om man ser det här i denna särskilt om man håller det lite så. Nu ska jag torka här.
2: De är för svaga när de är sån svag grön svag blå så blir det disktrasa. Trepack
1: Det saknas gult
4: Jag tänker på känseln mycket, att det är skönt att det inte bara är slätt. Det blir lite strävt.
M: Du menar att du tycker om känslan. Tycker du extra mycket om de med rutor tex?
4: Känslan i allmänhet att det är nånting att ta på
M: Lite friktion
4: Ja
1: Jag har inte tänkt så mycket på mönstren
M: Skulle ni föredra med eller utan mönster om man ser det i de här produkterna?
1: Inte den gröna
Flera: Utan
6: Det beror på vad det har för funktion. När jag ser detta tänker jag på min hallmatta som jag har nedvänd för att det ska vara luft emellan. Jag har sånt på min hallmatta.
1: Den här tycker jag är ok med.
M: mm det är lite mindre struktur på den.
4: Jag tycker den är mest disktrasa
1: Jaså det tycker jag den gröna är fortfarande
4: Nej jag tycker den är lite mer heltäckningsmatta
1: Men tänk att ha de som grytunderlägg och så också. Det är ju kul om det är olika färger och man kan lägga ihop dem.
6: Som ett grytunderlägg skulle jag med kunna tänka mig.
5: Ja jag också
6: Det skriver jag till här grytunderlägg
2: Det skulle vara starkare färger då också eller mer i den stilen stilrent B gräddvitt.
6: Det beror sig på vad man har dukat med
5: Är det grytunderlägg kanske det inte kostar så mycket heller så då är det roligt med lite färg.
1: Ja då kan man köpa flera och byta ut lite. Det är ju sånt som är kul att ändra om lite då och då. Det kan man ju göra, det har man ju råd med.
6: Jag tycker det är fint som du sa Anna att man har det i en låda. Man drar ut en låda om man nu har och lägger sina smycken på det eller nånting sånt. Det finns jag tror det redan finns nånting sånt
1: Ja det gör det fast det är väldigt tråkiga färger

6: Ja det är nån beige tror jag. Jag har en sån låda hemma så är det fack man drar ut så kan man lägga livrem, smycken och sånt och då är det sånt i botten tror jag fast den färgen som du har där. (beige)
1: Det hade varit kul om det var mer färg på det. Inte den blå den är väldigt tråkig.
7: Den känns nästan lit smutsig tycker jag om den inte är smutsig.
3: Den känns lite himmelsblå fast lite smuts i den. Malmös blå.
2: Vinrött eller mörklila kanske hade varit bättre. Marinblå.
M: Så djupare starkare
1: Och nån rosa
M: Du har nämnt rosa och gul så du tänker lite knalligare kanske.
1: Ja på påsk är det ju gult det är givet och på vår och sommar är det ljusrosa och stark rosa tycker jag och sen kommer detta vid jul de två. Den här passar nästan alltid förutom på sommaren.
M: Känner ni det här materialet mer som ett säsongmaterial än det förra?
Flera: Ja
M: Vad tror ni det beror på?
7: Känns som de här är lite lättare att plocka undan på nåt sätt, stuva undan. Starkare färger.
4: Är det som botten i lådor så byter man nog inte så ofta
7: Nej jag tänkte som vas i så fall eller kruka eller nånting.
1: Men det hade gått att ha det som en kruka för det finns ju vissa krukor som har en ytterkruka och så har man en innerkruka i som man sätter själva blomman i. Förstår ni vad jag menar då kan det ju va nåt sånt här runt. Det blir mysigt på julen också. Jag ser mer jul i det. Om det inte är grytunderlägg.
M: Varför tror du att du förknippar det med jul?
1: Strukturen i det. Det påminner om de här gamla gråa tomtarna och vantarna. Det är sånt som ska va då.
7: Det håller jag nog med om faktiskt
6: Det skulle man nog kunna tänka sig att ha så och så tänker du att du har vasen inuti så har du detta utanpå
1: Ja, en kruka då. Det hade vart kul att se en sån på riktigt.
M: Det är ju inte lika traditionellt material det här för just de här produkterna så man får använda fantasin för att försöka se hur de kan användas. Om vi tittar på mönstringen igen, nu var det ju bara rutiga mönster här, tror ni att den skulle kunna bli roligare på något sätt?
1: Ja det tror jag.
M: Vad skulle ni vilja se för mönstring i så fall
1: Det beror på funktion med
M: Och känslan på det här materialet vad säger ni om den. Du sa att du tyckte om lite friktion. Vad tycker ni andra?
1: Det beror helt på vad det är för produkt.
M: Om vi tänker oss bara som ett exempel. En fruktskål.
1: Nä alltså jag vet inte. Tänk att ha kiwi i det här med alla de hårstråna
7: Ohygieniskt
M: Så ni tycker inte att det passar med mat?
7: Nä det går ju inte att torka av direkt
6: Nä det går ju inte tänk ett ruttnat äpple liksom det
7: Nä det är mer som du sa att det borde vara runt nånting i så fall så att det inte är i direkt kontakt med nånting
Kan man se det som en liten fot runt en kruka som nån dämpning?
Flera: Mm
7: Ja men nåt sånt
Tyckte ni att det här kändes som ni förväntade er när ni först tittade och sen kände på det?
2: Det var hårdare än jag förväntat mig
Alla håller med
7: Ja det är sant man hade räknat med lite mer disktrasa, en torkad disktrasa
6: Ja precis
M: Om ni försöker uppskatta kvalitén på det här materialet vad skulle ni säga då?
1: Grytunderlägg, ja bra kvalitet
M: och om man försöker tänka i de här produkterna?
1: Skål vas? Nä
Flera: Nä
M: Dålig kvalitet då?
1: Men om en blomma vissnar, det läcker vatten och kommer lite jord i och diskar man och så kommer det… NEJ
M: Så skulle man kunna säga att alla är överrens om att det känns svårskött?
Alla: Ja
M: Var det någon som kryssade i att det skulle passa för någon av de föreslagna produkterna?
Flera: Nej
7: Jag kryssade i att det skulle passa för blomkruka för inomhusbruk men då tänkte jag inte att själva blomman skulle vara i utan att det skulle vara nånting i i så fall eller att det skulle vara till någon konstblomma för det här och jord går inte så bra ihop.
Vissa produkter är ju tänkta endast för plastblommor. Kan ni tänka er en sådan i det här materialet?
Flera: Nej
1: Det ser så fel ut. Det är inte så det ska se ut.

M: Så det känns långt borta?
7: Ja mer kombinationsmaterial skulle jag vilja ha det typ att man har det runt eller en bit upp
1: Men då tänker man mer att det är till en gryta det finns ju såna vinkylnings fodral..
7: Ja precis
1: Eller pot cover. En gryta man sätter i för att hålla värmen
5: Ja det är ju som de här karafferna med.
1: Mer sånt fast då är det mer picnic.
6: Ja och så är det mycket mjukare runt om.
M: Om vi ändå tänker oss att det fanns en kruka i det här materialet. Vad tror ni priset skulle vara?
1: Ingenting
M: Alltså är det inget ni skulle vara intresserade av att köpa då antar jag?
Flera: Nej
M: Håller alla med? Även du som kryssade i inomhuskruka?
7: Jag skulle överväga det. Det beror på hur det ser ut. Men inget självklart är det inte.
M: Som jag har förstått så beror det mycket på vilken produkt det är med det här materialet och det är svårt att se det i de här produkterna eftersom det inte finns idag.

Material 3 – Wood fibre composite

M: Vad tyckte ni om det här färgerna?
5: Det var svårt tycker jag
1: Jag tycker inte om de spräckliga för det ser smutsigt använt… det ser återvunnet ut och det är positivt men jag får en väldigt dålig känsla. Det ser billigt och gammeldags 80-tal
Allihopa eller?
1: Nä de här tycker jag funkar för det är ändå lite nyansskiftningar men de här tycker jag.. nä usch
2: Jag tycker tvärt om
4: Jag tycker bara att den svarta var fin för den är lite mer… den var lite lugnare
2: Jag gillar när ni höll upp den i solljuset (B) jag tycker om färgskiftningarna. I E också tycker jag om de olika färgskiftningarna. Där tycker jag strukturen kommer till sin rätt när det blir så stora skillnader i färgen. Det ser mest.. den ser lite misslyckad ut tycker jag som att det blev något fel här.
M: Den röda där ja.
1: Det tycker jag om dem (brun o svart)
5: Sen tyckte jag den röda var lite julröd. En julkruka.
1: om de här två var i lite starkare färger tror jag skulle kunna vara fint. Jag tycker inte om grönt från början och den här tycker jag var…
M: Vilken färg skulle du vilja ha?
1: Det hade funkat med starkare grön i så fall. Eller jag tycker om lila, vitt och svart. Och blått ibland
2: C får mig att tänka på farmors överkast. Solblekt
M: Tycker du bra om den eller?
2: Nej
Vad är er favorit bland de hä färgerna?
Flera: B
1: Näe
7: Men om man kollar lite i solen. Den ser ju ganska levande ut.
6: Jag tycker de två (svart och brun)
Varför tycker du om edm?
6: Alltså jag har en skål hemma en ganska stor skål som nästan liknar detta. Lätt och så här och jag älskar den skålen. Så det kan jag tänka mig. Och så kan jag tänka mig en hög vas också att ställa bredvid den här skålen.
M: Ja, håller ni andra med
Flera: Ja
6: Man behöver inte ha nånting i den här vasen den kan va som den är för jag har ingenting i skålen.
M: Vad tror ni att det är för material om ni gissar?
3: Plast
7: det känns som pressat
6: I min skål är det trä men jag vet inte vad det kan va.
4: Jag skrev plast trä känsla
Flera håller med
7: Det känns som det är ihop limmat. Det är ju väldigt lätt
6: Väldigt lätt ja
1: Det är lite som det bordet man har utomhus. Vet ni vilket det är. Det ser ut som att det är trä målat med grått. Aluminium ben tror jag. Det känns så fast lite mindre trä än det gråa bordet
7: Det känns som det är tåligt
M: Tyckte ni om känslan? Du tyckte att det kändes tåligt.
7: Ja det tycker jag

M: Tycker du det är bra kvalitet då också
7: Jo det tror jag, det känns som att ytan är så pass hård att det skulle kunna hålla för en del. Jag tänker att det går och torka av smidigt så att det ser bra ut.
M: Vad tyckte ni andra om känslan på det?
5: Det känns bra för min del.
1: Jag känner mig velig
6: Jag känner mig med väldigt velig om detta
M: Vad tror ni att det beror på?
1: Det känns inte riktigt bra.
6: Det ser lite plastigt ut ändå.
M: Tror ni det har med vikten att göra eller med känslan av ytan?
1: Det är nog känslan
6: Känslan när jag ser på det
4: Jag tycker A och B ser bättre ut än de andra färgerna för de ser plastigare ut.
1: Jag håller med
4: Så jag tänkte mig B i en stor öppen skål och då skulle det kännas ganska bra.
M: Ni två har bägge nämnt stora produkter. Tänker ni andra med så eller?
Flera: ja
Så vilka produkter har ni kryssat att ni skulle vilja se de här i?
5: Jag tog vas och skål
6: Jaha du tog vas ja det kanske kan vara fint i en vas.
1: Jag har tagit blomkruka för inomhusbruk men helst utomhus och sen kanske skål.
2: A tror jag passar som skål och B som stor kruka
7: B tänkte jag som utomhuskruka. Tyckte den var så fin i solen på nåt sätt
M: Just att den kommer fram i ljuset?
7: Ja
1: Känner man inte på den ser den mer ut som ett levande material.
7: Ja, det gör den om man skulle strukturera den lite. Göra så att det ser ut som träribbor skulle man kunna tro att det är ett träslag av något slag som är lackerat då. Fast mycket tåligare.
1: Ja den ser hård ut. Den ser nästan ut som sten tycker jag om man inte känner det.
Tycker ni om det? Tycker ni om att den ser ut som sten och sen inte känns som det?
1: I vissa produkter tycker jag om det. Det är någon stor kruka med vit trekant som är plast och när man lyfter den blir man chockad och det tycker jag är skitbra för det är jobbigt att bära tunga krukor med jord i och sånt. Det är jobbigt att flytta på dem.
7: Ja sten är väl ganska kostsamt. Jag kan tänka mig att man får ett lite bättre pris på en sån här.
M: Okej så om vi snackar om priset…
7: Det känns som man får en prisvärd produkt om man gjorde nånting som imiterar ett material som är dyrare.
1: För mig är detta lågt pris
2: Det tror jag med
M: håller ni andra med?
M: Ja fast det ändå inte ser ut som det. Det är först när man känner på det tycker jag. Det är först då man kan tänka att det är ett billigt material.
M: vilka av er skulle vilja köpa en produkt i det här materialet då?
1: Kanske
5: Jag skulle kunna tänka mig
6: Ja en kruka
Fler håller med

Material 4 – Re-Y-Stone

M: Vad har ni för reaktioner på det här materialet?
1: Billigt, plastigt
5: Jag tyckte om det
7: Lite fettfläcksvarning på det där blanka
M: Men du sa att du tyckte om dem
5: Ja jag tycket om dem
M: Vad är det du gillar med dem?
5: Ja jag tyckte om alltihop. Fast jag har lite svårt att se det som vas och skål men blomkruka kanske
1: Jag tänker detta i köket som kakelplattor
5: Ja lite så fast jag tycker det är fint.
7: Frågan är om det skulle vara det i en annan färg också. De är ju ganska mörka de här.

M: Vad tycker ni om färgerna?
1: Svart.
2: Jag tycker om den bruna nyansen fast inte ytan och prickarna
M: På D där?
2: Mm
5: Det tycker jag var snyggt med det där mönstret
2: Jag tyckte om E på utomhuskruka
Flera håller med
3: Jag tycker den ser smutsig ut.
1: Det ser ut som kaklet i Stockholms tunnelbana
6: Jag tycker bara om den (B). Den kan jag tänka mig som en bordsskiva, bänkskiva, laminat om man nu inte kan köpa äkta.

M: Varför tycker du bara om den?
6: Jag tycker detta ser plastigt eller tillgjort ut på något konstigt vis.
1: Kan man få denna i fler färger med?
M: Det här materialet kan inte idag göras i ljusare färger. E är den ljusaste.
6: Jag kan tänka mig en sån i en formgjuten bricka av något slag.
1: Även fast inte ytan är jämn? Fast det kanske inte är så farligt
6: Man kan ställa nånting på det. Jag skulle kunna tänka mig också om man hade haft en större sån fyrkantig så kan man hänga den på väggen så skulle man kunna ta ett kort i mitten så blir det en fin struktur runt omkring.
M: Så du tycker om strukturen?
6: Ja jag tycker om strukturen
1: Det gör jag med
6: Det ser lite som du säger det ser lite klinkers kakelaktigt ut
5: Ja skiffer det tycker jag är fint.
6 och 7 håller med
2: Jag tycker inte om att fingeravtrycken syns så himla mycket.
Flera håller med
1: Nej det är ju inte så himla kul om man har en produkt som man ska gå och bära och det blir fingrar på.
7: det känns som att de är väldigt fingeravtryckskänsliga framförallt den här C.
Varför tyckte ni att den kändes billig? Ni som sa det? Vad tror ni det beror på?
1: Det är en helt annan baksida inte alls samma det känns som det är målat på eller printat.
2: Det dycker jag känns på framsidan också
4: Det känns som att man kan skrapa av men jag tycker att D och den (okänd) ändå har ganska fin struktur när man tittar på dem.
M: Om man inte hade sett baksidan, skulle det vara anorlunda då?
1: Det beror på tjocklek och vad det är för produkt. Den känns ju inte riktigt…
7: Nä den skulle kunna krasa till liksom
2: Alla utom E glänser för mycket. De ser väldigt plastiga ut.
1: Den här (E) känns ändå lite spännande men jag är inte riktigt förtjust i färgerna. Den känns mer ordentlig.
M: Och den såg ni i en utomhuskruka. Vad tror ni det beror på?
4: Den känns lite som sten.
1: Den här tänker jag på toalett och barn, alltså dusch och vatten och droppar.
4: Jag tänker lekfullt med barn.
7: Ja en hink eller nåt
1: Lite fel att den är svart bara då
Vilka produkter förutom utomhuskruka skulle passa för det här materialet?
1: Jag kan se det som en skål med innomhus med lite apelsiner i.
M: Skulle ni vilja ha det tjockare?
1: Ja tjockare fast inte mycket men åtminstone en centimeter. Eller nåt sånt här kanske (visar en vas som ser ut att vara tjockare än vad den är eftersom kanten har gjorts tjockare).. då ser man ju inte tjockleken i här.
Skulle ni vilja ha en sån här produkt om det fanns?
Blandade svar
M: Hur mycket skulle ni kunna betala för dem?
1: det beror på vad det är för nåt
2: det ser ju billigt ut
6: det beror på vad man har det till jag kan tänka mig att det kunde va snyggt.. Jag skulle kunna tänka mig att köpa en stor så platta om jag hade ett bord som jag är lite trött på. Då kan jag göra en stor fyrkant av det och lägga i en ände om jag har ett glasbord tex. så kan jag lägga det där så kan jjag ha nånting på det. Och då kan det ju va så här tungt så förändrar jag mitt bord lite

Material 5 – Acrodur + Natur fibrer

Vad har ni att säga om det här
2: Säsongsprodukt men jag tycker om dem
M: varför säger du säsongsprodukt?
2: Färgerna igen. Det är en sån sak som man kan förändra lite beroende vilket humör man är på.
M: Är det några färger du tänker på framförallt för det?
2: Jag tycker om alla utom E
7: Det här känns ju som ett sånt material som man kan lacka med vad som helst nästan va?
M: I olika färger och ytor menar du eller? Ja det går nu är det ju ganska transparant så att man ser igenom. Är det något ni tycker om?
Flera: Ja
4: Jag tycker den vita är lite finare än de andra
6: Jag tycker det ser ut som nålfiltsmaterial
1: Det beror lite på vad de ska användas till tycker jag
7: Jag tänkte ett sånt fat det skulle man kunna ha i en mer solid lack. Alltså så att den är helt… man inte ser strukturen.
1: Men man känner ju att den är hårig. Jag tycker om den här stilen men hade aldrig velat ha mat på en sån här bricka.
2: Ja inte direkt på den
7: Du menar frukt och så eller?
2: Ja äpplen och bananer
1: Jag bara känner att den här hårar av sig. Den gör säkert inte det men det känns så om man håller i den.
6: Mm det tycker jag också
1: Aldrig i livet säger jag
6: Nä jag skulle aldrig köpa nånting i detta
1: det beror på vad det är inte en bricka men jag tycker om det här (vita)
M: vad var det ni tycker om med den vita
3: Mönstret är fint
1: Fräsch
5: Och man ser inte det svarta håret
1: Den här tycker jag är lurig (grön)
2: Det ser ut som korsstygn
1: Jag tycker det ser ur som en filt så är det absolut inte det
5: Ja det blir lite konstig känsla, plastig
1: Men jag tänker som ett foto det känns som man kan printa sin egen bild på det. Den här (röda) tycker jag inte om det är någon byggsak
1: Hur känns den gråa?
2: Den hade jag kunnat ha i ett fönster eller nånting som en kruka kanske eller i alla fall utsidan av en kruka. Jag tycker om den marinblå mörkblå färgen och strukturen.
1: Ja jag tycker om den här.
M: Vilken struktur föredrar ni för det finns ju dels den här med långa fibrer som man ser så finns den här som man inte riktigt ser trådarna i.
2: Den vita tycker jag bäst om
Flera håller med
4: Där man inte ser trådarna
7: Ja där trådarna inte framträder så mycket.
M: Vad skulle ni tro om kvaliten och pris på produkter i det här?
1: Jag tycker det är väldigt svårt att säga
2: Jag tror det är ganska bra kvalitet men ganska billigt
1: Men det beror på vad man ska ha det till jag hade ju inte velat ha en kruka i detta det känns som det läcker igenom
2: Det behöver kanske vara något annan på insidan
7: Jag tycker att det känns ekologiskt på något sätt
6: Ja det kan man säga
7: Om man lämnar det ute för länge kommer det att återgå till kretsloppet liksom.
2: Det är det som jag gillar med det
7: Jo det är väl bra i och för sig
6: Jag undrar om det ändå inte är massa lim i det
1: Men jag kan tänka mig det i en ram med lite olika mönster och så och då gör det inget om det är lite hårigt heller. Det kan vara kul ibland.
4: Jag tycker den vita som förvaringslådor skålar. Lite ramar med kanske. Det är lite mer användbart än de andra. Det ser känsligt ut för vatten men ändå ganska tåligt om det inte utsätts för det.

Övrig diskussion

M: Vilka egenskaper tycker ni är viktigast när ni köper den här typen av produkter? Några exempel kan tex. vara miljöaspekter, pris, kvalitet, utseende. Så vad är det ni framförallt går på när ni väljer?

2: Utseende och kvalite
6: Utseende går jag också jättemycket på
2: Fast man borde väl tänka mer miljöaspekt men det är fortfarande utseende och kvalitet som får mig att välja det.
1: Först kommer väl utseende för annars kollar man ju inte på det och sen känner man på det och känns det bra så ja det måste ju hålla för ändamålet annars är det ju ingen mening att köpa det och känns det sådär då köper jag något annat hellre.
M: Håller ni med allihopa?
Flera: Ja
5: Sen beror det ju på just om det är någonting jag skall ha kanske länge eller om det bara är något jag ska ha under en kort tid. Då vill jag kanske inte att det ska kosta så där jättemycket.
M: Vilken har varit er favorit av de här fem grupperna?
Flera: ettan
Allihopa?
Alla håller med
Varför?
1: kvalitet
7: det känns som ett roligt material
Och vilket tyckte ni minst om?
Flera svar
M: Det var alltså lite utspritt där. 2, 4 och 5 fick vi där okej. Och vad har ni för orsak till det?
1: Jag ser det inte för skålar, krukor och vaser alls (2)
7: Det känns inte som kvaliten skulle bli bra
6: Jag tycker inte om sånt som ser ludet ut (5). Titta här man ser ju här på kanten. Nä inte alls!

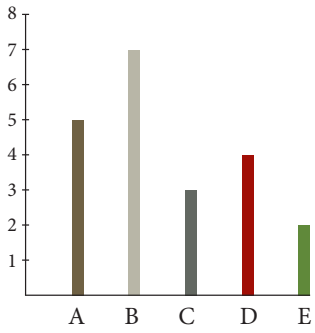
Appendix VI

Focus group results

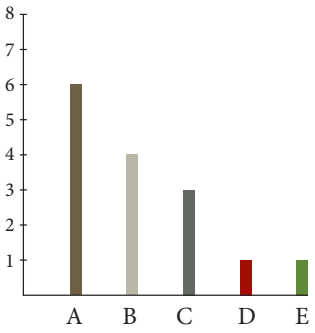
This Appendix presents the compiled results from the focus group questionnaire. The bar charts show how many participants that gave each response and the scales show the individual opinions of each participant and the variation of answers. For each material group a couple of quotes have been selected and translated into English.

CORIAN

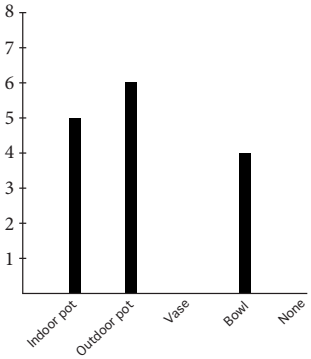
What colours do you prefer?



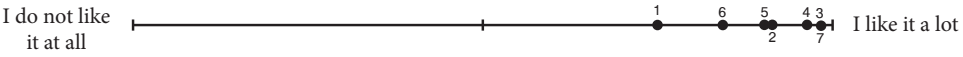
What patterns do you prefer?



In what products would you like to see this material?

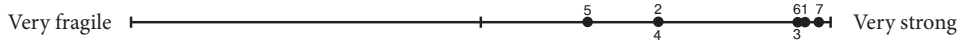


What do you think of the feeling of the surface structure of the material?



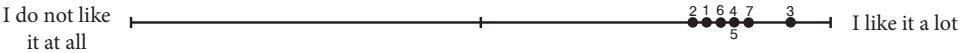
Mean value 9.0
The anwers were spread between 7.5 and 9.8

How would you estimate the strength of the material?



Mean value 8.6
The anwers were spread between 6.5 and 9.8

What is your overall impression of the material?



Mean value 8.6
The anwers were spread between 8 and 9.4

Quotes from discussion:

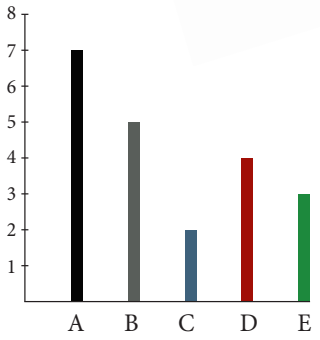
"I like B. It goes together with most things, I think it's very neutral. And C is a bit more fun and D was a nice colour"

"I think it has a nice feeling. If you make a product out of it it feels like it would be of good quality"

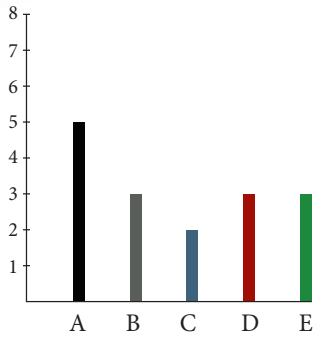
"It feels good and luxurious"

NORDIFA

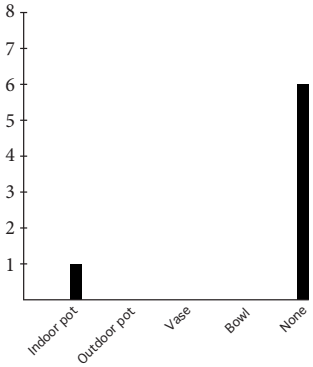
What colours do you prefer?



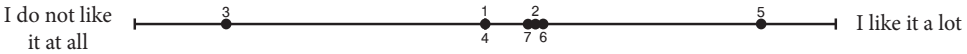
What patterns do you prefer?



In what products would you like to see this material?



What do you think of the feeling of the surface structure of the material?

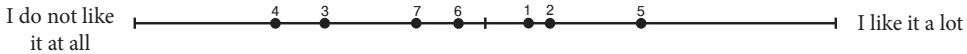


Mean value 5.3
The anwers were spread between 1.3 and 8.9

How would you estimate the strength of the material?

Mean value 3.9
The anwers were spread between 2.4 and 9.2

What is your overall impression of the material?



Mean value 4.6
The anwers were spread between 2 and 7.2

Quotes from discussion:

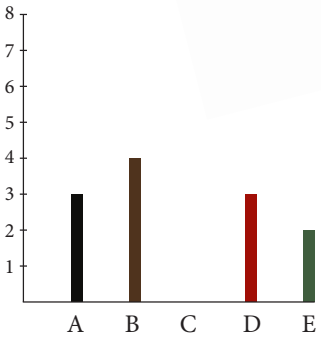
"I like the dark grey colour and the hue of it. It feels stylish. And the others make me think of dishcloths"

"I think a lot about the feeling, that it is nice that it's not just plain. It becomes a bit rough"

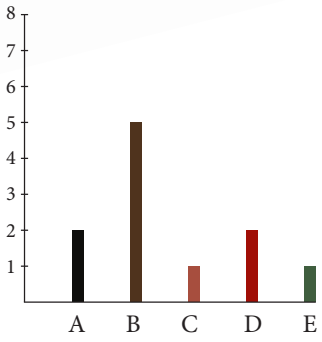
"It looks so wrong. That is not how it is supposed to look"

KARELINE

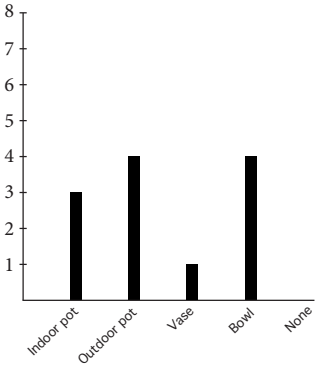
What colours do you prefer?



What patterns do you prefer?



In what products would you like to see this material?



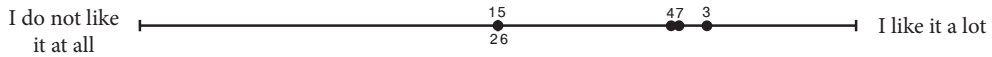
What do you think of the feeling of the surface structure of the material?

Mean value 5.8
The anwers were spread between 5 and 7

How would you estimate the strength of the material?

Mean value 8.5
The anwers were spread between 5 and 9.9

What is your overall impression of the material?



Mean value 6.1
The anwers were spread between 5 and 7.9

Quotes from discussion:

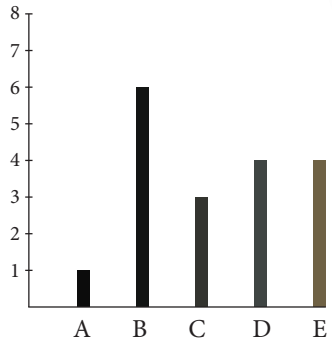
"I liked when you held it in the sunlight (B). I like the colour changes. I also like the colour changes in E. The structure comes to its right when the colour changes gets that big."

"If you don't touch it it looks more like a living material"

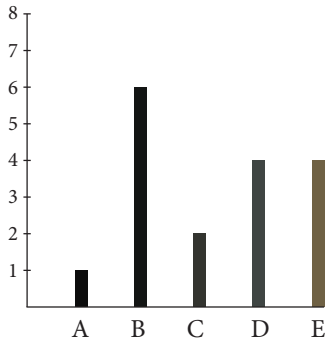
"Stone is quite expensive. I would imagine you get a better price for something in this"

RE-Y-STONE

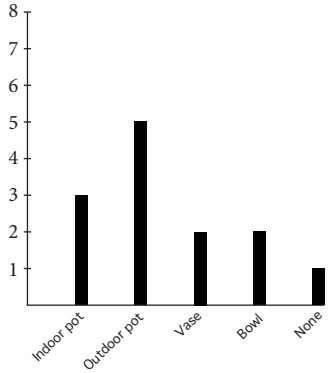
What colours do you prefer?



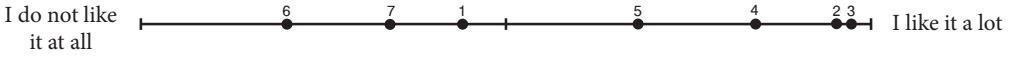
What patterns do you prefer?



In what products would you like to see this material?

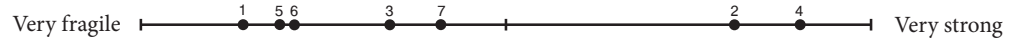


What do you think of the feeling of the surface structure of the material?



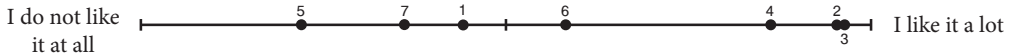
Mean value 6.3
The anwers were spread between 2.0 and 9.7

How would you estimate the strength of the material?



Mean value 4.3
The anwers were spread between 1.4 and 9.0

What is your overall impression of the material?



Mean value 6.2
The anwers were spread between 2.2 and 9.6

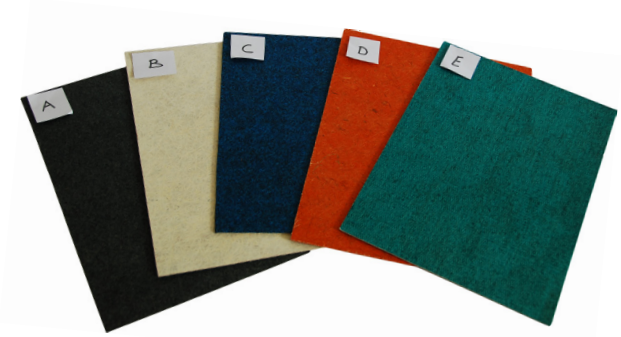
Quotes from discussion:

"I like all of them but I find it hard to see them in a bowl or vase but in a flower pot maybe"

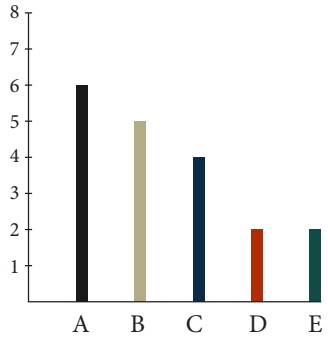
"I think this looks plastic or fake in some strange way"

"It feels like they are very sensitive to finger prints. Especially this, C"

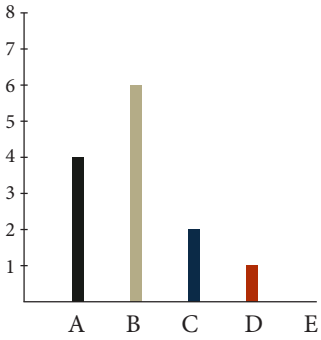
ACRODUR + NATURE FIBRE



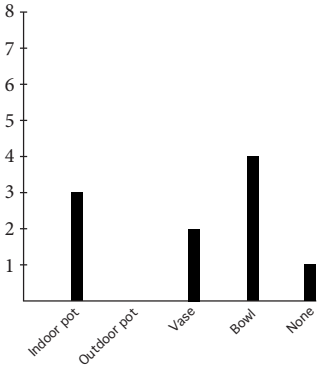
What colours do you prefer?



What patterns do you prefer?



In what products would you like to see this material?



What do you think of the feeling of the surface structure of the material?

I do not like it at all — 3, 1, 6, 2, 7, 4, 5 — I like it a lot

Mean value 5.4
The anwers were spread between 0.5 and 9.4

How would you estimate the strength of the material?

Very fragile — 2, 1, 3, 4, 6, 7, 5 — Very strong

Mean value 4.5
The anwers were spread between 0.7 and 7.0

What is your overall impression of the material?

I do not like it at all — 3, 1, 2, 4, 7, 5 — I like it a lot

Participant 6 answered "Don't know"

Mean value 5.5
The anwers were spread between 0.9 and 8.0

Quotes from discussion:

"You can feel that it is hairy. I like the style but I would never like to have food on a tray like this"

"I think it is pretty good quality but pretty cheap"

"If you leave it outdoors to long it will go back to the natural life cycle"

Appendix VII

Specification of requirements for plant pots

Below is a specification of requirements for IKEA plant pots. The requirements are organised into the categories functionality, aesthetics and environment. The specification was used for the creation and evaluation of plant pot concepts.

Functionality

- Be durable (The concepts are evaluated for their intended usage)
- Be stable (The concepts are evaluated considering how stable they are when an inner plant pot of largest possible diameter is placed in them)
- Facilitate watering (Designs with wide openings are given higher scores)
- Facilitate handling (Is the plant pot easy to move and arrange?)
- Be easy to clean (Will the surface absorb dirt? Can the concept be cleaned in a machine?)
- Be easy to transport/store (How much space is taken up?)
- Prevent leakage (Is the plant pot waterproof?)

Aesthetics

- Be attractive (A minor user test will be used to range the concepts)
- Be versatile in style and function (Can the concept be used in many ways? Can the look be easily changed?)
- Fit many peoples' styles (A minor user test will be used to range the concepts)
- Fit the IKEA range (This will be determined in a discussion with an IKEA product developer)
- Bring novelty (Is the concept different from what is existing in the IKEA range today?)

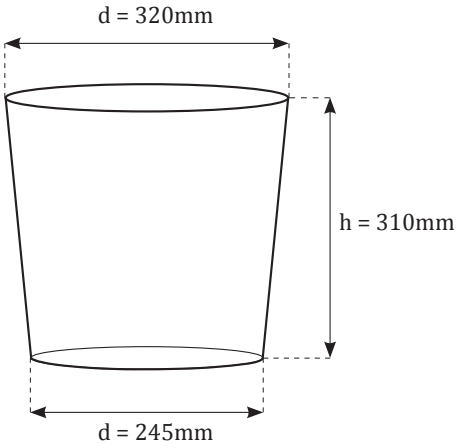
Environment

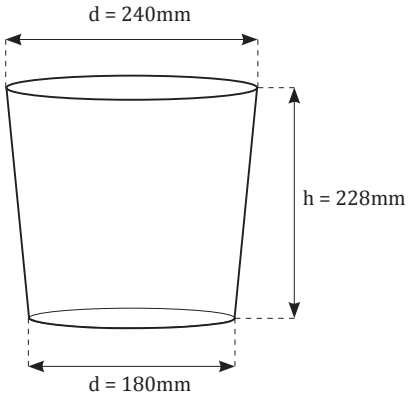
- Be recyclable/separable (How many materials are used? How pure are they? Can they be recycled?)
- Minimize waste material (How much waste is caused in manufacture?)
- Minimize material use (How much material is required for the manufacture?)
- Use renewable materials (Content of renewable materials)
- Use recycled materials (Content of recycled materials)
- Use energy efficient production (A general comparison will be made)
- Have low density
- Use environmentally better materials (well managed sources or proven lower environmen tal impact)

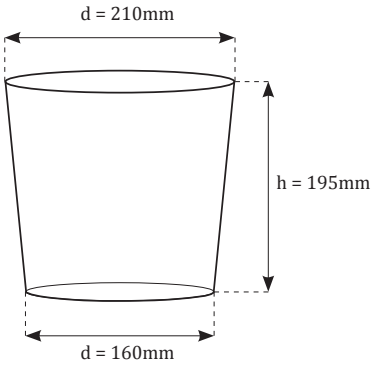
Appendix VIII

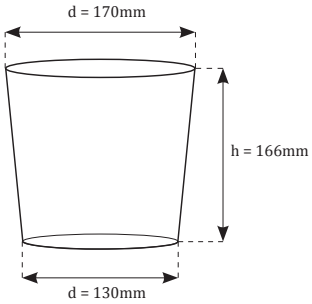
Dimensions inner plant pots

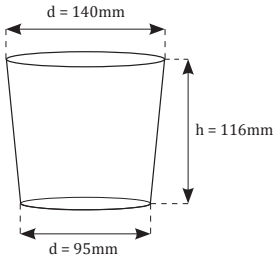
When developing the plant pot concepts consideration was taken to the different sizes avaliable of inner plant pots. This Appendix show the dimensions of the inner plant pots used by IKEA as well as for this project.

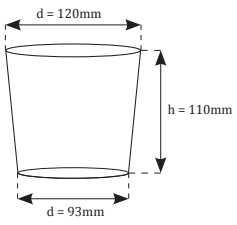


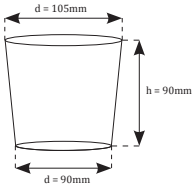










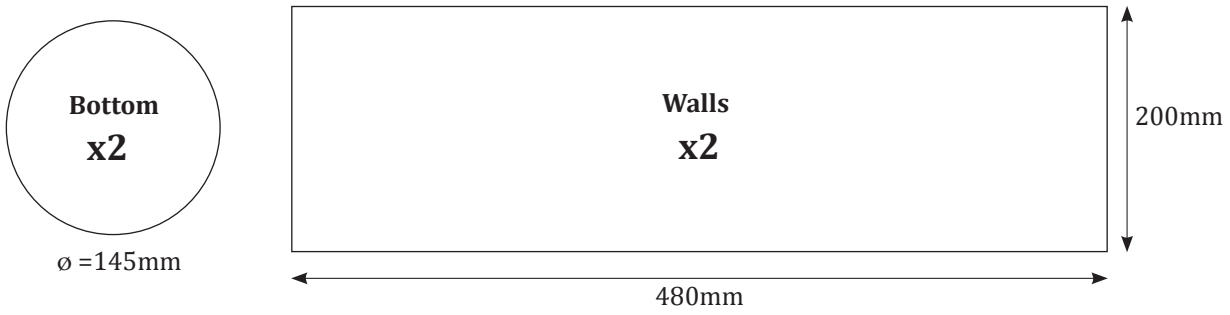


Appendix IX

Patterns for Lilla Blå and Sprudla

These are the construction patterns that were used for the prototypes of the fabric plant pots Lilla Blå and Sprudla. The dimensions are given without seam allowance.

Lilla Blå



Sprudla