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Creating flexibility within the circular kitchen

Master Thesis in Industrial Design Engineering

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Department of Architecture and Civil Engineering
Chalmers University of Technology
Gothenburg, 2019

Master of Science Thesis

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Cover photo: Erik Storbacka

Abstract

The kitchen is today the natural gathering point within our homes. It is no longer a room where we only cook food and eat but serve numerous other activities such as working, socializing, watching tv-series or writing assignments. With this broad area of use there is a need for flexibility and adaptability. When users change their living situation, for example move in with someone or get children, the kitchen should be able to adapt to the changed needs of the user. If the kitchen is not flexible there is a risk that the user tears down their kitchen and buys a new one, making the life cycle of the existing kitchen cut short and leading to unnecessary climate impact.

This study aimed to explore design solutions within kitchen furniture and deliver a conceptual design proposal of a kitchen furniture design that could support a flexible kitchen and be a part of a future kitchen adapted to the circular economy. In order to deliver a conceptual design solution, research were performed on the history of the kitchen, the sustainability issues of the modern kitchen as well as research and predictions on how the kitchen will look like in the future. The study was limited to kitchen furniture within Swedish apartments, thus excluding white-goods and kitchen appliances.

The study was performed as an iterative, exploratory design process structured around four main project phases, *explore, identify, ideate* and *evaluate*. The *explore* phase consisted of research on the history of the kitchen, the Swedish kitchen today and predictions of the future. The exploration was performed in literature studies, study visits, interviews, user studies and trend analyses. To identify the sustainability issues and user needs, a requirement list was created based on the insights found in the exploration phase. The requirement list served as a base when ideating, creating ideas and concepts in the ideation phase. The research, requirement list and ideation resulted in a concept idea that was further developed and evaluated in a final conceptual design solution.

Insights gathered throughout the study lead to the conceptual design which is an effort to initiate discussions in order to change the direction of the current take-waste production and use model of the kitchen furniture industry. The concept is a modular furniture solution, based on two bio-composite components that can be assembled into a variety of kitchen layouts and furniture products. It addresses the need for flexibility and user adaptability by providing the user with a modular, open furniture system. A proposed circular business model was created for the conceptual design, which was evaluated in a consultation interview with an expert, a peer-review with design students and a comparison against the created requirement list.

Preface and acknowledgements

This master-thesis and product development project was performed at Chalmers University of Technology in the spring of 2019, at the department of Architecture and Civil Engineering, within the master programme Industrial Design Engineering. Supervisor for the project was PhD student Sofie Andersson and examining professor was Ulrike Rahe.

It has been a long and insightful semester and I would like to start out this thesis by mentioning some of the people who helped me along the way.

First of all, I would like to direct a big thank you to my examiner and to my supervisor, Ulrike Rahe and Sofie Andersson, for letting me write my thesis within the circular kitchen project and giving me the advice and motivation I needed to keep pushing, work harder and reach my goals. Being a part of the circular kitchen project has been challenging, interesting but most of all rewarding and I would like to thank all the people involved in the project. Special thanks to Julia Lindhagen, Raymond Xue and Hal Martínez Reales for all your support, helping me with my ideas and arranging the workshops. Thank you also to Gilliam Dokter and Anita Ollár for input and solid advice.

Thanks to all the kitchen experts and designers who I interviewed during the project, for invaluable insights and letting me borrow your time. Your opinions and knowledge has been a huge contribution to this project, thank you!

Finally, a thank you to my family, my friends and my girlfriend for supporting me through my academic journey and making me take breaks every now and then when I really needed it. I would not be here without you guys, thank you!

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Introduction

Background

This master thesis project was part of the Circular Kitchen project which is a public-private partnership collaboration between Chalmers University of Technology and TU-Delft. The project is funded by the European Institute of Technology with support from industry partners.

Kitchens today function as natural gathering points in apartments and houses. They are no longer only places for cooking food and eating but also serve numerous other activities such as studying, socializing and playing. With this broad area of use, there is a need for flexibility. When users change their living situation e.g. get children or move in with someone, the kitchen should be able to adapt to the changed user needs. If the kitchen is not adaptable and flexible there is a risk that the user buys a new kitchen, making the life cycle of the existing kitchen cut short which in turn leads to unnecessary climate impact. The kitchen, the furniture within the kitchen and the kitchen appliances should be able to adapt to changing user needs and promote sustainable behaviour.

Purpose

The purpose of this project was to explore design solutions within kitchen furniture and deliver a conceptual design proposal of a kitchen furniture design that can support flexibility and be a part of the future circular kitchen. Furthermore, the purpose was to research sustainability issues related to the Swedish kitchen today and to research and predict how the kitchen should look like in the future.

Goal

To fulfil the purpose of the project, following questions were aimed to be answered:

- How can kitchen furniture be made more flexible to fit varying apartment sizes and user groups while serving other activities than cooking food and eating?
- How should kitchens look like 10-20 years from now in order to support circular- and flexible solutions?

To communicate and document the findings in the study, three main deliverables were sought to be created:

- Research on the history of the Swedish kitchen, the Swedish kitchen today and a visionary look at the future of the Swedish kitchen
- A requirement list to specify which aspects to consider when designing for flexibility and circularity within the kitchen
- A conceptual design proposal of a flexible kitchen furniture solution in relation to different kitchen layouts and activities

Scope

The research conducted in this study was limited to focus on Swedish kitchens within apartment buildings. The products addressed within the project was kitchen furniture, thus excluding white-goods and kitchen appliances. The resulting design proposal was

on a conceptual level and did not include manufacturing issues, cost estimation or detailed material properties. Other predefined conditions were that the concept solution should fit into the scope of the Circular Kitchen project and address circularity.

Process

Project model

This project was executed using an iterative, exploratory design process consisting of four main phases. The four phases were *Explore, Identify, Ideate and Evaluate*. Figure 1 depicts the phases of the project.

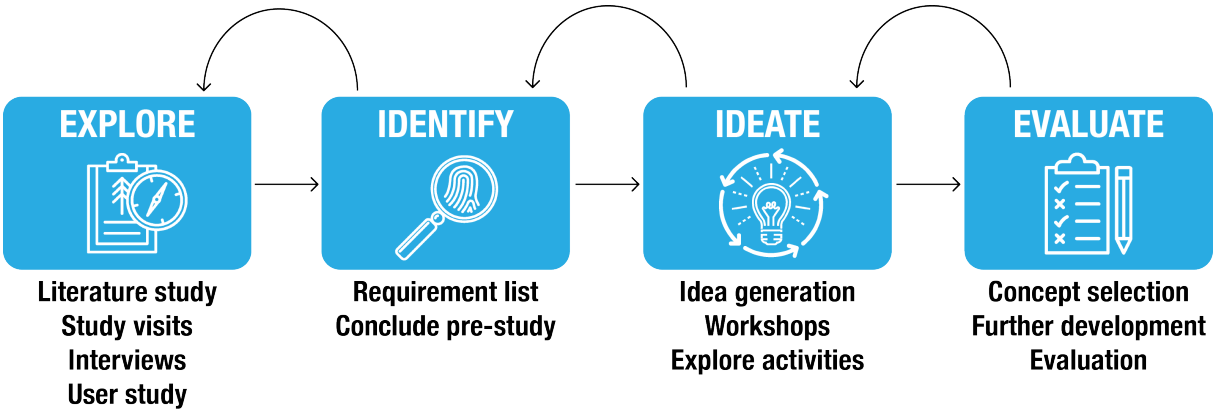


Figure 1. Project model.

Description of phases

This was an iterative design process and all four phases have been addressed accordingly. Due to the project aiming for a solution adapted to the future circular economy, circular design thinking has been applied constantly throughout the project when iterating and conducting the research in the phases.

Explore

The explore phase was centred around finding insights about Swedish kitchens and the people who use them. This was done by exploring the history and development of the modern Swedish kitchen, studying the Swedish kitchen of today and making an effort to predict how the Swedish kitchen will look like in the future.

Identify

The identifying phase consisted of finding out how and where to implement the concept solution. This was done in the identifying phase by writing a requirement list which served as a basis for the ideation phase.

Ideate

The ideation phase consisted of idea generation based on the requirement list created in the identifying phase. The identified activities were explored and idea generation methods were used in workshops and creative sessions.

Evaluate

The evaluation phase of the project consisted of an assessment of the created concept ideas and the selection of one concept idea for further development. The chosen concept idea was developed into a final concept solution and evaluated.

Report structure

This report is a documentation over the design process performed in the study. The report is divided into nine main chapters where the methods and findings are presented, discussed and concluded. The first chapter, *Method*, describes the research-, design- and evaluation methods used throughout the project. The three following chapters, *A brief history of the Swedish kitchen, The Swedish kitchen today* and *The future of the kitchen* deals with the past, the present and the future of the Swedish kitchen. These chapters contain the insights gathered in the pre-study. The chapter *Ideation* starts off with an exploration of the identified activities and a summary of the pre-study findings which are concluded in a requirement list. The rest of the *Ideation* chapter presents the findings and ideas created using the idea generation methods and is concluded in two main concept ideas for further development. The chapter *Concept selection* contains the choice of a concept idea for further development. The chapter *Further development* summarizes the final development of the concept design, from concept idea into final concept design. The final concept design is presented in the chapter *Visualization and evaluation*, where the solution is visualized and evaluated. The report is concluded in the two chapters *Discussion* and *Conclusion*, where the results are discussed and concluded. Figure 2. describes the main report chapters in relation to the design process.

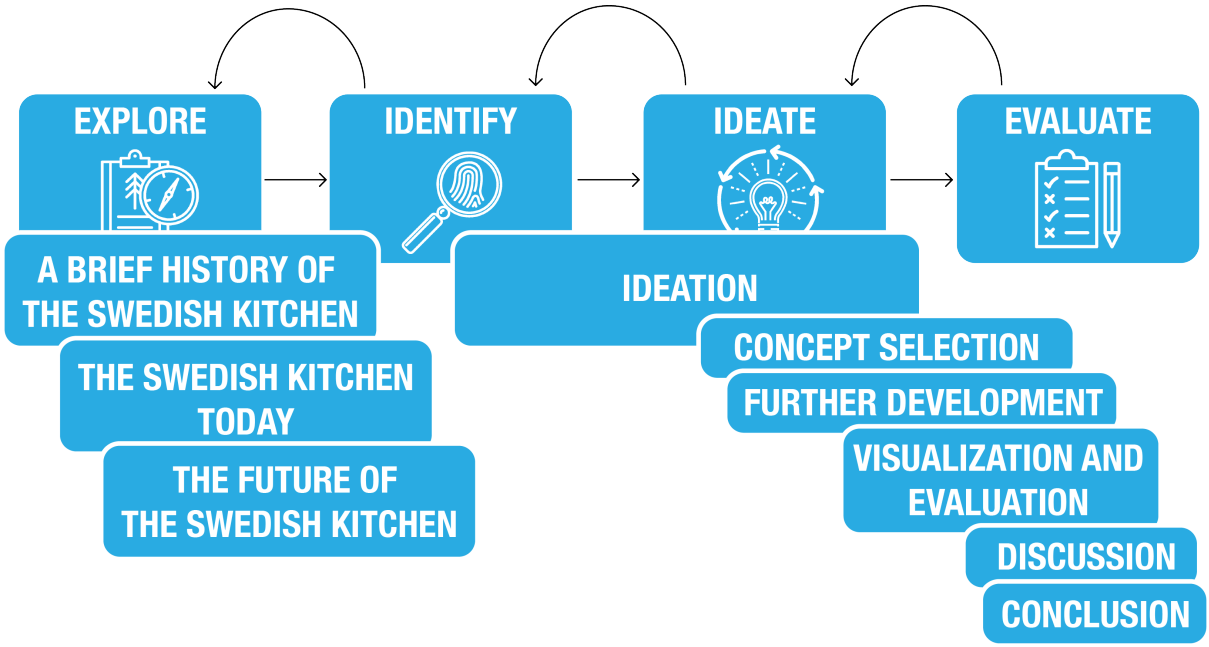


Figure 2. The report chapters in relation to the design process.

Method

Circular design thinking

A circular design thinking approach was used throughout the design process. The mind-set of circular economy looks wider than traditional manufacturing, the focus is lifted from exclusively targeting end-users and instead considering everyone who extracts, builds, uses and disposes of things (Circular Design Guide, 2017). When designing for the circular economy, the designer must consider how the product and its materials can be reused, refurbished, remanufactured or recycled. The designer must also consider using energy from renewable resources and work to ensure that created waste can be put back into the circular system (Swedish Standards Institute, 2019). Figure 3 explains the technical- and biological cycle and the circles in which new design shall take place according to the circular design thinking mindset.

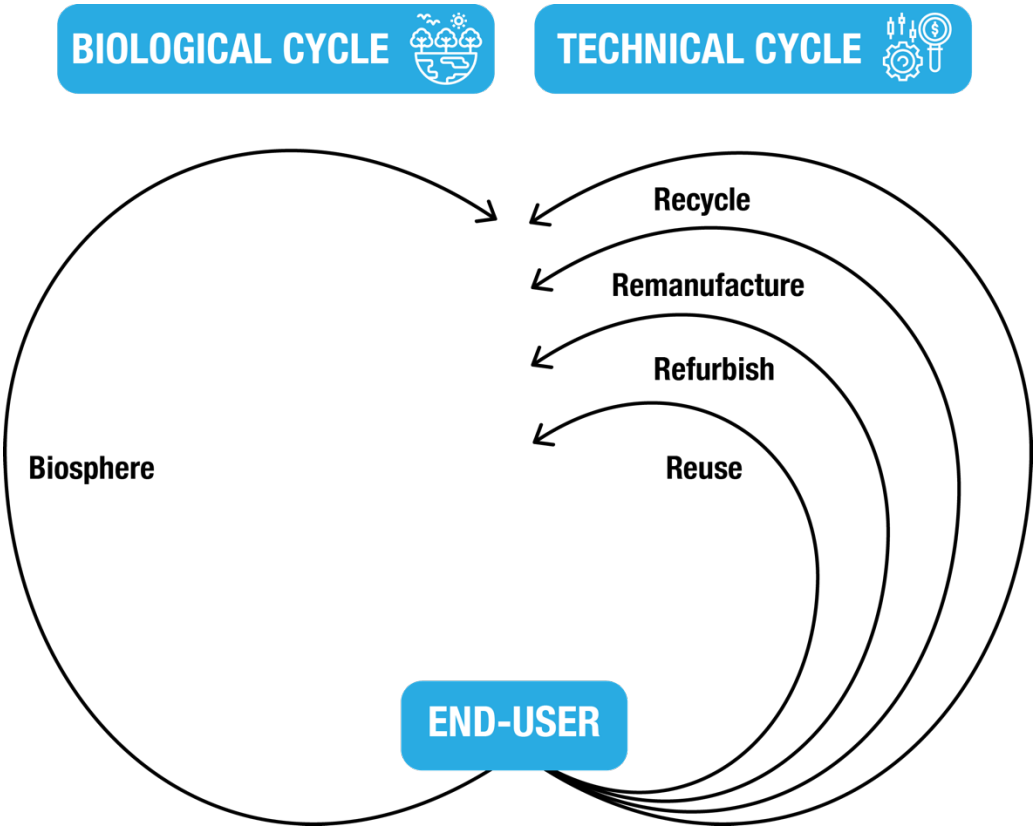


Figure 3. Circular design model.

Activity-centred design

Since the concept was aimed towards the general population of Sweden living in apartments and not one specific user group, an activity-centred design approach was used in the ideation phase. This was done in order to explore the tasks and artefacts related to the activities identified in the pre-study and letting the activities in part define the product and its structure. Activity-oriented design puts emphasis on the activity related to a given piece of technology as the designer studies the tasks related to the activity (Norman, 2013). All assessments of the activities were performed in collaboration with an invited kitchen user. Figure 4 explains the steps used when applying the activity-centred approach to the project context.

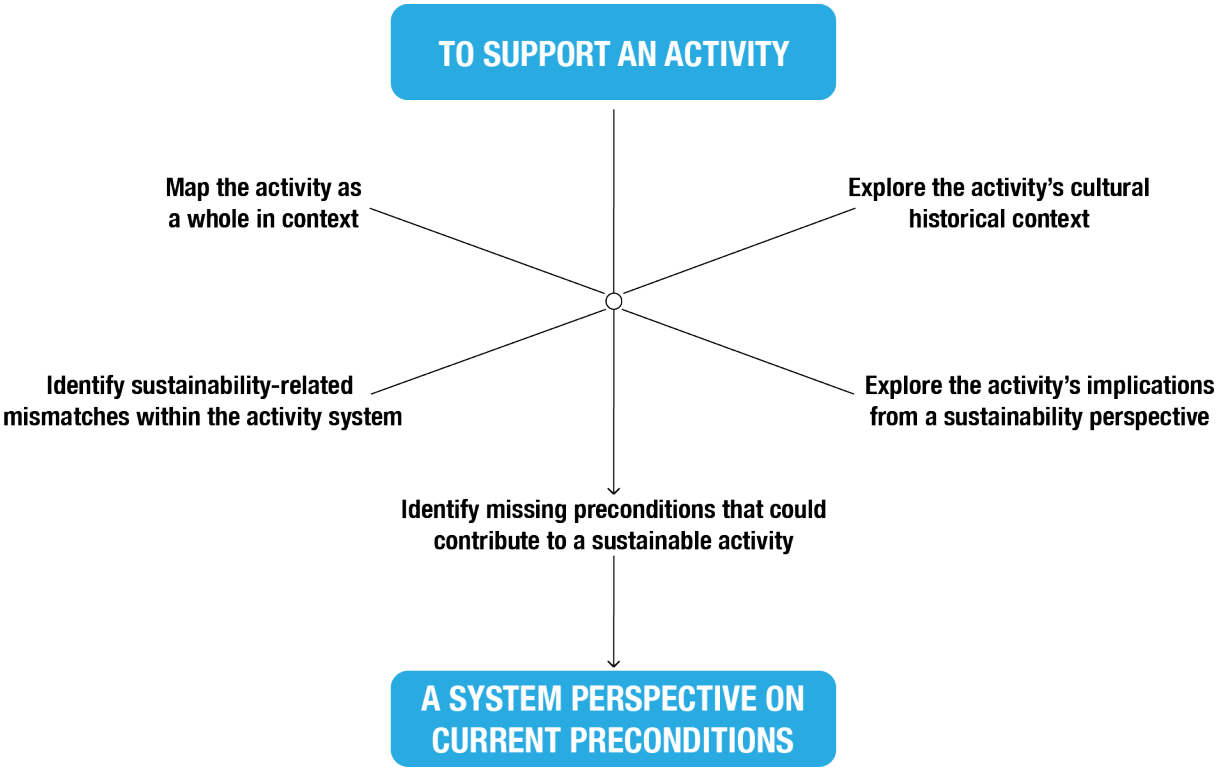


Figure 4. The activity-oriented design model.

Literature review

The history of the modern Swedish kitchen, predictions on the kitchen of the future and the sustainability issues of today was studied in books and research articles found at the Gothenburg city library, the Chalmers library, internet encyclopaedias and through Chalmers library article search. Newspaper articles, statistics and surveys were found through research article references and internet search engines.

Study visits

Study visits were performed at kitchen stores in the Gothenburg area and short semi-structured interviews were performed with the staff. This was done in order to get a sense of why people buy new kitchens, what is new within the kitchen industry and what products and styles are the most popular today. The aim of the study visits was to generate a deeper understanding of how the kitchen manufacturers advertise and sell their kitchens rather than generating qualitative data. Inspiration gathering and benchmarking are performed through the visits and by studying the kitchen manufacturer's catalogues and webpages.

Interviews

Kitchen experts and designers were interviewed, in order to gather knowledge on the kitchen industry today as well as insights and suggestions as to how the kitchen could, or should, look like in the future. All interviews except one were performed over telephone and recorded for referencing in the project report. The exception was the interview with Marianne Färlin which was performed via e-mail correspondence. The interviews were conducted in Swedish and translated into English by the author, transcribed full length interviews in Swedish can be found in appendix 1.

User study
An online survey was sent out through social media to kitchen users living in apartments. Four questions about the kitchen were asked in order to get a sense of how users view their kitchen and what activities they perform in the kitchen.

Questions:

1. If you won a free kitchen renovation, what would you change in your kitchen? Why?
2. Besides preparing and eating food, what activities do you perform in the kitchen?
3. What are the most important aspect of the fitted furnishings within a kitchen? (e.g. the design, big countertops, dishwasher etc.)

4. How do you sort your kitchen waste?
   (If you sort your waste, how can it be done easier?)
   (If you don't sort your waste, what would you need in order to start sorting?)

Requirement list
A requirement list was written in order to conclude the findings in the pre-study and spell out the identified needs of the product concept. Five requirement groups are represented where the requirements and guidelines for the design concept is specified. The requirement list defines key design variables and leaves as little margin for subjective interpretation as possible (Ulrich & Eppinger, 2012)

Speedstorming
Speedstorming was used in a workshop with invited design students, the idea generation method is an alternative form of brainstorming, inspired by speed-dating. The participants get to quickly work on different problems with different people in a limited amount of time. A workshop leader prepares questions for the participants to answer during the session. For example, if the group consists of eight people the workshop facilitator prepares four problems which the group then brainstorms on, one problem at a time in pairs of two. The participants have to work quickly due to the time pressure and if successful the method leads to a big amount of ideas in limited time. (Wikberg-Nilsson, Ericson, & Törlind, 2015)

Brainwriting
Brainwriting was used in a workshop with invited design students, Brainwriting is an alternative to brainstorming, developed by Bernd Rohrbach. Participants writes or draws their ideas for a specified problem on a piece of paper and then sends it along to the next participant who either further develops the idea or draws a new idea. The aim of the method is to use the whole groups creative potential and eliminate the notion of one idea belonging to one person (Boeijen, Daalhuizen, Zijlstra, Schoor, 2013).

Negative idea generation
Negative idea generation was used during the solitary creative sessions and is based on the idea that it's sometimes both easier and more entertaining to destroy and criticize ideas than to create and build ideas. A positive focus area and a scenario is formulated,

such as ‘How can we make countertops more flexible and easier to use for small families?’ This positive focus area is then reversed to a negatively sounding scenario but with the same basic premises. For example, ‘How can we make countertops more static and harder to use for small families?’ (Michanek & Breiler, 2007).

Morphological chart

A morphological chart was created in the beginning of the ideation phase, the morphological chart is a method used to generate and evaluate ideas in a systematic manner. It is performed by breaking down the products purpose into functions and sub-functions, ideas are then generated by combining the functions. (Cross, 1989)

Sketch prototypes

Simple and quick sketch prototypes as well as more refined sketches are used throughout the ideation phase in order to generate ideas in relation to the pre-study and requirement list. The sketch is a visual manifestation of the designers thought process, it’s not the result of the sketch that is the goal but rather the thinking that starts when sketching. (Wikberg-Nilsson, et al., 2015)

Mock-up

A physical mock-up is used in the HSB Living Lab test kitchen to translate the created ideas into concepts ready for evaluation. The created mock-ups are used to test out different forms and sizes physically in a kitchen environment. Mock-ups are used to evaluate new technical solutions, sizes and form (Johanneson, Persson & Pettersson, 2013).

Virtual prototypes

CAD-models and renderings are created to construct and visualize the final concept. The purpose of the CAD-model is to evaluate the concept and simulate its mechanical functions. The renderings are used to communicate and explain the final concept (Johanneson, Persson & Pettersson, 2013).

Concept selection

The concept selection is performed by evaluating the concept ideas against the created requirement list and by using the Concept Selection method from the Circular Design Guide. First, each concept is evaluated by looking at its Viability, Feasibility and Desirability. Then, the concepts are assessed against the principles of Circular Economy and plotted on a matrix to measure their difficulty to implement against how much potential impact they could have (Circular Design Guide, 2017).

Circular business model

Using the circular business model canvas from the Circular Design Guide, an initial business model was created for the final concept. This was done in order to exemplify how a circular business can be built around the final concept solution. The circular business model expands the perspective to the wider system in which the product will be manufactured and used (Circular Design Guide, 2017).

A brief history of the Swedish kitchen

A century of evolution

The kitchen has seen immense changes and development over the last hundred years, from being a secluded working space for housewives to becoming the central point of our homes. In order to create an innovative design concept and a vision for the future circular kitchen one must understand the history and cultural significance of the room which we call kitchen. This chapter is a brief summary of the history of the modern Swedish kitchen, from the 1920's to present day.

When the Museum of Modern Art in New York City opened their exhibition *'design + the modern kitchen'* in 2010 they prefaced the exhibition as following:

> *'Meal machine, experimental laboratory, status symbol, domestic prison, or the creative and spiritual heart of the home? Over the course of the past century no other room has been the focus of such intensive aesthetic and technological innovation, or as loaded with cultural significance' (MoMA, 2010).*

The modern kitchen was arguably born in the USA, but it was German and Austrian architects that gave the kitchens their form and aesthetics (Torell, Lee, & Qvarsell, 2018). In 1926, Austrian architect Margarete Schütte-Lihotzky created the 'Frankfurter küche' (Frankfurt kitchen), the rationalized and standardized design of the kitchen became the blueprint for an ideal, modern European kitchen. The Frankfurt kitchen (figure 5) was created to rationalize and make the housewives work effective as Lihotzky considered this necessary in the women strive for personal growth and financial independence (Larsson, 2013). Kitchens (including the Frankfurt kitchen) were during this time clearly separated from other rooms within Swedish homes and their sole purpose was effective and functional housework.

Figure 5. Reconstruction of a Frankfurt kitchen (Vittoratos, 2008).

With the Frankfurt kitchen and following kitchen concepts inspired by the Frankfurt kitchen as role models, fixed and standardized kitchen furniture were gaining popularity in Sweden, signalling a department from the old and unpractical kitchens of the past. Architects, engineers and researchers who in Sweden had been striving to standardize the kitchen since the start of the 1900's with the creation of Standardiseringskommittén (The Committee for Standardization) and they were now gaining momentum. The committees work was inspired by research done in the USA, Germany, Belgium, Austria and Holland and their research was crucial to the creation of the modern Swedish kitchen. The Swedish government, influenced by the research performed by the committee, adopted their ideas and research into their housing

policies with goals to build affordable housing for the entire population (Torell, et al., 2018).

Whereas the functional kitchens built in the 1930's and 1940's clearly separated the housewives from their families, the kitchens built during the 1950's were getting increasingly bigger and social. Kitchens would during this time include seating for the whole family, no longer separating the housewives from their families. The Swedish kitchen standard was accepted into the Swedish Standards Institute in 1950 and became the blueprint for rational manufacturing and planning of kitchens in Sweden. In other parts of Europe, kitchens were at this time still designed individually for different households (Larsson, 2013).

The housing shortage in Sweden during the 1950's led to the Swedish government implementing a large-scale public housing project, starting in 1964. The goal of the project was to construct one million new apartments in a ten-year period (Nationalencyklopedin, 2019). The public housing project, later known as miljonprogrammet (million programme) included a standardized apartment with three rooms and a kitchen. The kitchens built in the housing project were often parallel kitchens and included a stove, countertops and a sink (Larsson, 2013). The ambition of the project was that everyone in Sweden should have access to affordable housing and functional kitchens, backed by the decades of research performed by The Committee for Standardization and The Home Research Institute (later turned into The Swedish Consumer Agency) (Nationalencyklopedin, 2019). Figure 6 shows a typical kitchen built in the million programme apartments.

Figure 6. Million programme kitchen (Bresciani, 2016).

By 1970, Swedish kitchens were becoming places for casual social gatherings and often decorated in bright colours. This time-period is of great cultural significance as men, in greater occurrence, started to contribute to kitchen work. Women had been joining the workforce in greater numbers since the 1950's and by 1970 the housewife was more or less a thing of the past. During the neon coloured 1980's less and less of the practical and rational aspects of the kitchens were to be found (Larsson, 2013). Figure 7 shows an 1980's kitchen by IKEA.

Figure 7. IKEA catalogue 1985 (IKEA, 1985).

During the 1990's, the Swedish kitchen standard was set aside as Sweden joined the European union and subsequently adopted the European kitchen standard. Ideals about open plan apartments were trending and the kitchen island was introduced into Swedish homes. Kitchens were now increasingly designed for socializing and it became common to build kitchens in open floor plans, connecting kitchens with living rooms (Torell, et al., 2018). In the early 2000's more people started to renovate and re-do their kitchens as rental apartments were turned into condominiums. Having the perfect kitchen had become an indication of wealth in Sweden as a majority of social interaction was taking place in them. This transformation of the kitchen towards a social area is continuing to this day and as more of our social interactions take place in the kitchen, the kitchen has become one of the most important status symbols within our homes (Larsson, 2013).

The Swedish kitchen today

Numbers and layouts

Approximately 48,2% of the Swedish population lives in apartments (SCB, 2019). The most common apartment type in Sweden's three big cities (Stockholm, Gothenburg and Malmö) is a 57 square meter apartment, with two rooms and a kitchen (SCB, 2016). The kitchen layouts in these apartments vary depending on the floor-plan of the apartment. Product catalogues from kitchen manufacturers on the Swedish market features five main kitchen layouts which they advertise to their customers. These five layouts are: *linear I-shaped kitchen, L-shaped kitchen, U-shaped kitchen, parallel-kitchen* and *kitchen island in connection to other layout,* an explanation of these kitchen layouts can be found in figure 8.

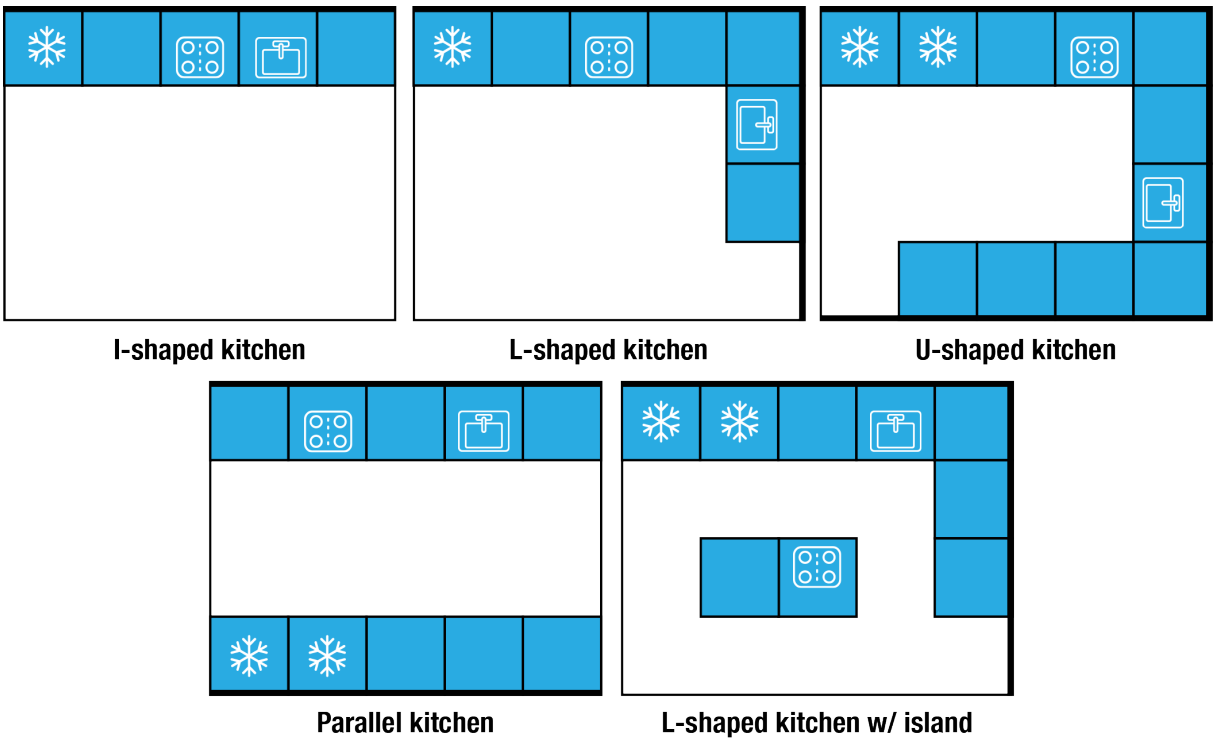


Figure 8. Kitchen layouts.

Sweden has since the 1990's moved from subsidized and standardized housing projects towards market oriented housing. Earlier housing and kitchen standards were based on surveys performed by the home research institute and on how housewives used their kitchens (Femenías, Holmström, Jonsdotter & Thuvander, 2016). The old, standardized and researched Swedish kitchen is disappearing, kitchen manufacturers have adopted the European kitchen standard which, according to Thiberg (2007) is not as precise and informative as the old Swedish standard. Today, it's a buyer's market, kitchen manufacturers build kitchens based on their customers taste and style and Swedes are at the moment of writing this thesis increasingly interested in buying new kitchen furniture. During 2018, gross sales for kitchen furniture went up 3% to a total of 3,9 billion SEK (Trä- och möbelföretagen, 2019).

Activities in the kitchen

The Swedish kitchen of today is no longer a standardized workspace where we only cook food or eat but has according to Ledin and Machin (2018) become the main room for creativity and social interaction, taking over the role of the living room. The kitchen

is today a multifunctional space where users perform an array of activities beyond cooking food and eating. A recent survey ordered by Skanska, performed by Kantar Sifo shows that 62% of the Swedish population uses their kitchen to socialize with friends and family, 22% of the respondents also uses the kitchen to do their homework and 22% uses the kitchen as a workplace (Skanska, 2018).

Study visits

Kitchen stores within the Gothenburg area were visited to gather an understanding of the Swedish kitchen industry and how the kitchen manufacturers advertise and sell their kitchens. The sales staff in the stores shared similar opinions on how often and why people renovate or buy new kitchens and similar views on the trends of today. Below are observations made at the stores and talking points brought up by the staff.

Köksforum

According to the interviewee at the Köksforum store there are three reasons why people renovate their kitchens. The most common reason is that users want to showcase their own style and taste in their home. Other reasons include that the installed kitchen is not up to the user's standards when buying a new apartment. The third reason mentioned was users buying a new kitchen because their current kitchen is worn out and has to be replaced. Köksforum offers a wide range of kitchens to their costumers, mostly from international European manufacturers. Nearly all kitchens presented in the catalogues found in the store features a kitchen island and are big in size.

Marbodal

The main reason people buy new kitchens according to the Marbodal staff is that they want clean surfaces and increased functionality. When building new apartments, the existing kitchen may not be satisfying the costumers needs or live up to their standards. The interviewee mentioned that they often ask the buyer if they really need to demolish their whole kitchen or could settle for smaller changes such as changing the kitchen cabinets. Furthermore, the salesman mentioned that they advise their customers to try and sell their old kitchens via online market places or auction sites, but that this is easier said than done due to installed kitchens being difficult to move without demolishing them. Marbodal's catalogue features mostly white, rustic kitchens in classical style, the interviewee mentioned that 90% of the kitchens they sell are white.

HTH Köksforum

The interviewed salesman at HTH mentioned the currently low interest rates as a factor to why people want to renovate their kitchens. The salesman mentioned that the kitchen has become more social, taking over the place of our living rooms and therefore a symbol of wealth and status. The salesman also mentioned that as where before customers would keep their kitchens for 17-19 years, today they may redo their kitchen as frequently as every 12th year. Kitchen islands are popular at the moment and according to the salesman their customers are trying to fit kitchen islands into their homes even with limited space available.

HTH offers three flexible solutions for storage within the kitchen. The MagicMoveID which is a motorized shelving unit, built to utilize the highest cabinets, the WorktopID which is a cabinet on wheels that can be used to create extra working space and the TableID which is a foldable table, attached to the wall.

Kvik

The main reason people renovate their kitchens or buy new kitchen furniture is according to the salesperson at Kvik that they want a greater chance of selling their apartment or house. Other reasons may be that the existing kitchen is worn out, old and in need of renovation. The salesperson mentioned that white kitchens are still popular but that darker shades are coming into style. The trend is, according to the interviewee still cold and subtle colours. The salesperson also mentioned kitchen islands as hugely popular today and that Kvik recently released a kitchen island which is supposed to link the living room to the kitchen, by having a regular bookshelf directed at the living room and kitchen appliances and storage directed towards the kitchen.

Puustelli

The salesperson at Puustelli said that the main reason to why users buy new kitchens are that their old kitchen is worn out and that they need a new one. The salesperson also mentioned that Puustelli offers high end kitchens and may cater to a different target group than other kitchen manufacturers and that their customers want to express their style and taste by buying a Puustelli kitchen. The salesperson introduced the Miinus concept which is Puustelli's ecological kitchen solution, using bio-composite frames instead of wood.

IKEA

The interviewed salesperson at IKEA mentioned that customers buy new kitchens due to their old kitchen being worn out and in need of renovation. The IKEA store was, even at a weekday significantly busier than the other visited kitchen stores, and due to the high demand a more in-depth interview could not be performed. On their website, IKEA describes the kitchen as *"The heart of the home"* and state that they offer kitchen furniture for all styles and tastes.

Summary of the study visits

The interviewed staff at the various kitchen stores all mentioned their customers personal taste and style as reasons to why they renovate and re-build their kitchens. Opening up space and connecting the living room/dining area to the kitchen is popular today, people want a functional and inviting kitchen as the kitchen today has become the heart of the home. There are products which offer increased flexibility to the kitchen, such as the 'ID' solutions presented by HTH (figure 9), Kviks 'Prato X' kitchen island (figure 9) and The 'Miinus' kitchen by Puustelli (figure 10). However, a majority of the kitchens on display in the stores are static and fitted to the room, allowing no flexibility in terms of layout changes.

Figure 9. HTH Table ID, Kvik Prato X, HTH Worktop ID & HTH MagicMove ID (HTH, 2019)(Kvik, 2019)(HTH, 2019)(HTH, 2019).

Figure 10. Puustelli Miinus (Puustelli, 2019).

Looking through the manufacturers catalogues they all focus on how they can deliver every kitchen to their customer's specific taste. There is a need for flexibility in order to allow the user to express personal taste and style without having to renovate or rebuild their whole kitchen. There is also a need for solutions that can allow other activities beyond cooking food and eating to take place in the kitchen.

Material and measurements

The material used in Swedish kitchen furniture is, based on the study visits and the furniture manufacturers catalogues, mainly MDF, particleboard, solid wood and metal. The exception is Puustelli which are using a bio-composite material in one of their kitchen lines.

The Swedish kitchen standard was, as mentioned in the previous chapter *A brief history of the Swedish kitchen,* replaced in 1997 by the European standard. The European standard for safety requirements and test methods used in Sweden is SS-EN 14749:2016 (Swedish Standards Institute, 2019) and for measurement coordination SS-EN 1116:2018 (Swedish Standards Institute, 2019). The new standards does not include help with kitchen planning or configuration and the measurements mentioned are recommendations (Torell, et al., 2018). Kitchen countertops are recommended to be 900 mm high in total with a differential of +-50 mm depending on the application. For tables in seating height a recommended 600 mm+200 mm is recommended depending on the application. The standard mentions that minimum depth of countertop working space standing on the floor shall not be measured below 600 mm. For width to height proportions recommendations are given depending on the application area (Swedish Standards Institute, 2019).

Sustainability and the Swedish kitchen

Gross sales of kitchen furniture in Sweden is increasing (Trä- och möbelföretagen, 2019), kitchen furniture are replaced often and accounts for a majority of the climate impact caused by private renovations (Femenías, Holmström & Jönsson, 2018). As mentioned by the interviewees during the study visits, customers are looking to replace units or whole kitchens based on personal preference, a need for functionality, a higher chance to sell their apartment or that their current kitchen is worn out. This often leads to the users replacing their whole kitchen as it is hard to replace only one unit of the modern fitted kitchen (Maguire et al., 2014). According to the interviews performed during the study visits and the product guarantees given by the manufacturers, kitchen furniture has an expected life-cycle of 25+ years. These kitchen furniture life-cycles are shortened by renovations as users sometimes renovate their kitchen as alarmingly early as three years after purchasing a new kitchen. Local Stockholm newspaper Stockholm Direkt (Toll, 2017), describes how this kitchen renovation trend is spreading, even to recently built residential areas. In 2017, half of the apartments for sale in Stockholm had done a kitchen renovation in the last ten years and according to the article, kitchens in Stockholm are being replaced due to owners wanting to add their personal touch to their apartments or being able to sell them at a higher price (Toll, 2017).

The kitchen furniture in Swedish apartments are rarely built for re-use, refurbishing or recycling and therefore ends up in landfills or incinerated, only a small portion (8%) of kitchen furniture is recycled (Forrest, Hilton, Ballinger & Whitaker, 2017). To tackle this problem, the European environment bureau has identified five main challenges that the furniture industry must face in order to move from the current linear approach into a model for the circular economy. Forrest et. al (2017) describes the challenges as following:

Materials and design challenges

The move from solid wood and metal to cheaper materials has restricted the potential for a successful second-life of manufactured products. Drivers and incentives for improvement are limited and the product design is weak in relation to recycling, re-use, durability, disassembly and repair possibilities.

There is a lack of information on the chemicals used in furniture production and in the finished products which forces additional costs and challenges on recycling companies.

Demand side challenges

End-users are seldom informed and educated on how to maintain and repair their furniture, which is needed in order to prolong the life-span of the products. There is also a lack of available spare parts for end-users which encourages them to buy new products instead of re-using or refurbishing old products.

There is not enough awareness on the availability and benefits of second-hand furniture, the price differential between new and second-hand furniture is not big enough to drive sustainable purchasing behaviours. The market for recycled material is either underdeveloped or oversaturated.

Closing the loop challenges
Allowing services for significant refurbishment or repair is costly due to the high transport- and labour costs in many parts of the EU. There are currently weak drivers and incentives for the collection and re-manufacturing of furniture. Mechanisms for producer responsibility are not implemented in the furniture industry.

Policy challenges
Furniture is not typically managed in accordance to the circular waste hierarchy as re-use fails to be prioritized over recycling, incineration or landfill. Underinvestment in infrastructure to accommodate re-use, repair and re-manufacturing has limited the potential of furniture being managed within the principles of circular economy.

User study
The user study was aimed at people living in apartments, no delimitations were made in regards to age group or the size of the respondent's apartment. The online survey was sent out through the social media platform Facebook to reach a broad audience. The survey, which yielded 44 answers, includes opinions both from users with prior knowledge in design as well as people with no prior experience in design. The age of the respondents varied between 20-60 years.

All responding users would radically change their kitchen if they were given a free renovation, none of the answering users were content with their current kitchen. A majority of answers regarding what the users would change in their kitchen if they received a free renovation were drastic and large scale. Most frequent answers included adding more countertop surface, adding storage and replacing white goods. The answers suggest that if the users had the funds and opportunity, they would make large-scale changes to their kitchen based on their personal taste and preferences.

Below is an excerpt of answers given to the first question, *'If you won a free kitchen renovation, what would you change in your kitchen? Why?'*:

- *'Everything! The actual layout of the kitchen is poor and I have ideas how it could be done better. But in all honesty it may be more about the room than the actual kitchen.'*
- *'Redo everything from floor to ceiling, for a more modern and adapted kitchen.'*
- *'Would like to get more countertop surface so more people can cook at the same time.'*

Most frequently mentioned activities taking place in the kitchen beyond cooking food and eating were socializing, studying and working. Suggesting that the kitchen is a place that users like to invite guests to as well as a room were users wants to be productive. None of the respondents said that they only use the kitchen to prepare and eat food.

Below is an excerpt of answers given to the second question, *'Besides preparing and eating food, what activities do you perform in the kitchen?'*:

- *'Socializing.'*
- *'Listening to music and socializing by the kitchen island.'*
- *'Watching movies, paying bills, stretching. I do almost everything in the kitchen.'*

Figure 11 shows the total percentages of answers to question two.

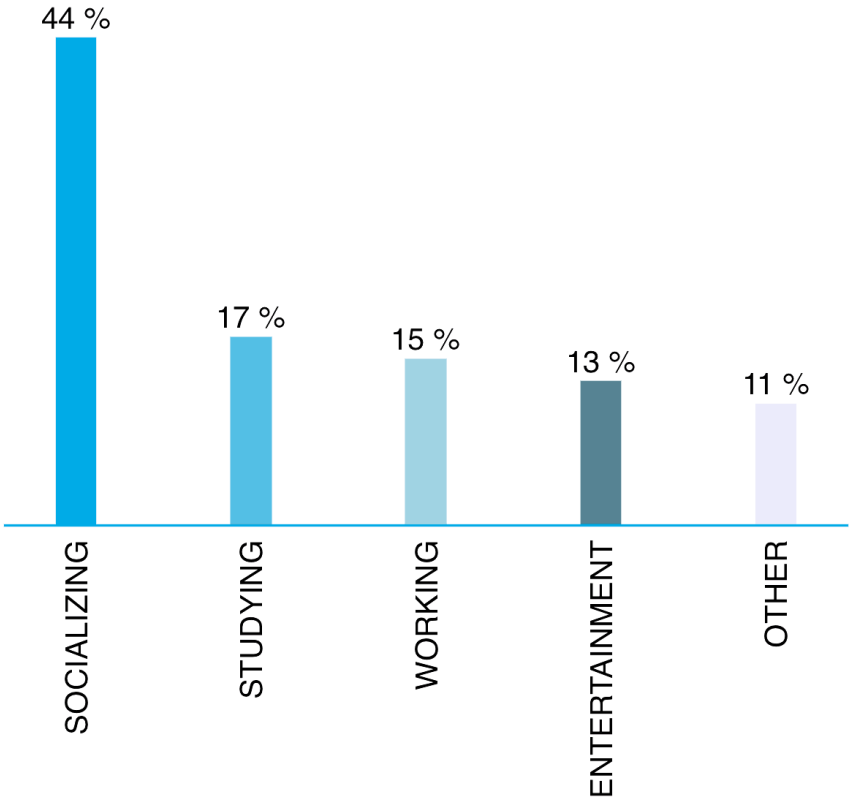


Figure 11. Answers to question two.

A majority of the users mentioned countertop surface as the most important aspect of the fixed furniture within a kitchen. The users that claimed to have sufficient surface space in the kitchen mentioned that their countertops often get cluttered with kitchen appliances.

Below is an excerpt of answers given to the third question, '*What are the most important aspect of the fixed furniture within a kitchen?*':

- *'Large countertop surfaces and space for several people to move around in the kitchen. And chairs/bar stools so people can hang out in the kitchen.'*
- *'Large countertop surfaces that doesn't get cluttered with coffee makers, kettles etc.'*
- *'Good storage capabilities. Easy to keep clean, neat and fresh so that you are inspired to cook good food and socialize.'*

Regarding how the users sort their kitchen waste, nearly all users saw their sorting procedure as unstructured. The overall reason being lack of storage for their waste. The users that did not sort at all argued that their landlord or municipality did not provide them with the sufficient possibilities to do so.

Below is an excerpt of answers given to the fourth question, 'How do you sort your kitchen waste?':

- *'I need a better solution for composting. When I swab up stuff from the sink and try to throw it in the compost I always spill something disgusting on the floor and end up cursing.'*

- *'It's a mess. I don't have access to sort food waste unfortunately. The rest (packaging) ends up in a cabinet all higgledy-piggledy. When the cabinet is full I sort the waste in cardboard bags and walk to the recycling station which is 500 meters away.'*

- *'I don't sort at all. I only have a garbage chute.'*

Summary of the User study

It is apparent that the kitchen is an area that users have a lot of strong opinions on. Respondents to the survey had a clear idea of what is important in the kitchen and what they would change in their kitchens if given the opportunity. A majority of the respondents mentioned countertop surface and storage as the most important aspects of their fitted furnishings. Most frequently mentioned activities performed in the kitchen were socializing, working and studying.

The future of the kitchen

Predicting the future

The future is hard to predict, opinions on how the future kitchen will look and function varies depending on who you are asking and what their interests in the kitchen industry are. Following chapter is an effort to find consensus points and gather insights on aspects to consider when designing the kitchen of the future. The trade-fair Living Kitchen, held bi-annually in Cologne, Germany is one of the key events in the international kitchen sector. They describe their vision of future kitchens in their 'Living Kitchen Blog' (2019) like this:

> *'...kitchens of the future will be required to look less and less like kitchens. Ideally, they too will become oases of well-being for residents, just like other rooms in the home.'*

As mentioned in previous chapters, the kitchen is becoming an increasingly social area and frequently integrated to other rooms in the home. The lines are getting blurred as the room we call kitchen is no longer as clearly defined as it used to be. The Global Kitchen Report from The Cosentino group (2017) which is the result of a collaboration between 17 experts within design, sustainability, cooking, domestic technology, nutrition and sociology, describes the disappearance of the kitchen as a separate room altogether and foresees that kitchens in the future likely will be connected to, or integrated with the dining- or living room. However, a recent study ordered by Swedish construction group Skanska (2018), performed by Kantar Sifo, shows an increased public interest in separating the kitchen and the living room. The statistically reliable, nationally representative survey were answered by 1000 Swedish respondents. When asked the question 'Which of the following floor plans would you like in your home?' a slight majority, 35% of the respondents answered 'Floor plan with separate kitchen and living room' indicating a slight change of attitude towards open floor planning in Swedish homes.

Swedish apartments are getting smaller and according to a study performed by Riksrevisionen (2019), overcrowding in Swedish apartments is increasing. The Swedish housing market has changed, construction companies are prioritizing surface efficiency and home buyers are choosing central locations over living space (SVT, 2019). The kitchen area in these increasingly smaller homes will have to be designed as flexible space to accommodate other activities, such as socializing and working (Ahn, Parrott, Beamish & Emmel, 2008). Kitchen manufacturers, manufacturers of white-goods and manufacturers of kitchen appliances must acknowledge these societal changes and address them through their products and services.

Digitalisation and the kitchen

Opinions differ on how the digitalisation of our society will affect the kitchen. What can be confirmed through a recent OECD report is that Sweden, at the moment of writing this report, are world leading in digitalization and tops OECD's list for most connected gadgets per 100 inhabitants (OECD, 2018). The Global Kitchen report from Cosentino Group (2017) states that the most immediate technological innovations within the kitchen will be increased connectivity and development of smart appliances. Developments in smart technology within the kitchen will be linked to cooking food but also to the use of the kitchen as a space for socializing or working.

Interviews

Following are excerpts from the interviews performed during the exploration phase, the focus of the interviews was the expert's idea of the kitchen today and their predictions on the future of the kitchen. All interviews except the interview with Marianne Färlin were performed via telephone and recorded for reference. The interview with Marianne Färlin was performed via e-mail correspondence. All interviews were performed in Swedish and later translated to English by the author for rendition in this chapter. Full-length, transcribed interviews in Swedish can be found in Appendix x.

Interview with Stefan Nilsson

Stefan Nilsson is the owner and curator of Designgalleriet in Stockholm and one of the most famous trend hunters in Sweden. He has been in the design industry for over 20 years and is a frequent contributor to TV, radio and magazines for trend reports.

According to Stefan we will live in smaller apartments and cook less food in the future:

'One thing we do know is that in the future we will live smaller, the big spaces that we have today will not be available and we will live in smaller areas. This will force the kitchen to have another function in our homes as we will cook less food.'

Stefan mentions home delivery services and semi-manufactured food as reasons to the declining amount of cooking that will take place in our kitchens. According to Stefan, the kitchen has to be flexible and accommodate for other activities while generating discussions about sustainability.

'I think the social space will be in focus, not the actual kitchen. In the future it will not be one living room and a kitchen but rather a larger family room for everything.'

'Another aspect of the kitchen is that the kitchen will be the room where we debate and discuss sustainability issues. The kitchen is where we sort our waste, which will be more of an ideal in the future and that will factor into how we plan and build our kitchens much more in the future.'

When discussing the digitalisation of the kitchen, Stefan was sceptical as to how much smart technology will affect our kitchens:

'We are going to cook less food but when we do it we want to do it with our hands and have a physical experience. The technical solutions will come second.'

'If we cook 2-3 times a week today and the rest is warming up ready food or other solutions, I think in the future we will cook once a week. And then you have to ask yourself, how big of an oven do I need? What size do I need my fridge to be? If we only cook once a week, I don't think we need all these technical solutions.'

Interview with Richard Moberg

Richard Moberg is the concept manager and head of sales at Puustelli. Richard worked on the development of the Miinus kitchen, which is Puustellis ecological kitchen concept.

Discussing the kitchen trends of today, Richard talks about how sustainability issues has started to affect the kitchen industry:

'...we are seeing more and more people opening up to ecological solutions. Younger generations are thinking more sustainable and taking more sustainable choices. Young people are not interested in consumption but can rather prefer renting or loaning products. You no longer need your own car for example, just look at the automotive industry and the development there. People are more prone to sharing products and services today and that is starting to reflect into the kitchen.'

Richard mentions how their ecological line is gaining in popularity and how he hopes that it will take over in the future:

'We're not seeing a downward trend for our standard line but rather a stable trend. But we are seeing an upwards trend in inquiries and sales of our ecological kitchen. So in the long run I believe our ecological product line will take over, at least that's what I'm hoping for.'

Predicting the future of the kitchen, Richard talks about compact solutions, sustainable materials and open floor plans:

'More people will invest in compact solutions instead of big, extravagant kitchens. I hope and believe that kitchens of the future will be more sustainable, with better materials that doesn't affect the environment in a bad way. The trend with open plan kitchens will continue and social areas will be integrated to the kitchen. We are seeing it today and that trend will continue. People no longer see the kitchen as a working area but more as a social area. The kitchen is also seen more as a piece of furniture today. The future demands a more furniture-like kitchen built from sustainable materials.'

When questioned about the digitalisation of the kitchen Richard mentions how the main advocates for more connected solutions are manufacturers of white goods but also that we should not dismiss the technical development.

'Manufacturers of white goods are promoting the digitalisation of the kitchen, but I think that is mostly a way for them to stand out. Sure, there are solutions which are beneficial, when the appliances can communicate with each other for example. Then there are solutions which I find less useful, but of course I think we cannot dismiss the digitalisation. The trend is moving towards more smart and connected solutions and will continue to do so.'

Interview with Linda Berner

Linda Berner is the product manager for kitchens at Vedum and has 8+ years of experience within the kitchen industry.

The biggest trends in the kitchen industry right now is according to Linda, smart solutions:

'People want smart, flexible solutions for their kitchens, smart solutions and less cabinets. The kitchens are getting smaller and people are living in smaller apartments, that leads to people wanting good functional solutions in an as small

area as possible. Open floor plans and kitchen islands are hugely popular today and as the apartments are getting smaller the kitchen will have to merge into other rooms. With smaller kitchens all the space has to be utilized.'

Here is what Linda had to say about the digitalisation of the kitchen:

It will certainly affect the kitchen more and more, and there are certain smart solutions which people are asking for. Such as induction charging and other smart solutions.

Predicting the future of the kitchen, Linda mentions sustainability and flexibility as important factors:

I think that there will be more functional storage, more smart technical solutions and a digitalisation of the kitchen. The sustainability issue is also important, people are getting more and more aware of sustainability issues in relation to the kitchen. With the greater environmental awareness, it will be important to be able to change the appearance of your kitchen without tearing out the frames.

Interview with Marianne Färlin

Marianne Färlin is the marketing director and vice president at Vedum. She has over 20 years of experience working within the kitchen industry.

Discussing the future of the kitchen, Marianne mentions sustainability, quality and function as the most important factors to take into consideration:

We are experiencing an increased awareness to take wise, long term decisions, our customers want to make safe and personal choices. For example, the opportunity to change and replace hatches. We are also seeing an increased interest for natural materials like stone and wood etc. The sustainability awareness and the requirements from the building companies when it comes to environmental impact – are increasing.

Kitchens today are often open plan in newly produced apartments and an integrated part of the apartments furnishings. Newly produced apartments will surely become even more space effective and offer an increased flexibility. By that I mean it will serve both the small household and the big (think families that varies week to week for example). We will see even more smart solutions thanks to technical development, I'm thinking about energy, voice controlled products and apps to maintain our costs for example. New, smart and intelligent materials are being developed, reusing, recycling etc. Also growing vegetables and spices in your home, maybe the line between inside and outside can become more blurred?

Interview with Mikael Warnhammar

Mikael Warnhammar is a Swedish designer who has worked closely with IKEA for over 25 years and designed several of their kitchen concepts.

When discussing kitchen renovations and why people renovate their kitchens so frequently, Mikael talks about how people use their kitchens to express their personal taste.

'Kitchens and bathrooms are rooms where people want it to be new and fresh, especially younger people. It's like their statement, they want to put their mark on their home to some extent. Kitchens can quickly become worn-out, especially if they are done in bad materials. We (IKEA) changed our measurement five years ago, now you can store more things as we have better drawers. We're utilizing more space.

When asked how IKEA defines the kitchen today Mikael talks about how the kitchen has become the heart of the home.

'Everything happens in the kitchen, it's the heart of the home. It's where you do homework, eat, socialize then go about your business. The living room has lost its charm. Many people want their kitchen as a big thing and have an open floor plan. But there are also people who are starting to look towards putting up doors to their kitchen as they don't want cooking fumes everywhere.'

Discussing the future of the kitchen Mikael talks about the decreasing space in apartments and how technology can be implemented:

'I don't think we will notice a big change in our kitchens. More than different colours, materials and such. The white-goods will be more modern and allow for more functionality in one central appliance to combine functions. Maybe we will need smaller kitchens in the future as we can't afford the large spaces we've had in Sweden. We are constantly trying to find more compact solutions, but we have to have the opportunity to build those kitchens. I don't believe in any revolutionary changes; we will still have kitchens ten years from now.

Summary of the interviews

It is evident from the interviews that the future kitchen has to be flexible, compact and fit into a smaller area. Users must be allowed to make customizations to their kitchens without doing large scale renovations. Furthermore, sustainable solutions for frames are needed as well as smart storage solutions. The digitalisation of the kitchen is debated; white-goods manufacturers are implementing smart solutions at a higher rate and kitchen manufacturers will have to adopt to these changes.

Ideation

Exploring the activities

The exploration phase found three main activities, beyond cooking food and eating, that should be addressed in the final concept design. As mentioned in the user study, the literature review and the interviews the three most frequently performed activities besides cooking food and eating were *studying, socializing* and *working*. An activity-oriented design approach was used to explore these activities in a kitchen context. A kitchen user was invited to discuss and assess the activities tools and related tasks in a kitchen environment.

Studying

Object: Learning
Context: In the kitchen
Tools: Computer, pen, paper, book, table, chair, power-outlet

Studying in the kitchen requires a surface to store your tools, if using a computer there is also an additional need to have a power outlet in order to keep the computer charged. Furthermore, there is a need for ergonomic seating intended for longer periods of sitting, the activity could alternatively be performed while standing and would then require a higher table to be able to perform ergonomically.

The activities implication in a sustainable perspective is depending on the pre conditions of the kitchen, does the kitchen allow the activity to take place at all?
How much space of the kitchen is used to perform the activity?
Is the electricity used in the kitchen coming from sustainable sources?

Looking at the historical development of the activity, the most important development is arguably the introduction of the computer as a tool for learning. The activity studying can now be done using a computer as the only interactive tool, however, this is not always the case.

Sustainability mismatches within the activity system is on a tool-object level. The tools within the system, the table and the chair is often not suitable for studying purposes. This is due to the use of kitchen furniture which is not designed for studying. Varying table heights and chair configurations could contribute to a more sustainable activity. Storage for the used tools may be needed as well as power-outlets.

Socializing

Object: Social interactions
Context: In the kitchen
Tools: Other people (physical or virtual), table, chair, kitchen furnishings

Socializing in the kitchen requires space to allow several people in the kitchen area at once. Seating can be required, if one person is cooking food for example the other person may want somewhere to sit, as to not interfere with the person cooking food. If present, the seating should be in close proximity to the cooking area so that the people within the kitchen can interact. If cooking food together, the persons within the kitchen should be able to see and hear each other. If the socialization is taking place virtually e.g. via computer or telephone, additional power-outlets, surface space and seating is required.

The historical development of socializing in the kitchen has, as explained in previous chapters, gone from separated kitchens with limited social interaction towards open kitchens with space and seating to accommodate several people at once. And as mentioned in the pre-study this development is continuing today as more of our social interactions take place in the kitchen.

Mismatches within the activity system can be found on a tool-object level, the chairs within a kitchen is often not designed for prolonged periods of sitting which can be required when socializing. Cooking areas, stoves and sinks can be facing a wall or a window, having the person cooking turned away from the other people in the kitchen. Kitchen layouts where several people can interact and cook food together could contribute to a sustainable activity.

Working

Object: Creating deliverables, product or service
Context: In the kitchen
Tools: Computer, telephone, pen, paper, table, chair, power-outlet

Working in the kitchen requires a surface to store the tools used in the work conducted. If using a computer or telephone, there is also an additional need for a power-outlet in order to keep the telephone and computer charged.

The historical development of the activity has, as mentioned in the pre-study, been from housewives working full-time within separated kitchens to people working remotely from home in their kitchens. The tools used when working from home has changed, often limited to a computer and a telephone.

Mismatches within the system can be found on a tool-object level. Chairs and tables within kitchens are often not designed for working. If seated while working there is a need for ergonomic chairs to allow longer periods of sitting down. If standing up, there is a need for varying table heights in order for the activity to be performed ergonomically.

Summary of the activities

The activities working and studying both require similar surfaces, surface space and storage capabilities from the concept design. Socializing requires surface space, openness and kitchen layouts which promote socialization.

Requirement list

The exploration phase of the project resulted in several insights to take into consideration when ideating for the concept design solution. These insights were compiled into a requirement list which can be found in full length in appendix 2. Below is a summary of the 4 requirement groups present in the requirement list.

Circular design thinking

The main requirement from the project description and context is that the concept should fit into the circular kitchen and subsequently a circular business model. This means that circular design thinking must be applied throughout the design process. The concept should meet one or several of following design prerequisites: *longevity, service, re-use in manufacturing and material recovery*. These ideas should be present in the final concept and be considered when creating the concept ideas.

Allow other activities

The concept shall as the project description stated, and the pre-study confirmed, be able to allow other activities to take place in the kitchen besides cooking food and eating. The concept should add flexibility to the kitchen, by allowing varying activities to take place in relation to cooking food and eating. The most important activities found through the exploration phase were *socializing*, *working* and *studying*. One or several of these activities should be addressed, in relation to a kitchen environment, in the final concept solution design.

Space efficiency

As the exploration phase has shown, the need for space efficient and compact solutions are required. This includes for example ideation of space saving mechanical functions for storage, the surfaces used in the addressed activities as well as when cooking food and eating.

Aesthetics

The concept should add value to the user by offering aesthetically pleasing design. Users should be able to customize and modify the appearance of the concept without having to replace the whole kitchen.

Workshop 1

A creative workshop was held with seven invited design students. Five problem areas were prepared to gather initial ideas using the speedstorming method. The questions discussed with the participants were:

- How can we make kitchen furniture fit into smaller kitchens?
- How can we create more countertop surface space in small areas?
- How can we combine a countertop with a kitchen table?
- How can kitchen furniture be made movable? (not stuck to the wall)
- How do we promote other activities than cooking food and eating in the kitchen? (such as socializing, working and studying)

The workshop generated several ideas to consider when creating the concept idea. A large amount of mechanical, space efficient functions were discussed, part of the created ideas can be found in figure 12.

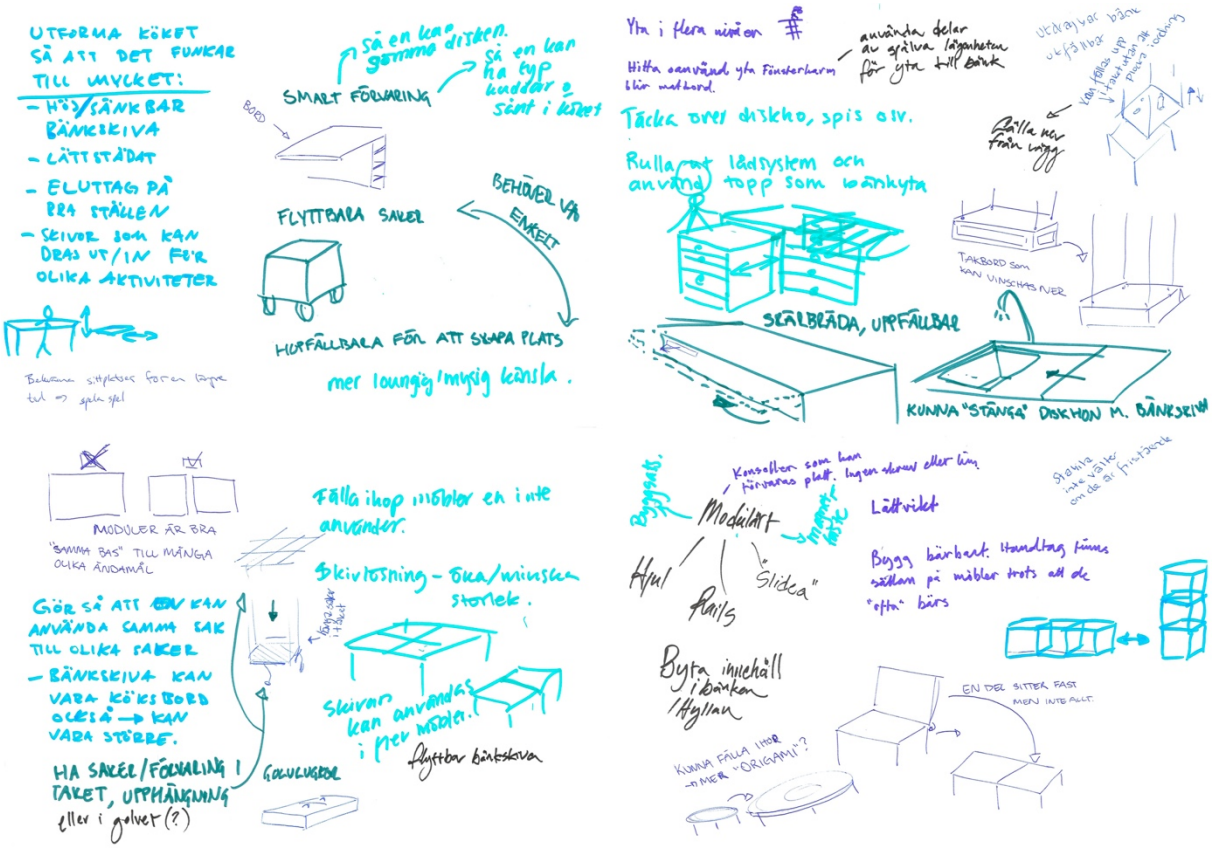


Figure 12. Idea creation in the workshop.

Amongst the ideas created, several were discussed further when ending the workshop. For example, the use of adjustable table heights to serve varying activities. Building modular and movable furniture was present in many of the discussed ideas.

Following is an excerpt of ideas created and discussed:

- Height adjustable countertops
- Smartly placed power-outlets

- Being able to ‘close’ the sink and stove
- Folding non-used furniture
- Frames that can be stored flat, no screws or glue used for assembly
- Building portable furniture
- Utilizing existing non-used space such as windowsills

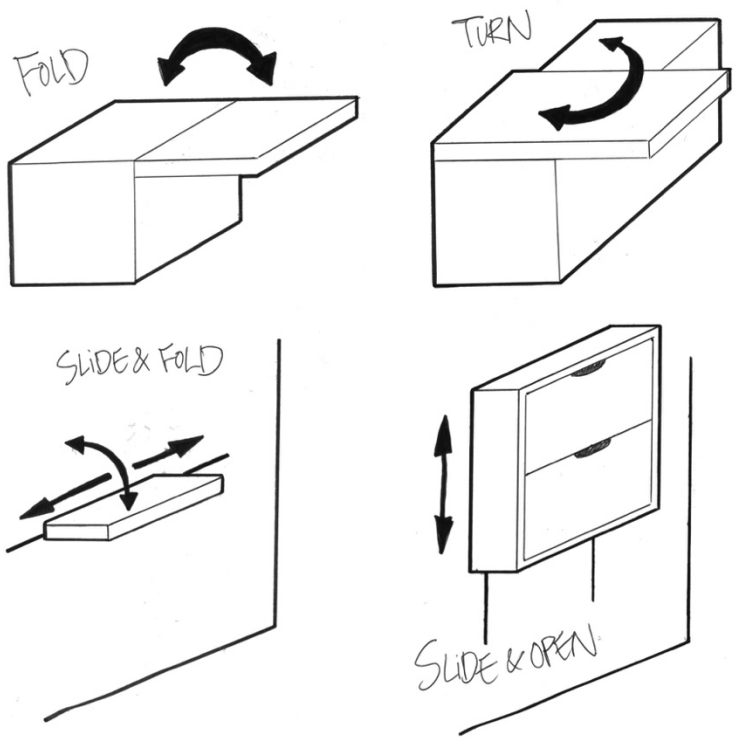
These ideas were further developed when performing the solitary creative sessions.

Workshop 2

A workshop was held with three invited design students to generate ideas on flexibility in the kitchen. The idea generation method used was brainwriting and the focus of the workshop was to generate and discuss space-efficient solutions. Figure 13 shows the brainwriting session.

Figure 13. Brainwriting session.

The brainwriting session resulted in several mechanical functions to consider when developing surface efficient and flexible kitchen furniture. There were discussions on how tables and countertop surfaces can be folded and how to incorporate modular thinking into kitchen furniture design. Some of the discussed ideas can be found below in figure 14.



Discussing mechanical functions related to space-efficiency lead to insights on what functions to consider when constructing furniture for storage and countertop surfaces. This was a part of the process of constantly thinking about and discussing ways to assemble and construct flexible furniture.

Figure 14. Workshop ideas focusing on mechanical functions.

Workshop 3

A co-creation creative workshop was held in the HSB Living Lab with invited kitchen users. The eight participants included both design students and users with no prior knowledge of the design process. The participants were split into two teams with three persons in each team and given the assignment to create their dream kitchen layout. To do so, the teams used the movable kitchen modules available in the HSB Living Lab test kitchen. A prerequisite was that the Teams should include a place to eat as well as a stove top and a sink. Team 1 had no limitations as to how big their kitchen layout could be designed, Team 2 had approximately 5 square meters to work with, simulating a significantly smaller kitchen size. Figure 15. shows Team 2 working on their kitchen layout.

Figure 15. Working on a layout in the small kitchen

Team 1, having the bigger area to work with, instantly created a kitchen island in connection to their kitchen. Team 2 struggled to fit an eating area into their smaller kitchen and ended up creating a kitchen peninsula facing outwards from the wall. When the layouts had been created, the teams were given the assignment to cook food in their kitchens. This gave the participants a chance to evaluate their kitchen layouts in a real life situation. Figure 16. shows Team 1 cooking using their kitchen island.

Figure 16. Team 1 cooking on the kitchen island.

Concluding the workshop, both teams were satisfied with their layouts, they all felt like their layouts were inviting and promoted social interactions. They could all engage in the cooking while being social and talking amongst each other. Creating sufficient space for seating was harder in the smaller kitchen as they had to create their dining area in direct relation to the kitchen layout. They managed to find a solution where an eating area was created in the same height as the countertop used when preparing the food. Figure 17. shows Team 2's final kitchen layout.

Figure 17. Team 2's final kitchen layout.

The workshop resulted in insights on how the ideas created during the ideation phase could be related to different kitchen layouts in real-life situations. The kitchen island

promoted social interaction and was used by both teams although Team 2 ultimately built a kitchen layout using a peninsula. The team's kitchen layouts are illustrated below in figure 18.

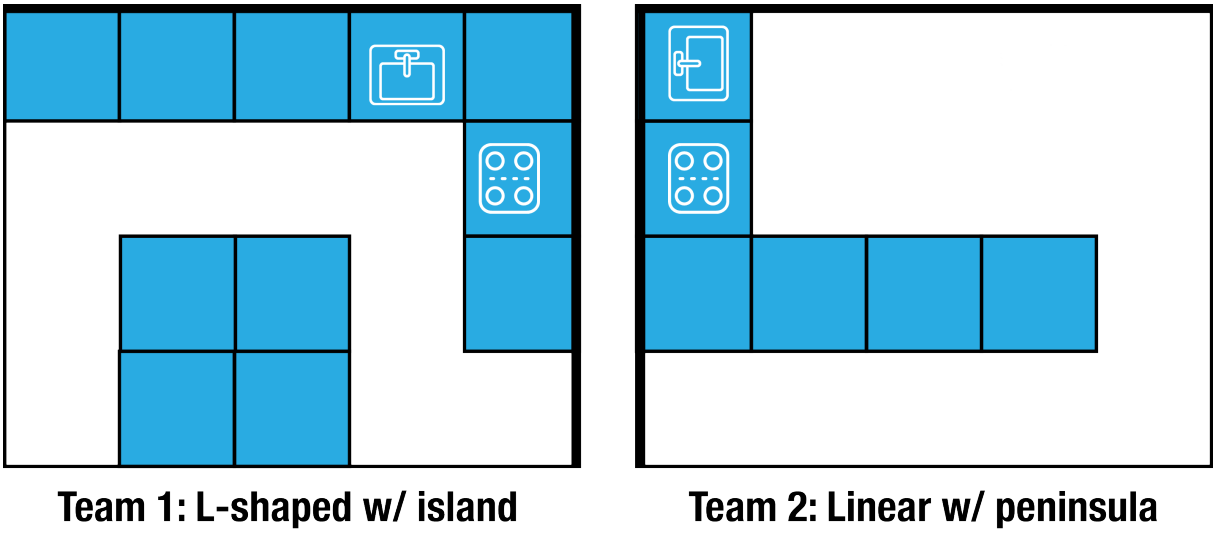


Figure 18. The team's created kitchen layouts.

Creative sessions

The creative sessions performed solitary served as a base to further develop ideas and contextualize them while continuously sketching and discussing ideas in the workshops. The findings and ideas created through the idea generation methods are presented in this sub-chapter.

Morphological chart

The morphological chart (figure 19) was used to break down part of the requirement list in the beginning of the ideation process. The chart was an illustration of how different requirements could be met with different solutions and was positioned at the workplace during the ideation phase in order to relate created ideas back to the requirement list and continue the thinking process.

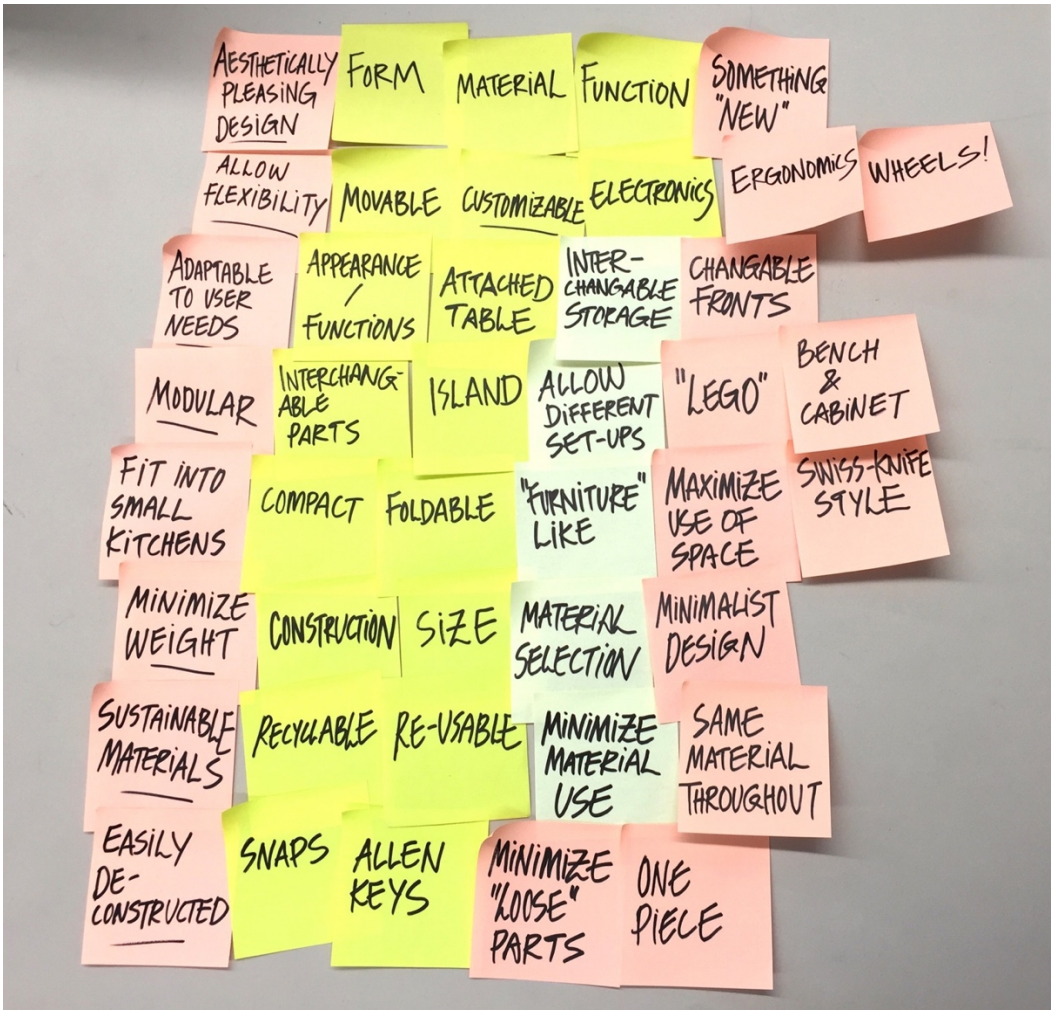


Figure 19. Morphological chart.

Through thinking about the ideas in relation to the requirements the morphological chart was a constant reminder of where the concept idea should be headed.

Negative idea generation

The negative idea generation session generated ideas which may have been overlooked in a 'positive' idea generation session. An illustration of the negative idea generation can be found in figure 20.

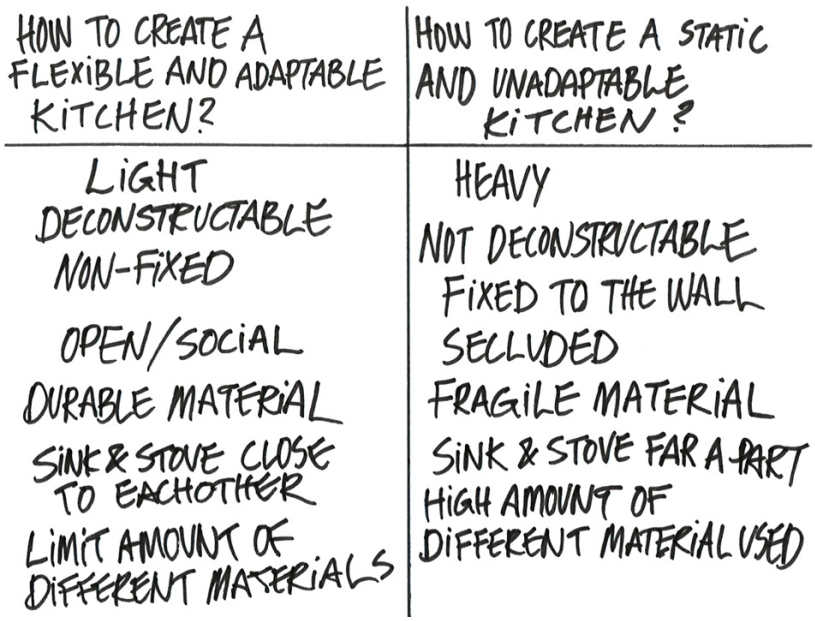


Figure 20. Negative idea generation.

The negative idea generation lifted important aspects to consider in the concept idea. That the concept should be light for example which is related directly to the form of the concept, including material selection and construction. The openness of the concept can be directly related to the activity of socializing, as Workshop 3 showed, openness was beneficial to the kitchen layouts when used for social interaction. The method also leads to reflections on how to build kitchen furniture without having to fixate them to a wall.

Sketching

Sketch prototypes were used throughout the ideation phase, they generated discussions and were used as a support when explaining ideas to people within the circular kitchen project and to other design students. Mechanical functions were included in some sketches, others focused solely on form and expression. The sketches were of varying quality and focus as they were used to generate discussions and reflection throughout the design process. Figure 21 shows a sample of the created sketches during the ideation phase.

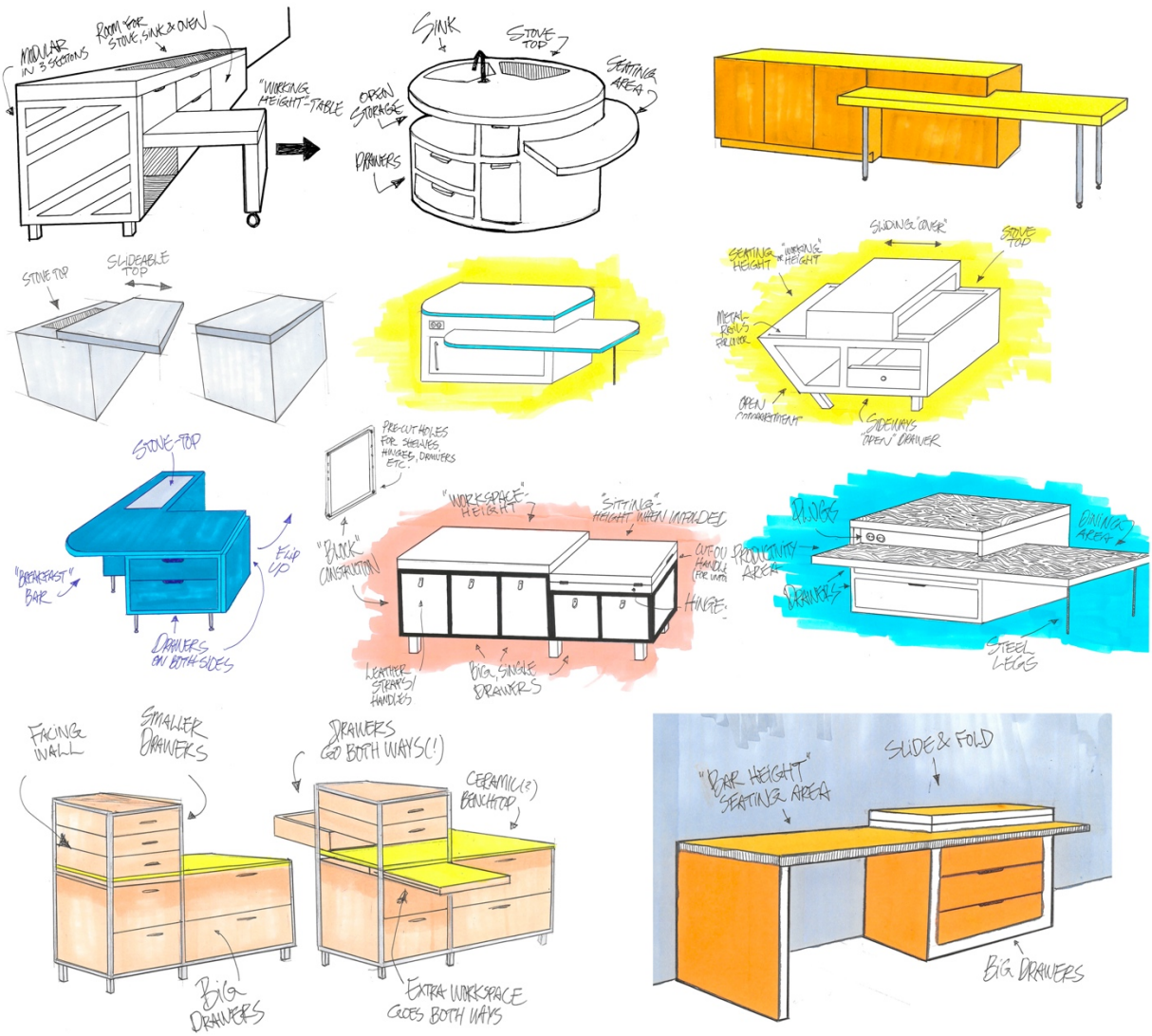


Figure 21. Sketch prototypes.

Iteration

During the half-time presentation, three concept ideas were presented and discussed. From the feedback gathered it was evident that the ideation had become too focused on static forms and expression. This prompted an iteration as the concept ideas had to be more versatile and have a wider focus, on circularity and the main purpose of the project; creating flexibility. Part of the ideation process were iterated in order to create new ideas as well as to re-visit and reflect on already created ideas. To be able to create a finalized concept design, a decision was made to create a concept idea which could be further developed into a final concept design. This decision was made in order to choose a track for further development, as the final concept design had to address many different aspects and fit into the bigger picture of the circular kitchen project.

Finding a concept idea

The iteration performed after the half-time presentation lead to a review of the created ideas and the found insights as well as a generation of new ideas. By going back and revisiting insights from the pre-study and further developing ideas created in the

workshops and during the solitary creative sessions, two concept ideas were created in order to allow a choice of track for further development.

Concept idea 1

Concept idea 1 was building a kitchenette-style, compact kitchen with all the functions and storage needed in an as small area as possible. The idea featured both open and closed storage possibilities and a table which could be pulled out for use when eating or performing the activities; studying, working and socializing. The concept idea also featured a cover which hides the food preparation area, stove sink etc. when not in use. Figure 22 shows the concept idea.

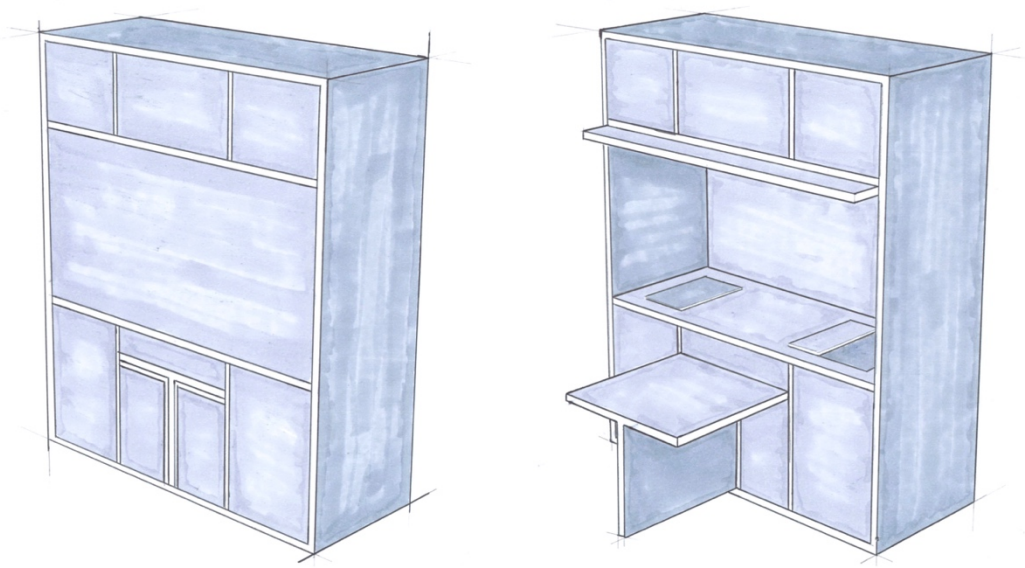


Figure 22. Concept idea 1.

The concept idea was based on the insight that people's attitudes on open floor planned kitchens is changing in Sweden towards a separation of rooms once again. This insight was also mentioned by Mikael Warnhammar during the interviews, that some users want to be able to close out the kitchen and subsequently the cooking fumes. The concept idea addressed this notion with the built in cover, offering an alternative to the user to be able to hide the cooking area, without having to separate the rooms. Similar ideas were discussed during workshop 1, using slide-able covers to hide the cooking area. The concept could also be used as a fixed feature within the apartment and for example integrated with a wall. Furthermore, the concept idea allowed for further development of storage solutions and combinations of surface heights.

Concept idea 2

Concept idea 2 was building kitchen furniture in bio-composite modular sections, allowing interchangeable storage and layout possibilities. The idea includes an adjacent height adjustable surface that could be used when cooking food and eating as well as when working and studying (figure 23). Several of the interviewees mentioned a need for sustainable solutions and this concept idea offered great opportunity for adaptation into a circular business model. The idea could also be developed to tackle the challenges identified by the European environment bureau (explained in previous chapters).

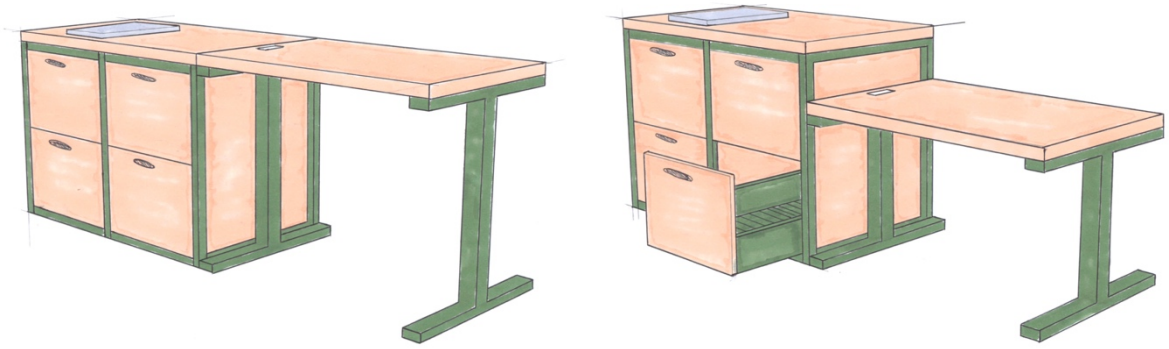


Figure 23. Concept idea 2.

The standardized modular sections, paired with the height-adjustable countertop offered flexibility in layout- and customization possibilities as well as addressing the activities. First created early on in the ideation process, the idea of building modular furniture in sections were present throughout the ideation phase and the concept idea allowed further development of storage solutions and construction solutions for easy assembly.

Prototyping

The concept ideas were prototyped in the HSB Living Lab test kitchen using physical mock-ups in order to find and test dimensions related to cooking and to the activities. Figure 24 shows the prototype of concept idea 1 when closed, opened and when the pull-out table is pulled-out.

Figure 24. Prototyping concept idea 1.

Concept idea 1 would have to be 2000 mm wide and 2400 mm high. The depth would have to be approximately 700-800 mm to fit the pull-out table inside. The pull-out table needed to be at least 800 mm wide to allow two persons sitting in front of each other. Using these measurements, the concept idea would cover 1,6 square meters of floor space.

The height adjustable table for concept idea 2 had to be 1200 mm wide to facilitate four people sitting at the table. The depth had to be 800 mm when used as a kitchen

island or peninsula. When used against a wall, the modules can be scaled down to a depth of 600 mm. Using the height adjustable table against a wall would however decrease the functionality as fewer people can use it simultaneously. Figure 25 shows a mock-up of concept idea 2 positioned as a kitchen island with two bio-composite sections and the attached height adjustable table.

Figure 25. Prototyping concept idea 2.

Concept selection

Choosing a track for further development

The two concept ideas were evaluated against the requirement list categories and then compared using the circular design guide method for concept selection. The assessments for each concept idea against the requirement list categories can be found below.

Concept idea 1

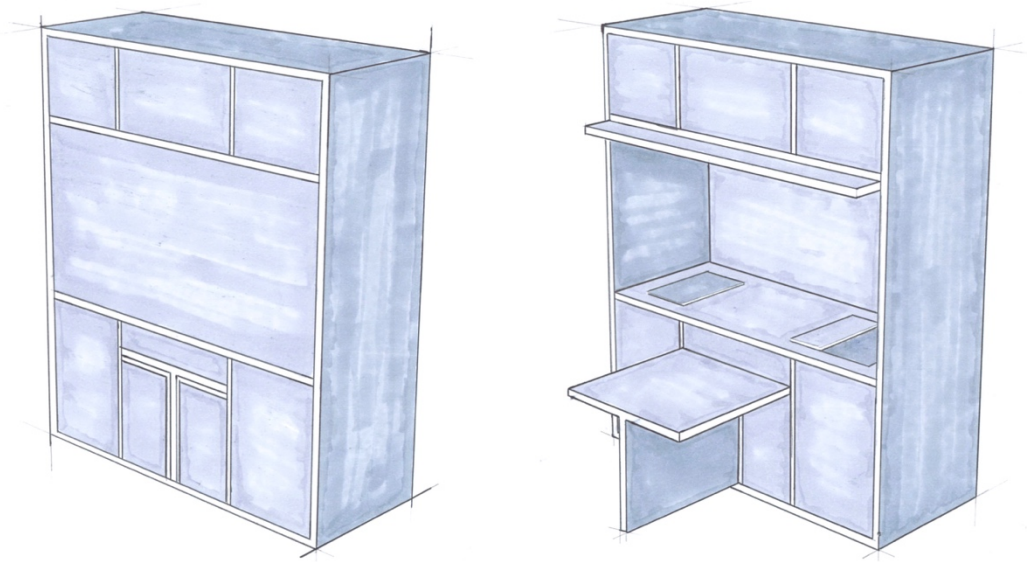


Figure 26. Concept idea 1.

Circular design thinking

The concept idea can be designed for longevity as the idea features a clearly defined form intended for a long life-cycle of use. Possibilities for user refurbishment and customization are however limited as the construction is likely to be complex and require professional knowledge to alter. The material used can be chosen to allow material recovery or re-manufacturing although this would likely lead to higher production costs and market price.

Allow other activities

The concept idea allows both working and studying when using the pull-out table which is at a sitting height. Drawers and cabinets can be further developed to allow storage of the material used when studying or working. When used for cooking, the concept idea cannot be said to promote socialization as the stove, sink and preparation area will be facing a wall. The cover which can hide the cooking utilities does however give the user an opportunity to quickly hide the stove, sink and preparation area and focus on socializing with guests etc.

Space efficiency

The concept idea would fit into small kitchens and be compact. There are also great possibilities for space-saving functions, exemplified with the pull-out table and storage which can be further developed.

Aesthetics
The design of the concept idea is subtle and timeless; it does however not allow for customization which can be needed in order to sustain the long life-cycle.

Concept idea 2

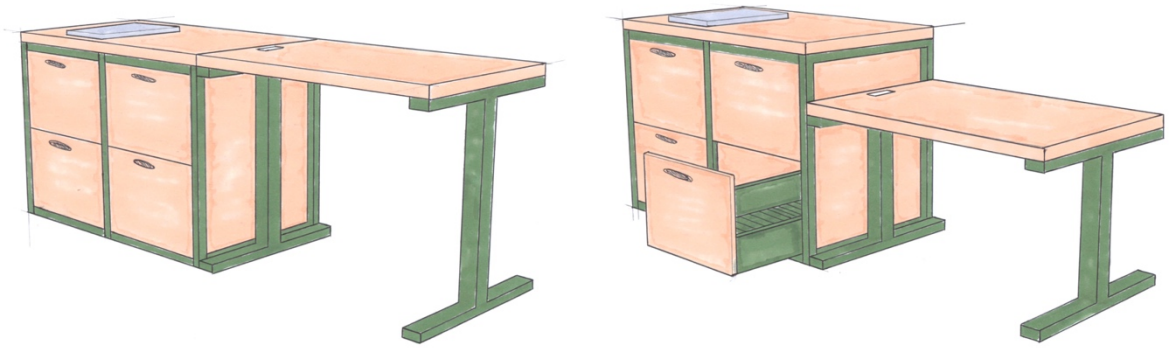


Figure 27. Concept idea 2.

Circular design thinking
Concept idea 2 is designed for both service, re-use in manufacturing and material recovery. With the bio-composite base, the concept could be adapted to a circular business model. Longevity is in this concept idea weighed against flexibility in terms of layout- and customization possibilities, the concept idea allows a longevity with the used material and form while also promoting customization and refurbishment.

Allow other activities
The height adjustable countertop included in the concept idea can be used as a table to allow both working and studying. When the concept idea is used as a kitchen island or kitchen peninsula, socialization can be promoted. If used as a kitchen island the concept idea allows several people to interact in the kitchen simultaneously.

Space efficiency
The concept idea can fit into small kitchens and be compact, it is however depending on how many modules are used and how the layout is designed. Space saving functions can be promoted in the different storage possibilities given from the bio-composite frames.

Aesthetics
The aesthetics of the concept idea is raw and functional and promotes user customization due to the open design of the frames which allows different drawers and inserts.

Circular design guide concept selection
Assessing the concept ideas through the concept selection method by the circular design guide, both concept ideas had their benefits. Concept idea 1, the kitchenette, is arguably easier to implement with already existing manufacturing techniques and machines depending on the final material choice. The idea of concept 1 was to use conventional materials such as MDF, particleboard and solid wood. Concept idea 2 with the bio-composite frames will likely require acquisitions of new tools and

implementing new manufacturing techniques as bio-composite materials and techniques are fairly new, especially within the kitchen industry. Concept idea 2 is designed for re-manufacturing and reuse, the frames can be replaced and re-manufactured into new frames. The material within concept idea 1 is harder to reuse and the focus would instead be on prolonging the lifetime of the product and design for longevity.

Concept idea 1

Viability
The long-term business goals of concept idea 1 would be to design for longevity and assure that the concept has a long life-cycle, when the product reaches end of life the product must be de-constructible so that the used material can be recovered and recycled.

Desirability
Concept idea 1 has great potential to fit into open plan apartments and serve as a kitchen when needed and as a working area when desired. It offers a great deal of functionality to user. It could also be installed as a fixed feature within an apartment wall.

Feasibility
Incorporating electronic functions into the design could improve the feasibility of the concept.

Concept idea 2

Viability
The business goal of concept idea 2 would be to design for re-use and remanufacturing. The material used should be returned to the material producer in order to recycle the material and remanufacturing it into new products. The concept will be adaptable and focus on promoting re-use and customization, allowing upselling and sales of upgrades to the kitchen.

Desirability
Concept idea 2 has the potential to be a base for sustainable kitchens, by offering flexibility and adaptability. The height adjustable table could also serve handicapped people and promote inclusiveness.

Feasibility
Storage solutions could be developed to fit into the frames to create space efficiency. A development of the height adjustable table could transform the concept into a complete work station for studying and working.

Matrix
The concept ideas were plotted on the matrix from the circular design guide concept choice method in order to visualise how easy they are to achieve versus the impact they could have. Figure 28 shows the concept ideas plotted on the matrix.

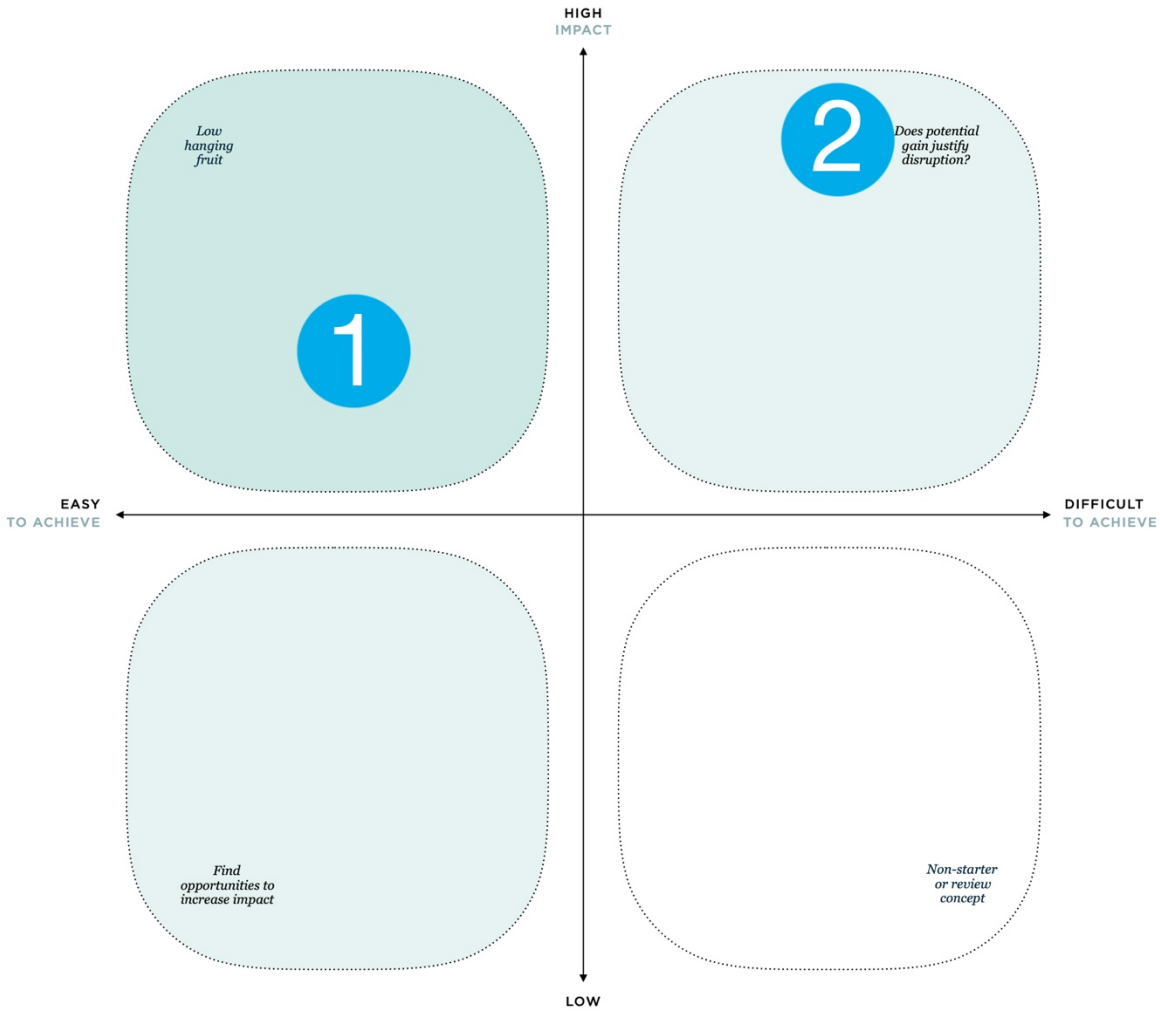


Figure 28. Plotting the concept ideas using the circular concept choice method.

As illustrated in the figure, concept 2 will arguably be more difficult to implement but have a higher impact. Concept idea 1 is easier to implement, but the impact will be less.

Summary of concept choice

After assessing the concepts using the requirement list and the circular design guide method for concept selection, it is clear that concept idea 2 will be the more beneficial concept in order to reach circularity in the longer perspective. Since the project aimed at finding a visionary conceptual solution for future kitchens, concept idea 2 was chosen for further development.

Further development

Developing the final concept design

This chapter will address questions regarding the final design of the concept, the material selection, the construction of the final concept, the circular business model in which the concept will fit into and how the concept addresses the identified activities. Sketch prototypes and renderings were used to find the final design idea and visualize how it could be implemented in varying kitchen layouts and address the activities. Ideas for drawers and open storage were sketched and discussed. A decision was made to include legs to the modular sections as this would allow flexibility by giving the possibility to vary the height of the modules, while adding a sense of lightness to the design. Several sketch prototypes and renderings were created. Figure 29 shows the initial idea for the design.

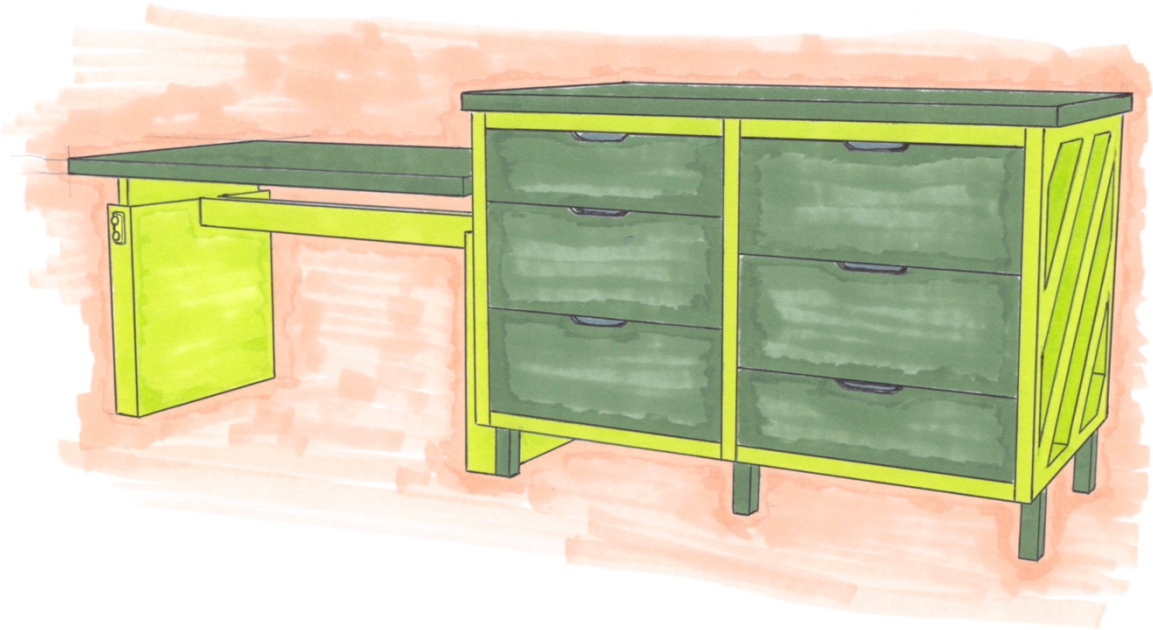


Figure 29. Initial idea for the design.

To get an idea of how the concept would function in the activities, *socializing*, *studying* and *working* the concept was sketched in different situations and layouts. Figure 30 shows the concept as a linear I-kitchen paired with a kitchen peninsula.

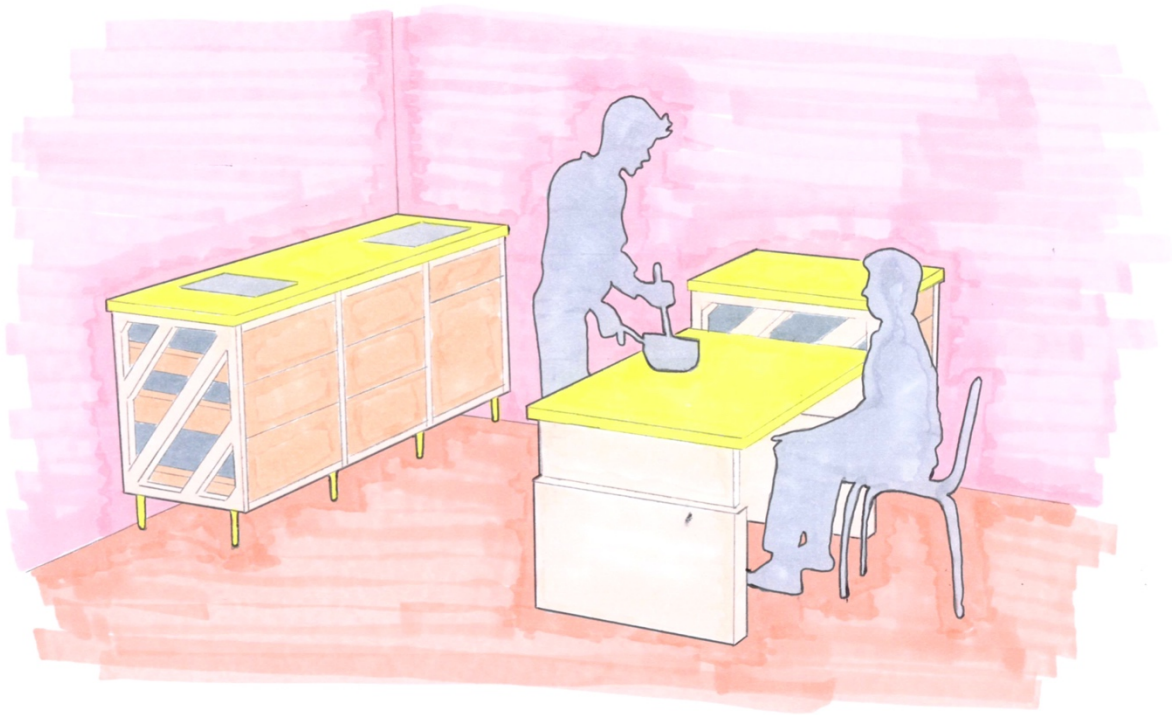


Figure 30. The concept idea used in a parallel kitchen layout.

Material

The final concept is based on sections of modular bio-composite frames and the proposed material for the countertops, drawers and fronts are natural, solid wood. An expert was consulted in order to find out more about bio-composite materials, how it can be used in kitchen furniture and how the material could be used in a circular business model. Below are excerpts from the interview which was performed in Swedish and translated to English by the author for rendition in this chapter. Full-length, transcribed interviews in Swedish can be found in Appendix 1.

Interview with Richard Moberg

Richard Moberg is a concept manager and head of sales at Puustelli which uses bio-composite materials in their Miinus concept.

Richard mentioned how bio-composites can be recycled and re-manufactured into new frames and components but that Puustelli does not do it today due to a lack of resources and infrastructure. Puustelli instead focuses on longevity as they offer a 30-year guarantee on their bio-composite frames. Richard also mentioned that their customers has the possibility to recycle the bio-composite but that they currently do not offer any service to take care of the material.

Bio-composites has superior material qualities in strength, heat resistance and moisture resistance compared to commonly used frame materials such as MDF, particleboard or solid wood. The bio-composite that Puustelli uses is tested to withstand temperatures from -25° C to 90° C. The most valuable material property of the bio-composite in a kitchen context is according to Richard its ability to withstand humidity and moisture. Temperature is generally easy to regulate within our homes but water damage can easily destroy wood-based kitchens.

Construction

The construction of the frames and height adjustable countertop was based on assessments made when prototyping the concept idea in the HSB Living Lab and on the consultation interview performed. The first ideas for the construction were created using sketch prototypes and CAD-models. When discussing the initial idea for the construction within the Circular Kitchen Project and in the consultation interview it was clear that the modules had to be created from several smaller components as the initial ideas for the construction would result in a too high manufacturing costs. Figure 31 and 32 shows the initial ideas for module construction.

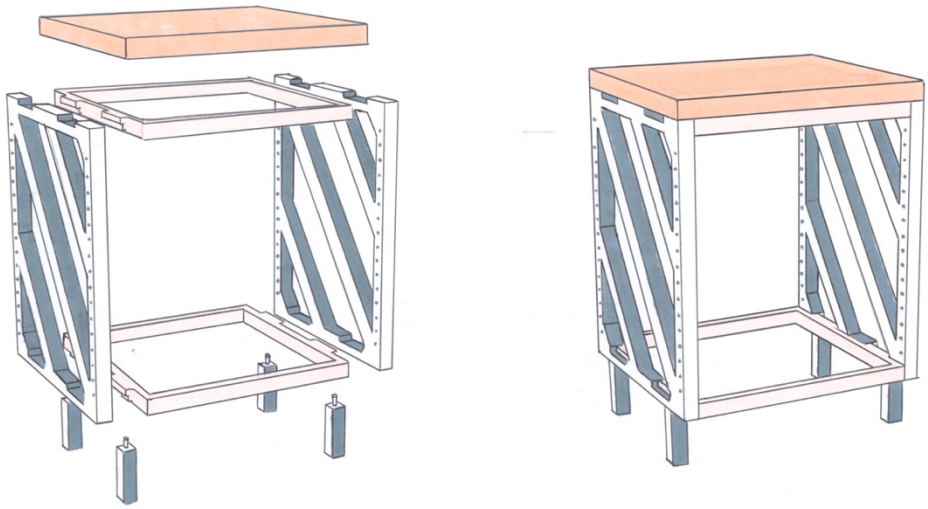


Figure 31. Initial idea for the construction of the modules.

Figure 32. Idea to assemble the modules.

In order to decrease the number of components, 'click-together' solutions were sketched and explored in order to find out how to assemble the modules while limiting fastening elements and used components. Figure 33 shows ideas for connections.

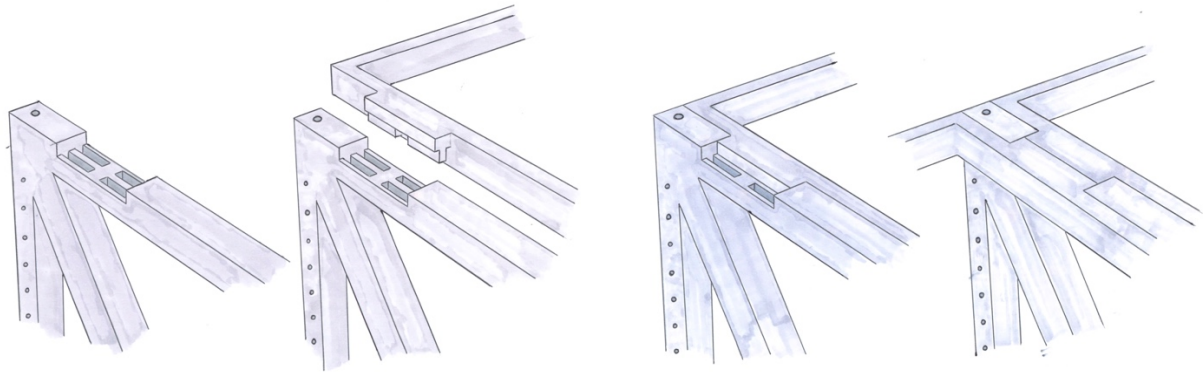


Figure 33. Sketching ideas for connections.

A change of direction

During the work with the construction and detailed design of the concept a decision was made to move away from the idea of including an electric, height adjustable countertop and instead focus on how to create different heights mechanically by using different connection techniques. Producing or buying moulds for bio-composite products are expensive and in order for the concept to be feasible, a change of focus was needed. The proposed components had to be smaller in size, as the initial idea would not be a viable investment for a kitchen furniture manufacturer due to the high manufacturing and tool costs it would impose when using the bio-composite material. An iteration was performed in order to find a solution were modules and height adjustable countertops could be built from bio-composite materials while still being in a competitive price range. The final concept is further explained in the following chapter 'visualization and evaluation'.

Circular business model

Following is an initial effort to contextualize how the final concept would fit into a circular business model. The proposed circular business model is based on the consultation interview and assessments made when creating the final concept design.

Key partnerships

The key partnerships in the business model will be the end-user, component manufacturers, shipping companies and contractors.

Key activities

The concept is aimed at a kitchen furniture manufacturer, proposed key activities are sale of the kitchen furniture while offering installation, de-installation and material recovery for re-manufacturing in the form of a deposit system.

Key resources

The key resources will be a shop, a warehouse and a digital platform. The shop will function as a showroom for the assembled products where users can discover and buy products. The warehouse will store components for the end-product which will be assembled in the user's home. The digital platform will function as a digital showroom and web shop where users can order spare parts, additional components or refurbishment services from the company.

Value proposition
To fulfil the needs of a circular, flexible kitchen; the concept will function as the product which a service can be built around. The service will be the company taking responsibility of the product's material life-cycle by offering a deposit system to the end-user. When the users want to change their kitchen layout or their current components are worn-out, the company will offer a deposit system and give the user a refund when returning components. As the concept is customizable it creates possibility for the company to upsell and offer the end-user additional components.

The possibility of product customization offers a flexibility to the end-user as users can download tutorials on the company website on how to transform or upgrade their purchase. This also leads to product uniqueness as every customer can transform their kitchen according to their personal taste. B2B clients will benefit from the sustainable value of the furniture company as it adds a boost to their sustainability image.

Customer relationships
The company will aim to create strong personal relationships with their customers by engaging them with transparency, personal assistance and community building. Transparency is the company being open and honest about how their products are made and how much CO2 emissions every product causes, communicated through product information and social media platforms. Personal assistance is the company providing the users with information on how to repair, maintain and adapt the product. User information is shared when buying the products and through the company's website. The company will promote re-use by building a community of users sharing and adapting their kitchens with the products.

Channels
The company will foster a strong relationship to their component and material suppliers. By giving the users an incentive to return and recycle the product material, the company takes responsibility for the reverse logistics chain.

Customer segments
The main customer segments will be users living in condominiums where they own their kitchens. This customer segment can be broadened to include building owners, offices, rental apartments and houses as well as construction companies.

Costs
Material costs could be lowered by the recycling of material, in collaboration with the materials manufacturer. The biggest costs will be the logistics and installation/de-installation services, the used material is however lighter than conventional materials used in kitchen furniture production which lowers costs of logistics. The concept will not depend on finite resources but instead focus on how to take responsibility of the used materials.

Revenues
The business model creates ecological value as the material used in the frames can be re-manufactured. By giving the user freedom to customize their kitchen, upselling can bring revenue when users changes drawers, countertops or frames.

Figure 34 explains the overall product life-cycle of the concept which the circular business model is built upon. The company sells the product to the end-user, offering installation, spare parts, upgrades and de-installation. The company also offers the end-user refurbishment services and encourages the end-user to resell or trade their kitchen components on the second-hand market. When components are worn-out or the end-user wants to change their kitchen layout altogether, the company offers the end-user a refund for returning their frames to the company. The frame material is transported back to the material manufacturer which remanufactures the frames into new product. The wood is recycled or reused through collaboration with recycling companies.

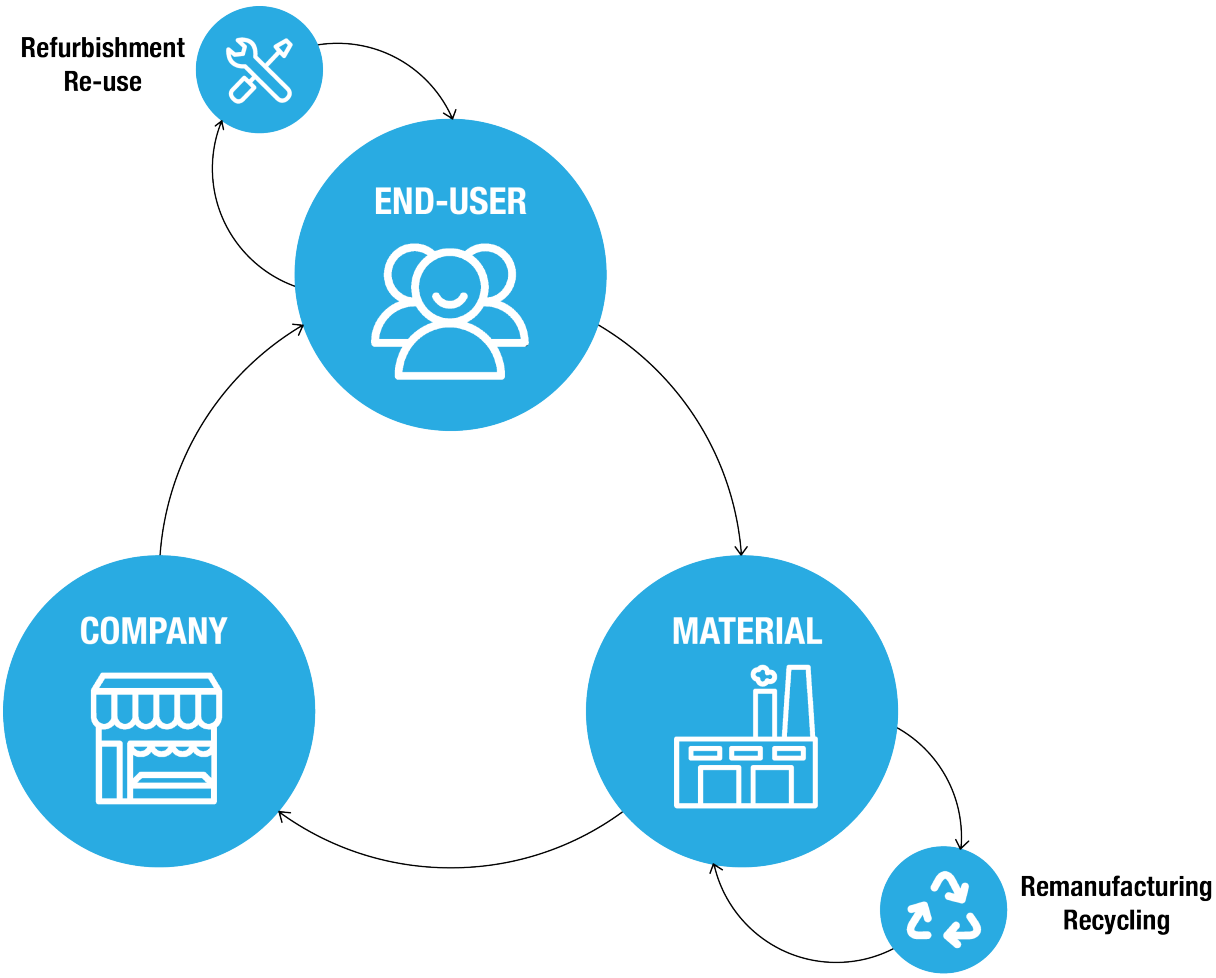


Figure 34. Circular business model.

Visualization and evaluation

Renderings

To present the final concept, several CAD-models and renderings were created. Following are renderings explaining the final proposed assembly of the concept and a visualization of the final concept in varying layouts and contexts.

Assembly

Following figures explains the proposed assembly of the components and how they can be used in a kitchen layout. The concept is based on two main bio-composite components as shown in figure 35. From these components, several modules and shapes can be created. The components can be stacked on top of each other to create frames for storage modules, tables or chairs. Drawers and inserts are made from solid wood and the sliders are made from metal. The components are clicked together using connecting geometry, these connections can be strengthened by adding cotters through the pre-cut holes in the components. The components are standardized in two sizes, 300 mm x 200 mm and 500 mm x 200 mm. These measurements were chosen based on the insights found during the literature study and when prototyping the concept ideas. From the standardized measurements of the components, different depths can be created, to serve both the addressed activities and fit into various kitchen layouts.

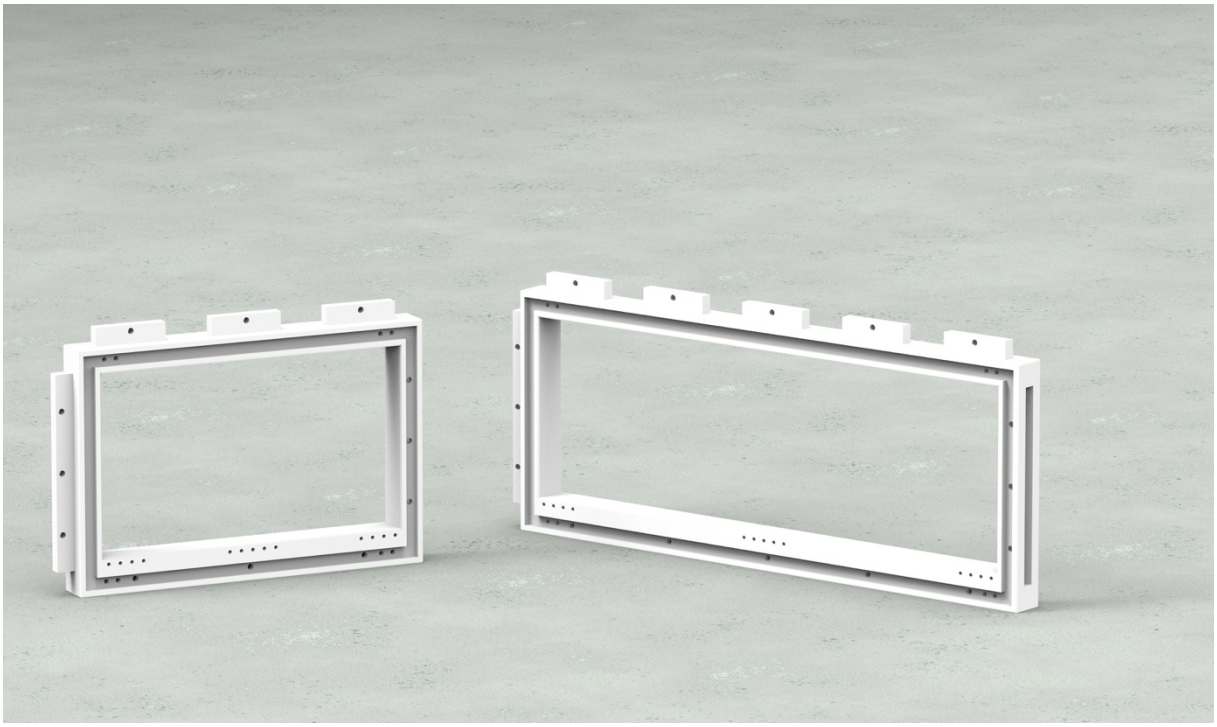


Figure 35. The two bio-composite frame components.

After the components are assembled, legs, sliders and drawers can be mounted on the frame. Figure 36 explains the assembly of the components and how inserts and legs can be mounted on the frames. In the figure the frame is mounted with four, 200 mm high drawers. This is just an example of how the frames can be mounted and is used to explain the assembly. Other configurations are possible. The drawer slides are mounted with screws into pre-drilled holes in the frames and the legs are mounted into pre-drilled holes in the frames.

Figure 36. Assembling a storage module.

Layouts

The design of the frame components allows countless configurations and layout possibilities. Figure 37 and figure 38 shows an example of how the components can be used in a kitchen context. Countertops can, for example, be turned into dining tables and vice versa by adding or subtracting frame components. Chairs and storage units can also be created using the components.

Figure 37. Linear I-kitchen.

Figure 38. I-kitchen with attached kitchen table, desk and chair.

The storage modules can either be placed on legs, directly on the ground or on wheels. Adding wheels to the storage modules creates flexibility so that the user easily can modify the layout of the kitchen. Figure 39 shows a linear I-kitchen layout with a kitchen island on wheels.

Figure 39. I-kitchen with kitchen island on wheels.

By adding frame components, the previously shown kitchen table in connection to the linear I-kitchen can easily be turned into a countertop for increased working space. Figure 40 shows the converted kitchen layout (now a L-kitchen).

Figure 40. Kitchen table converted into countertop surface.

The concept can also be used for other application areas, such as desks, sideboards and dressers. Figure 41 shows the concept when used as a desk. During the peer-review (further explained in following sub-chapters) there were discussions of creating covers or additional storage intended for the sides of the modules, to exemplify this, the concept was modelled in a desk setup with an attached magazine rack.

Figure 41. Using the concept as a desk.

The renderings above shows an example of layout possibilities and use areas, but in order to further exemplify the possible layout variations which the concept can be used within, figure 42 shows how the concept can be applied both in smaller kitchen layouts and within open floorplans. The lightly coloured boxes represents sitting height surfaces and the darker coloured boxes represents countertop heights. By combining the components into different layouts, the concept could be utilized in both smaller kitchens as wells as in bigger kitchens with an open floorplan.

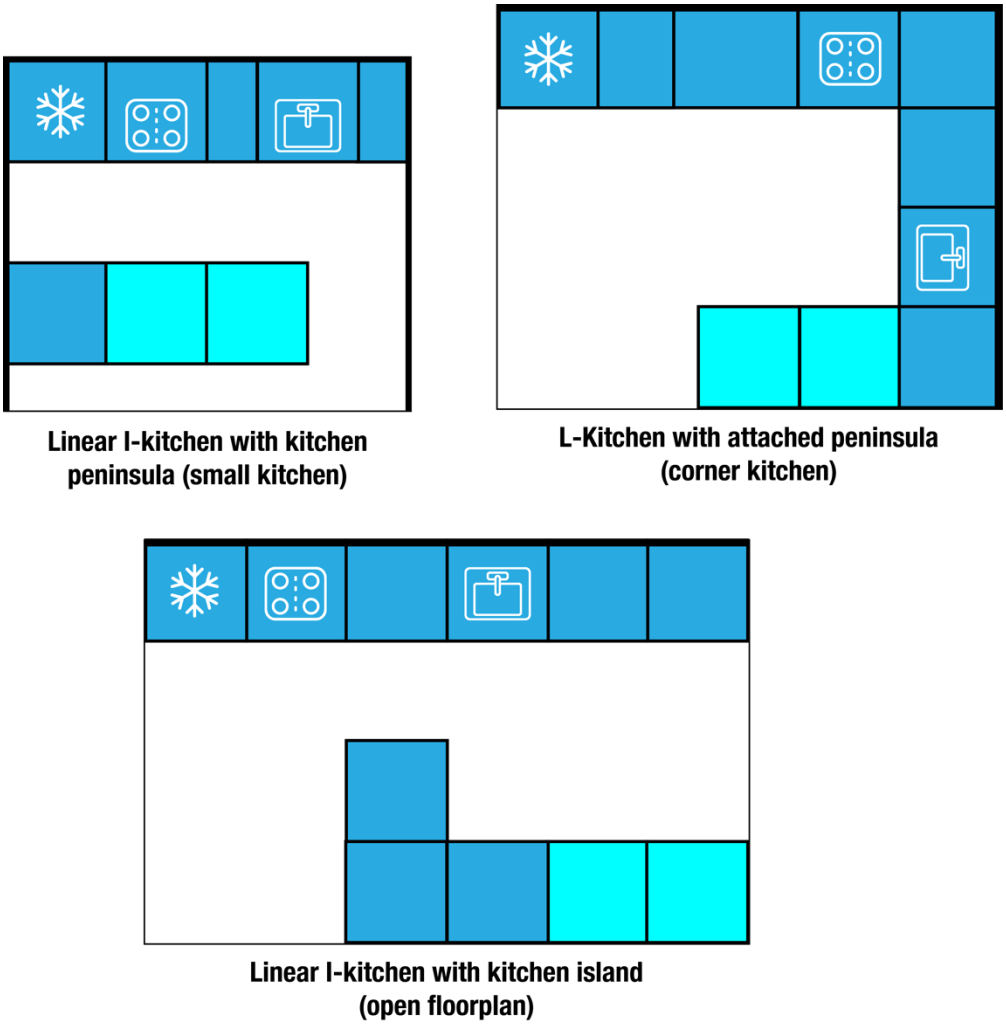


Figure 42. Example of kitchen layouts using the concept

Activities

Due to the many applications of the concept it can, as shown in figure 41 and in figure 43, serve the activities of *socializing, working* and *studying*. The activities are addressed through the varying surface heights of countertops, attached tables and storage possibilities. Additionally, chairs can be built using the frame components and allow sitting down as well as storage possibilities as exemplified in figure 41. Figure 43 shows an example of a kitchen layout where socialization is promoted through the open layout and closeness between food preparation area and kitchen table.

Figure 43. Socializing in the kitchen

Evaluation

The concept was evaluated against the requirement list and in a peer-review session with fellow students from the circular kitchen project.

Requirement list

The concept, while being highly conceptual, addresses circular design thinking. The concept is designed for re-use, refurbishment and material re-manufacturing. If implemented the concept could be incorporated in a circular business model and close the loop between product use and material recovery. The design allows deconstruction and easy assembly while featuring recyclable materials with the use of bio-composites. The bio-composite material also decreases the weight compared to conventional kitchen furniture materials.

Activities other than cooking food and eating is addressed through the many applications of the concept. The concept is not solely intended for storage units and countertops within a kitchen, but can serve a multitude of other furniture needs such as tables, chairs, desks and bar-height seating.

Space efficiency is dependent on the use of the components, they can be used in small layouts as well as bigger kitchens. The user has the freedom to configurate the layouts by adding or subtracting components, since the components can be fitted with various inserts, storage can be created in tight spaces.

The design of the concept is bold, the revealed frame material may be seen as a statement for sustainability, further development of covers can be implemented although the design is intended to stand out from the conventional kitchen furniture design and invite the user to customize and configure the layout. The open construction reveals all features and promotes user interaction by triggering ideas on how to configure and customize the layout.

Peer-review

A peer-review session was held with three design students from the circular kitchen project. The final concept was evaluated and pros and cons of the design were discussed. Figure 44 shows the peer-review discussions.

Figure 44. Discussions following peer-review

The feedback gathered was positive in the application of the concept into a circular system. The concept allows many application areas due to the design and addresses issues within conventional kitchen furniture production with the design and material choice. The 'open' design, revealing the frames was discussed and further developments of different covers and additional features can be performed. Renderings of the final concept were discussed and the group pointed out the need for more renderings showing the concept in use within a kitchen context, renderings were created in time for the final presentation.

Discussion

General discussion

The kitchen as an area is a versatile place filled with emotion and opinions. Trying to provide a conceptual vision of the future of this area has been difficult. The study has been successful in providing insights and estimations of the future, but they cannot be seen as certain predictions. The conceptual design solution is the result of the insights gathered in the pre-study and the authors subjective vision of the future. As such the proposed concept design and business model would likely look different if performed by another person. The research questions were answered through the requirement list and in the conceptual design solution. Allowing user customization and configuration gives a flexibility to the kitchen furniture. The concept can be used in varying applications and contexts not limited to the kitchen. Kitchen furniture of the future should implement circular design thinking and be flexible in the sense that they are not limited to applications within the room we today define as the kitchen. Sustainable materials, production and business models must be implemented to change the direction of the current take-waste model of the furniture industry.

One thing we all must agree on is that the future calls for sustainable design solutions, global warming is real and sustainable solutions and circular design thinking must be implemented today. Existing solutions which could promote sustainability and be adapted to a circular business model are often disregarded as too expensive or visionary and business is continued as usual. The proposed design concept and business model will inevitably not, in the short-run, be as profitable as conventional designs and business models for kitchen furniture production and to run a successful company, you need to make a profit. But we must ask ourselves what changes we can do, today, to promote sustainable production, use and recovery of kitchen furniture. Solutions exists, ideas exist and visions exist so let's start embracing them and discuss how they can be implemented. To reach a circular economy within furniture production, collaboration is key, all actors who in some way handles furniture products or supply material for furniture production must implement circular thinking into their business models.

Discussing the methods

The methods used throughout the project has been successful in providing insights and discussions to reach the written goals of the thesis.

The interviews were successful and gathered necessary insights on the subject, it was interesting to see the various perspectives of the experts and hear their views on the kitchen. Due to time limitations and the scope of the project, interviews were limited to kitchen furniture producers and designers. However, more interviews could have been performed with other actors within the kitchen industry, such as white-goods manufacturers, companies producing kitchen appliances, chefs and furniture companies not specifically focusing on kitchen furniture.

The literature used throughout the pre-study has been from a variety of sources including research articles, newspaper articles, blog posts, statistical data, books and encyclopaedias. The approach of looking at a wide variety of sources lead to interesting insights in the pre-study and several points for discussion in the ideation phase. The user survey was successful in pointing out which activities to focus the final concept on. The found, most frequently mentioned activities from the survey were later backed by statistical data from another source and this must be seen as a success. More

thorough user studies and interviews could have been performed and if I were to do a similar project again I would likely involve the users even more in the ideation phase.

Choosing a final concept was difficult, there were so many aspects to consider that it sometimes felt impossible to propose a complete concept solution. I am however proud of the result and feel like it is an solid contribution to the ongoing process of reaching circularity within the kitchen industry.

Discussing the limitations

The project plan and initiation was broad and left much to interpretation, due to the project being performed as an exploratory study some of the project limitations had to be defined along the way. The focus of the study was kitchen furniture but this is extremely wide, in the end the project was limited to frames, storage and countertops but there was constantly a need to put the ideas into the bigger perspective of the circular kitchen project and into a general kitchen context. As the lines are blurred of what the kitchen even is today, kitchen furniture could be almost any furniture that people use in their kitchen which I think reflects into the final concept.

Recommendations for the future

The final design is at a conceptual level and must be interpreted as such, the gathered insights and vision of the future kitchen are estimations and cannot be viewed as certain predictions. However, I hope that this thesis has sparked an interest in circular and flexible solutions. The design concept should be viewed as a contribution to the ongoing process towards reaching circularity in the kitchen and closing the loop within kitchen furniture production. The proposed alternative direction of how kitchen furniture can be used and sold should be considered as an inspiration when designing new services, circular business models and when incorporating new materials into the production of kitchen furniture. Due to the limited timeframe of the project, the design of the final concept did not reach its full potential, development of application areas are still needed and aspects like corners, covers, material properties and construction needs further development if the concept should be realized into a final product.

Financial aspects of the proposed business model and concept design was only touched upon briefly and further research is needed if the concept is to be implemented. The circular business model used to put the concept in a circular business context is directed towards the end-user. Further development of the business model is needed in order to address B2B applications when for example selling the concept to construction companies and owners of apartment buildings.

Finally, I would like to once again stress the need for circular and sustainable solutions, drastic changes are required if we are to ensure the future of our planet. Collaboration is needed within the kitchen industry, material companies, shipping companies, contractors, furniture manufacturers, end-users and policy makers must work together to reach sustainability. I hope that this thesis can initiate discussions within the kitchen industry and make concerned actors discuss collaboration possibilities to implement circular solutions.

Conclusion

The master thesis project resulted in a conceptual design concept that can be used to initiate discussions about flexibility and circularity within the kitchen. The vision of the concept highlights areas where development is needed in the kitchen furniture industry. Kitchens are getting smaller, overcrowding is increasing in Swedish apartments, this calls for flexible solutions as the kitchen is no longer a room where users only cook food or eat. Users must be able to perform other activities within the kitchen such as socialize, work and study. Sustainability must be prioritized in the production and use of kitchen furniture, the current take-waste model of the kitchen industry must be met with collaboration and smart solutions from all concerned companies and actors. This thesis, through the research and conceptual design solution serves as a base for discussions related to sustainability and flexibility within the kitchen.

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Appendix

Appendix 1

Interviews

Kitchen experts and designers were interviewed, in order to gather knowledge on the kitchen industry today as well as insights and suggestions as to how the kitchen could, or should, look like in the future. All interviews except one were performed over telephone and recorded for reference in the project report. The exception was the interview with Marianne Färlin which was performed via e-mail correspondence. All interviews were conducted in Swedish and relevant parts were translated to English by the author. Following below are the transcribed interviews, unedited in Swedish.

Interview with Stefan Nilsson

Vad är din vision för framtidens kök? Hur kommer det se ut om 10-20 år?

En sak som vi vet är att vi kommer bo mindre framöver. De här stora ytorna vi har nu är något vi inte kommer att ha på sikt. Då finns det också resonemang att köken kanske får en annan funktion det vill säga att vi inte lagar så mycket mat. Det ser vi ju början på nu, där vi då till exempel har ännu mer hemkörd mat än vad vi har nu. Det här med UberEats och hela den biten är ju ganska nytt men det finns ju indikationer på att vi, ja men på tio års sikt kommer det öka ännu mer. Då kan det bli en stor beteendeförändring av vad vi faktiskt gör i köket. Är köket en förvaringsyta eller är det en sällskapsyta eller vad är det för någonting? En annan sak man kan ta upp är ju hur familjekonstellationerna förändras. Där finns ju ingen flexibilitet i köket idag. Ena dagen så är vi två personer i hushållet och andra veckan är vi femton personer i hushållet. Med det menar jag alla dessa skilsmässofamiljer där man då har delad vårdnad av barnen. Det här är några av de stora frågorna som gäller för framtiden och för köket så det finns flera delar.

Vi ser idag hur köket har förändrats och blivit samlingsrummet, det är där man är. Det är där skolbarnen gör sina läxor och det är där man jobbar hemma när man jobbar hemifrån. Och på tal om att bo mindre, hela resonemanget kring ett arbetsrum, det har ju helt och hållet försvunnit. Vem tittar på ett boende där man har plats för ett arbetsrum? Det gör man ju inte, utan man jobbar ju i köket när man jobbar. Det är samma sak med barn-rummen, har man en sexåring så leker inte sexåringen i barn-rummet utan sexåringen leker i köket så köket har också blivit barn-rum av något slag.

Jag läste en bloggpost där det argumenterades för att vi inte kommer ha ett kök överhuvudtaget i framtiden, det låter lite väl drastiskt tycker jag. Vad tror du?

Det beror på hur vi definierar köket, det är ju det det handlar om. Är köket platsen där vi lagar mat? Vi kanske inte lagar mat, vi kanske kör take-away. Då kanske vi kallar det för något annat. Men det rummet kommer behövas och förvaring kommer behövas. Sen så sker ju statusförändringar i rummen hela tiden. Idag, 2019 alltså så vill man ju att badrummet ska bli större. Alltså vill. Då menar jag inte nödvändningsvis att vi bygger såna badrum men i bilden av vårat framgångsrika hem så har vi ett stort badrum där man nästan ska kunna göra yoga. Så förändras ju bilden av köket också. Är det platsen man de-facto lagar mat i eller är det någonting annat?

Tittar vi tillbaka på ganska kort sikt, på 00-talets början så var det tydligt att man skulle ha stora skrytmaskiner i köket. Till exempel den här stora induktionshällen eller teppanyakihällen, väldigt mycket stora apparater. Idag så är det inte det som är ett kök. Däremot så sitter vi och samlas och är i köket fortfarande, men de stora maskinerna finns inte där.

Så det är mer fokus på vad man gör i köket och inte utrustningen som finns där?

Ja nu när du har chansen att diskutera framtiden, så kan man diskutera vad vi gör i köket. Det är det vi berör när du ställer följdfrågan, det tycker jag är en jätterelevant diskussion.

Jag vill mena att 2019 så finns ett ideal om att man skulle vilja ha, till exempel, en kökssoffa. Det är ju en gammal bild, bilden av att man sitter i det här bondska köket med kökssoffa. Men det är ju också soffan man sitter i länge, man kan till och med slänga upp fötterna och halvligga i soffan. Det finns såna saker som ingår i bilden av köket. Men matlagningen minskar, det tror jag vi absolut kommer kunna se. Det syns ju också på termen av halvfabrikat och alltihopa.

Ett annat spår när det gäller köket är också, jag tänker att köket kommer bli det rummet där vi driver hållbarhetsfrågor alltså miljöfrågor. Det är i köket som vi har källsortering till exempel. Det tror jag vi kommer ha mycket mer som ett ideal när vi planerar vårt kök eller bygger vårt kök. Jag vill absolut en bra plats för att ställa mina glas och tidningsinsamlingar, jag vill kanske till och med ha kompost inomhus. Om det finns en teknisk lösning för det. Det kommer vara ett starkare ideal än att kunna ha teppanyakihäll, på kort sikt. Om man lyfter diskussionen till början, är köket för matlagning eller är köket för hållbarhetsarbete? Då tror jag absolut vi kommer gå mot något där vi gör en insats mot ett hållbarare liv. Det är där vi odlar, det är där vi gör alla de här miljövänliga valen. De gör vi i det rummet som vi kallar kök.

Är det för att det numera har blivit en statussymbol att visa att man är miljömedveten?

Ja både och, både status men även ett starkt intresse. Vi går ifrån en 70-årig period där konsumtion har varit status, det kommer vi helt och hållet lämna. Vi har inte längre ett behov av att visa upp våra nya saker. Jag gjorde en intervju tidigare i veckan där de frågade ”Säg tre saker man ska göra för att uppdatera sitt kök?”, det är helt ute. Att göra tre saker för att uppdatera sitt kök är helt meningslöst. Ingen är intresserad av det. Det är snarare det att återanvända tre saker, hitta tre saker du kan återanvända eller hitta tre saker du kan byta bort. Men att köpa tre saker för att uppdatera ditt hem det är helt ointressant som trend.

Jag studerar ju flexibilitet inom köket och har varit inne på det här att flytta kök etc. har du några exempel på flexibla kökslösningar som finns på marknaden idag?

Det finns massor utav intressanta kökslösningar. Om du tittar på till exempel möbelföretaget Tre Sekel som sitter i Tibro. De har gjort som en garderobs-kökslösning för det lilla köket. Mindre än en walk-in closet men det är också ett tecken på att köket blir något annat än matlagning tycker jag. Tre Sekel kan du titta på bildmässigt sett men sen så tycker jag att alla köksaktörer, oavsett om det är Marbodal

eller Vedum eller vad det nu kan vara. De diskuterar ju de här sakerna, köksbehoven förändras det är man medveten om.

Absolut, det är min känsla också, att det finns en stor medvetenhet om de här frågorna men få konkreta lösningar eller produkter på marknaden än. Det är därför jag strävar efter en flexibel lösning för det lilla köket.

Du kan kolla på Marbodal till exempel som gjorde köksskåp för odling. Det är ju ett intressant projekt. Men kolla också på vitvarutillverkarna, Whirpool gjorde ett projekt för tio år sen där man tittade på användningen av köket. Det är ju en sak att titta på de som bygger skåpen, men tittar du på de som gör vitvarorna så får du ett annat perspektiv. De vill ju sälja ett annat beteende, för dem är skåpen sekundära. Jag tror ju att skåpen blir sekundära. Du har sagt att du vill kolla på de mindre lösningarna och visst kommer det behövas, men däremot är maskinerna det som kommer vara intressant framöver.

Tror du vi kommer ha lika mycket vitvaror i framtiden?

Ja det tror jag, men de kommer byta helt och hållet fokus. Jag pratade om komposten till exempel. För att ha en kompost inomhus så måste du ha en eldriven kompost och det finns ingen som gör det idag. För det börjar lukta mögel, smuts, jord och allt vad det är. Vad gör du med komposten när den är klar? Det finns många delar i detta, men jag tror det är en sån pryl som jag tror vi kommer se, som kommer kanske ersätter, ja vet inte, mikrovågsugnen? Jag tror att antalet produkter kommer vara lika många men att de kommer byta funktion. Och jag tror att miljön kommer vara mycket viktigare. Vi kanske har vattenreningstankar, vi kanske har vattenbesparingstankar ja men du vet andra saker. Men antalet saker kommer vara det samma.

Nästan alla jag pratar med i köksbutiker nämner det här att vilja slå ut en vägg och skapa en öppen planlösning för köket, är det fortfarande aktuellt att göra det?

Därom tvista det lärde, det finns lika många som säger att köksväggen försvinner och lika många säger nä men nu kommer vi bygga igen rummet. Jag tror, en helt personlig iakttagelse, att vi kommer ha det stora allrummet. Med fokus på att det är i det stora köket man vill vara, jag tror att själva matlagningshörnan blir mindre. Men jag tror att den sociala ytan blir större, vilket innebär att köket kommer behöva gå in i vardagsrummet. Men vi kanske inte kallar det kök och vardagsrum om hundra år, vi kanske kallar det något annat.

Precis, men om vi pratar lite om digitaliseringen av köket, jag läste en annan intervju med dig där du var lite skeptiskt till hur mycket digitaliseringen kommer att påverka köket.

Ja det är ju något som vi går igenom just nu, just nu är vi trötta på den konstanta uppkopplingen. Det är en motreaktion som vi kommer gå igenom på två-tre års sikt där vi kommer ha den här aversionen mot den konstanta uppkopplingen. Just nu finns det köksleverantörer som tycker det är spännande med att kunna lysa ner receptet på bänken och så kan du läsa receptet på det man ska laga, eller du har en knapp på kylskåpet som talar om hur mycket mjölk du har kvar. Det finns en fascination hos köksleverantörerna för uppkoppling. Medans jag menar att den som vill laga mat kommer att vilja laga mat med händerna, på samma sätt som man odlar, med

händerna. Då är uppkopplingen helt och hållet sekundär. Man vill ha gjutjärnsgrytor, man vill ha tyngden i det, man vill kunna höra oljan fräsa i pannan. Det är mycket viktigare. Vi kommer laga mindre mat, men när man väl gör det så vill man ha en fysisk upplevelse.

Det har ju varit en trend att göra allt från grunden, kommer det fortsätta när man väl lagar mat?

Ja det tror jag. Det handlar om att man ser det som något roligt. Men om vi nu lagar mat två-tre gånger i veckan och resten är uppvärmning eller andra lösningar. Så tror jag att vi kommer laga mat en gång i veckan, och det är då man behöver ställa sig frågan: Hur stor ska min ugn vara för att laga mat en gång i veckan? Hur stort ska mitt kylskåp vara för att laga min mat en gång i veckan?

Så hela digitaliseringsbiten är lite av en fluga då? Eller inte fluga, men jag menar att företagen vill ju sälja fler funktioner, men att det alla de här uppkopplade lösningarna kanske inte behövs?

Nä jag tror inte det. Som ett argument för att det finns en övertro på teknik så kan jag ta det här med mobiltelefoni. När iPadsen kom så sa vi att det är ju helt omöjligt att kolla på TV i en liten iPad, idag kollar vi på TV i våra mobiltelefoner med en ännu mindre skärm. Vi anpassar oss till det här, vi behöver inte de stora skärmarna. Vi behöver inte receptet som lyser ner på bänken, det är inte det som är intressant.

Alright! Ja men det var i princip de frågorna jag hade, har du något mer att tillägga?

Jag tycker också du kan titta på, om du vill titta på ett nytt flexibelt hållbart kök så titta på, hur man kan uppdatera köket. Till exempel det företaget som gör luckor till IKEA-kök, kommer inte ihåg vad de heter nu men du fattar vad jag menar. Hur kan jag byta luckor och uppdatera mitt kök utan att göra mig av med stommarna? Det är ju helt meningslöst, varför måste jag slänga stommarna?

Ja det är ju ett av de stora problemen. Tror du förresten att vi i framtiden kan göra som i Tyskland eller Frankrike att ta med oss köken när vi flyttar?

Nej inte än, det ligger i vår kultur att inte göra det. Men det du också kan titta på, på tal om förändringar på relativt nära sikt är vad som händer med bostadskrisen. Hur ska man ha råd att byta kök? Det är också en relevant fråga.

Interview with Richard Moberg

Vilka är de största trenderna just nu i köket?

Trender kommer och går hela tiden men den absolut största trenden just nu är ekofrågan. Den är enormt stor just nu, den har vi sett öka år för år. På så sätt är våran nya, superekologiska produkt Miinus otroligt rätt i tiden. Vi var lite nya med den när den kom då var inte alls trenden lika stark som den är nu, det är ju sex år sedan vi släppte Miinus. Men jag skulle säga att ekofrågan är i särklass den största trenden just nu. Tittar man på den nya generationen som kommer efter min så märker man till det positiva att eran generation tänker ju mer varaktigt. Man är inte så intresserad längre

utav att förbruka utan man kan tänka sig att hyra man kan tänka sig att låna. Man behöver inte ha en egen bil för att ta det som ett exempel, jag tycker det är ett bra exempel man ser i bilindustrin. Alla dessa uthyrningstjänster för elmopeder, Sunfleet, biluthyrningspooler, biluthyrningsgrupper och hej och hå. Man är mer benägen att dela med andra, vilket är positivt. Tittar man på köksbiten så går det igen även där, kunderna börjar bli mer medvetna om vad det handlar om och det börjar de billigare leverantörer känna av ordentligt nu. IKEA som ett bra exempel har haft sitt tänk och har det fortfarande men de har varit tvungna att rucka på det nu för de inser att den typen av kund börjar sakteligen försvinna. Det här att göra hemma själv, billiga, den generationen börjar försvinna. Det är inte lika intressant längre. Man kan tänka sig att betala lite extra för att få det installerat och en riktigt bra slutprodukt som håller längre. Det börjar bli viktigare. Det tycker jag är en intressant välmående trend, det gäller ju allt men i kök är det extra viktigt. Nu är jag kanske lite jävig, jag jobbar i branschen och har en väldigt bra produkt. Vi har två brands, vi har våran vanliga Puustelli-produkt som är likvärdig många andra leverantörer i branschen och den ser vi ingen nedåtfallande trend på. Inte än i alla fall, utan vi ser nog snarare en stabil trend på den produkten men vi ser en uppåtgående trend på förfrågningar efter vår ekologiska produkt. Så på lång sikt så tror jag nog den kommer ta över helt, om jag ska vara helt ärlig, jag hoppas det.

Jag tycker det är ett intressant koncept ni har med erat Miinus-kök. Vad fick er att påbörja utvecklingen av det konceptet? Ni var ju som sagt tidiga med det ekologiska tänket.

Ja vi var otroligt tidiga, utan att bli allt för långrandig så kan man säga att hela Puustelli-koncernen ägs utav en familj som är otroligt miljömedvetna. Gillar att hitta vägar som gör att vi gör bättre kök miljömässigt. VD:n, en utav bröderna i familjen som driver företaget har fått fabriker att använda spillmaterial för att värma upp fabriker, man återanvänder saker, man slänger inte saker etc. Grundtanken var att han ville ta fram en produkt innan han klev av tronen, som stack ut på marknaden som var något alldeles extra när det gäller just miljö. Man insåg att man var tvungen att ändra helt och hållet på tänket om man skulle komma bort ifrån det traditionella. Det var egentligen grundtanken och fröet som lades från första början. Sen har man varit tvungen att koppla in externa firmor och personer för att ta fram just den slutprodukten vi har idag.

Hur har mottagandet varit för konceptet?

Blandat, får jag väl tillägga. Alla är inte så intresserade av miljö har jag insett. Vi tyckte det var en fantastisk produkt när vi släppte den för sex år sedan och slog ganska hårt på den ekologiska trumman, miljö och den biten. Men det togs inte riktigt emot på det sättet vi trodde det skulle göra. Folk var inte mogna för ekologi på det sättet, man förstod inte riktigt vad vi sålde.

Jag tycker det är intressant för någon måste ju ta det första steget bland er producenter.

Ja, så är det och vi har ju plogat mark nu i sex år och först nu börjar vi faktiskt bli föreskrivna i projekt. Det är ju jätte- jätteroligt. Nu äntligen börjar åtminstone arkitekterna förstå att det är en fantastik produkt. Den kostar lite mer, ja, men det gör väl allt ekologiskt. Det går inte att tillverka en mer hållbar produkt till samma pris som

en slit och släng produkt med mindre bra material, det vore en omöjlighet. Och varför skulle man köpa något ohållbart då. Det är det jag tycker har varit det bästa med vår produkt, den håller ändå en prisnivå som är klart konkurrenskraftig om man skulle jämföra äpplen och äpplen. Det är väl just där utmaning för oss har varit under den perioden vi har haft. Folk jämför inte äpplen och äpplen. Man går till IKEA, man får ett pris på en spånbaserad melaminlucka med laminatskivor och vill sedan ha ett pris från oss. Vad kostar då det här ekologiska alternativet? Och så blir differensen extremt stor, jo. Men det är ju som att jämföra en Dacia med en Tesla, det är klart att priset kommer att bli åtta gånger så högt. Så förstår man inte, den har ju fyra hjul och en ratt och kostar hundratusen, ny bil. Det är en bil, självklart men så fattar man inte riktigt vad man köper. Det är väl en utbildningsfråga, det är det här som kommer ta tid men vi märker att snöbollen börjar bli större och nu rullar lite fortare. Folk hänger med nu och börjar förstå, att okej, hur länge ska du ha köket då? Ska det sitta i bara åtta år tills man river ut och tycker luckorna börjar bli saggiga, äh då kör vi bara ett nytt kök. Så har ju tankarna gått med hela den här IKEA-trenden. Bra eller dåligt, jag vet inte. Jag tycker det är sådär.

Förhoppningsvis så kan väl, inte bara min, men även äldre generationer börja ta mer hållbara beslut och tänka långsiktigt.

Ja, men att man ser att det finns en möjlighet. Vi har till och med varit inne på om man ska kunna panta våra stommar. I och med att vi kan återbruka dem till annat. Vi kan mala ner bio-kompositen och gjuta nya bio-sidor. Fräsa upp björken och göra andra grejer, det går att göra hur mycket som helst med produkten. Vi har inte hunnit eller lagt prioritet på det bara.

För att byta lite spår, digitaliseringen av köket. Vad tror du om den, samhället i stort digitaliseras ju i hög takt. Hur påverkar det köket?

Nu tillverkar inte vi de produkterna utan köper in dem från andra part.

Precis, men ser ni en efterfrågan på digitala lösningar?

Nej, jag tycker inte det. Jag vet att vitvaruleverantörerna slår hårt på just digitaliseringen men det är väl ett sätt att sticka ut idag. Man måste hitta någonting som de andra inte har och då behöver man vara först även där. Det är några produkter som jag kan tycka är fiffiga, när grejerna börjar prata med varandra i köket. Sätter man på hällen så startar fläkten, det är en smart funktion. Att kunna se hur kylskåpet ser ut via mobilen för att man glömt inköpslistan, det är också en smart funktion. Men sen att sätta på ugnen hemifrån eller se om det är tio minuter kvar på tvättmaskinen på mobilen, jag vet inte. Det är funktioner jag tycker är rätt oanvändbara. Jag är lite ambivalent kring det med digitaliseringen, men vi kommer inte komma ifrån det. Hela trenden går åt det hållet så att det kommer att komma mer saker, det kommer det göra.

Avslutningsvis, vad tror du om framtiden? Hur kommer köket se ut om 10-20 år?

Jag tror personligen precis som hela ditt tema går på, att köken förhoppningsvis blir mer modellerbara på plats. Att man kan justera mer, man satsar mer på kompakta lösningar istället för det här stora flådiga. Det kommer finnas det med naturligtvis men jag hoppas och tror att framtidens kök är mer åt det hållbara hållet. Att man använder

mer material som inte tär på miljön på samma sätt. Att man använder mer naturella material istället för att tillverka icke-naturella material.

Ser ni en stor efterfrågan av köksöar och öppna lösningar just nu?

Det har ju varit en trend länge, och den tror jag kommer fortsätta. Den trenden tror jag inte kommer försvinna utan snarare öka ännu mer. Kanske inte Ö-lösningen i sig men att man integrerar sällskapsutrymmen med köket. Det har vi märkt och det har varit en trend som hållit i sig länge. Man ser inte köket som en arbetsplats, man ser det som en umgängesplats, som en möbel. Det ställer ju höga krav på maskiner så som fläktsystem, där kommer det också mer nyheter. Bora släppte sina produkter på marknaden för ett par år sedan, bara för att ta ett exempel. Att man integrerar fläktar i hällsystem för att slippa ha de här stora kåporna. Så det blir mer möbel-aktigt och man effektiviserar med såna lösningar. Det tycker jag är en kul trend, det slår jag ett hårt slag för. Att man går ihop. Där tycker jag Miinus gjuter in bra, för den tänker lite mer åt möbelhållet än bara kökshållet. Varje stomme är gjuten så att man ska kunna använda alla typer av låd- eller skåpskombinationer i samma lådstomme. Då kan man byta lådplacering, lägga till en låda. Utan att behöva vara utbildad, alla hål är färdiga så det är bara att skruva dit och du kan skruva i samma hål flera hundra gånger för bio-kompositen är så stark. Den är helt vattenfast så den tål fuktiga miljöer och är otroligt lätt. Det går att plocka isär och skruva ihop igen om man känner att man vill ta med sig köket.

För att svara på din fråga så tror jag att framtiden är åt det hållet, vi blir mer kravställda på att det ska vara mer möbel-aktigt och att det ska vara hållbara grejer. Det är det jag tror och hoppas på.

Interview with Linda Berner

Vilka stora trender ser ni just inom köksbranschen?

Ja det är ju att man vill få till så mycket lösningar i köket som möjligt, att det ska vara så flexibelt som möjligt och ha bra lösningar med mindre skåp. Köken blir mindre för man får mindre bostäder och då vill man ha så bra funktionella lösningar som möjligt.

Vad är det för funktioner kunderna söker, förvaring?

Ja precis, bra förvaringsmöjligheter.

Varför renoverar folk så ofta som de gör här i Sverige?

Jag tror det har att göra med att det har sålts mycket, att folk byter bostäder och då vill sätta sin prägel på den när de flyttar in. Att de inte är nöjda med det som finns där när de köper lägenheten eller huset.

Hur tänker ni kring hållbarhet i era kök? I material osv.

Hur tänker du då? Hur vi ser på hållbarhet?

Ja för ett stort problem är ju att stommarna är svåra att återanvända.

Ja, det är ju trästommar som vi använder idag. Vi ser väl kanske ingen ändring på det just nu men man vet aldrig vad som kan komma i framtiden.

Digitaliseringen av vårt samhälle som pågår på alla aspekter. Hur ser ni att det påverkar köket?

Det påverkar naturligtvis, induktionsladdning och såna saker till exempel ska finnas i köket och att det ska finnas smarta lösningar på det mesta så det påverkar såklart köket också.

Om du får spåna fritt, hur kommer köket se ut om 10-20 år?

Jag tror det kommer vara mer funktionalitet och förvaring. Smarta lösningar genom teknik och digitalisering. Om folk blir mer och mer medvetna om det här med hållbarheten så kanske man hittar andra sätt att byta ut saker i sitt hem utan att slänga ut hela köksstommar. Utan bara byta ut vissa delar.

Ser ni någon speciell trend i vad folk vill ha? Då tänker jag på köksöar, öppna lösningar etc.

Ja, det gör vi. Köksöar är inne just nu, det vill våra kunder ha.

Det här med att öppna upp köket osv.

Ja precis, när man får mindre lägenheter och öppen planlösning som går ihop med köket.

Har du några konkret exempel på en flexibel lösning som ni har? Då tänker jag på förvaring till exempel?

Ja vi kommer med nya, smala utdrag till exempel. Med mindre kök så vill man också minska antal passbitar och vill istället har fler skåp. Då har vi skapat smala utdrag som man drar rakt ut, med förvaring i. Istället för passbitar då.

Ser ni någon speciell trend inom själva designen av köket? Då tänker jag på färg och sånt?

Ja, länge har det varit vitt men nu börjar det komma mer kulörer. Senaste tiden har det varit grått. Men det kommer säkert ändra sig och gå mot mer varmare färger, vi ser en trend med varmare färger.

Interview with Marianne Färlin

Vad skulle du säga är den största anledningen till att människor köper nya kök idag?

Det är såväl behovsstyrd anledning som viljestyrd anledning. Nya kök ingår i nya bostäder och vi har ett stort antal äldre bostäder i landet som är i behov av renovering. Här kan graden av renovering betr. köken variera, t.ex. att befintlig planlösning inte fungerar enl. de behov man har, strävar efter bättre ergonomi, önskemål om ytterligare förvaring etc. etc.

Hur arbetar ni med hållbarhet i er köksinredning?

Hållbarhet är ett omfattande begrepp och svårt att svara på specifikt. Vi strävar efter att erbjuda ett sortiment som har en hållbar design, hållbar kvalitet och hållbar funktion. Alla stommar, flera av våra luckor och bänkskivor är svanenmärkta och vi har våra produkter registrerade i flera miljöbedömningssystem som t.ex. BASTA-registret, Sunda hus, Svanenmärkta flerbostadshus samt byggvarubedömningar. Läs gärna om vårt hållbarhetsarbete på www.vedum.se, där även vår hållbarhetsredovisning finns återgiven. Här ber jag dig precisera din frågeställning för att kunna svara mer konkret.

Vilka är de största trenderna just nu i köksbranschen?

De målgrupper som vi riktar oss till, delar våra värderingar om ett långsiktigt tänk och söker inredning med hållbar design, kvalitet och funktion. Vi upplever en ökad medvetenhet om att fatta långsiktiga och kloka beslut, man vill göra trygga och personliga val. T.ex. möjligheten att byta ut och ersätta luckor efter en tid. Därför ser vi t.ex. ett ökat intresse för naturmaterial så som natursten och trä m.m. Medvetenheten – och kraven från bostadsbyggarna – när det gäller miljöpåverkan ökar. T.ex. är våra färger fria från bly och kadmium och vi använder vattenbaserad grundfärg i vår ytbehandling. Generellt står förvaring i fokus, att ha anpassade inredningar för smarta och yteffektiva lösningar. T.ex. är anpassad inredning för källsortering i köken en viktig aspekt idag. Praktiska lösningar, bra ergonomi och ett arbetsflöde. Kulörtrenden är fortfarande i antal grå nyanser, medan vi ser nu att de varmare beige toner kommer. Energieffektiva vitvaror och smarta sådana kommer starkt.

Om du fick gissa, hur kommer köket förändras inom de kommande 10-20 åren?

Köken är idag ofta i en öppen planlösning i nyproducerade bostäder och en integrerad del av bostädernas inredning. Här kommer nyproducerade bostäder säkert att bli ännu mer yteffektiva och erbjuda ökad flexibilitet, dvs anpassningar för att passa det mindre hushållet såväl som det större (tänk familjer som varierar varannan vecka). Ännu fler smarta lösningar tack vare teknikutveckling kommer vi att se, tänker på energidelen, att t.ex. röststyra produkter, appar etc. som gör att vi kan styra våra kostnader. Nya, smarta/intelligenta material utvecklas (ta till vara/av återanvänt material osv). Att odla mera för eget bruk – kanske gränsen mellan inne-ute suddas ut något? Köket kommer dock fortsatt att vara hemmets nav, så som det alltid varit historiskt. Köket är den naturliga samlingsplatsen, där man inte bara lagar och äter mat, utan det är där man umgås, gör sina läxor etc. Ju smartare kök och funktioner vi får, desto fler användningsområden?

Interview with Mikael Warnhammar

Vad är de största trenderna just nu i köket?

Jag varit med om flera cykler nu, men det kommer ju igen. Nu blir det mer trä och matt och sånt det har varit väldigt blankt och högblankt. Jag tycker inte det är några större trender. Alla frågor mig, när kommer datorerna? Det är ju för att det smyger lite med vitvarorna, det är ju inga revolutionerande grejer.

Varför tror du så många renoverar eller bygger helt nya kök idag?

Därför kök och badrum är en sån grej som man vill ha nytt och fräscht. Framförallt yngre människor, det är deras statement att de vill sätta sin prägel på hemmet på något sätt. Sen vill ju många att det ska vara fräscht då, det blir ju väldigt sunkigt fort, det slits ju fort, speciellt om man inte gör det med bra material.

Vi bytte mått för fem år sedan på IKEA, du får ju plats med mer grejer idag för det är bättre lådor. Man utnyttjar volymen bättre, det är ju 80-underskåp istället för 70 som det var förr.

Som jag har förstått det så har IKEA lite egna måttsystem som inte de andra köksleverantörerna jobbar efter?

När vi gjorde METOD som den heter, då gjorde vi på 20-mått. Alla skåpen är delbara med 20 åt sidan och uppåt. Det stora problemet när det gäller kök överhuvudtaget, det gäller alla i det här, är vitvarugubbarna. De har alltid bestämt och gjort sina, aldrig brytt sig om hur köken är. Sen får alla kökstillverkare anpassa sig efter vitvarorna.

Så kökstillverkarna anpassar sig efter vitvarutillverkarna?

Ja men tänk alla passbitar som finns i ett kök, det är ju inte kökstillverkarnas fel. Det är vitvarugubbarna som tycker det är snyggt.

Hur tänker ni på IKEA kring köket, man lyfter ju fram det mer som paradrummet i hemmet och sådär?

Det har vi nog gjort länge på IKEA, för det är ju där allting sker. Det är husets hjärta på något sätt, det är där man gör läxor och äter och träffas. Sen drar ju alla vidare. Vardagsrummet har tappat sin charm, där sitter alla med sina datorer. Om vi jämför med 50-köket eller nåt sånt där som var skitlitet.

Vad letar folk efter idag då? Det här med öppna planlösningar, det är fortfarande det som gäller?

Jag tror det ja, många vill ha köket som en stor grej. Men sen är det nog några som börjar tänka till och vill ha dörrar för de inte vill ha matos överallt. Nu pratar jag om hela Europa. Det är ju lite olika, södra och norra. Sen händer det ju mycket intressant borta i Kina.

Vad tror du om framtiden för köket? Vad kommer hända med köket om 10-20 år?

Jag tror inte vi märker mycket, mer än ytorna då, kulörer, färg, trä, alltså material. Vitvarorna kommer bli lite mer moderna kanske, att man har en central. Istället för att man har tjugo lampor i köket där det står vad klockan är på varenda jävla vitvara så kanske det är en kontrollpanel.

Du var inne lite på det, men det här med digitaliseringen, tror du det kommer påverka köket?

Inte mycket, du behöver fortfarande vatten, du behöver avlopp, du behöver värme för att värma maten och hur man värmer maten där finns ju alla sätt redan med induktion och allt möjligt. Jag tror inte utseendemässigt att det händer så mycket. Snarare att amna behöver mindre kök i framtiden för man inte har råd med så stora ytor som vi har i Sverige.

Mycket av litteraturen jag läst pekar på att vi kommer bo mindre och laga mindre mat hemma, är det något som ni på IKEA tänker på? Att göra mer kompakta lösningar?

Hela tiden, men det gäller att det finns möjlighet att bygga de köken. Sen har du såna grejer som att folk blir längre, att Holländarna är längst i världen och vi är nummer två. Då kanske man ska ha möjlighet att ha en arbetshöjd som är 95 istället för 90, det erbjuder vi Holländarna. Det kan man göra idag, såna grejer. Men det är inga, jag tror inte på några revolutionära, jag tror ju fortfarande vi har kök om 10 år ungefär på samma sätt. Sen kommer ju grejer som Sous Vide till exempel, det är trender som kommer och kanske är det några som håller sig.

Många argumenterar för att vi knappt kommer laga någon mat alls i framtiden?

Men det tror jag. Och framförallt hur man lagrar det, det har vi pratat mycket om. Med kylzoner och sånt där. Att man kanske kan förvara det i lådorna på något sätt, att man har olika zoner där. Idag är ju kylskåpet bara kallt, men jag menar potatis eller gurka eller kött eller fisk, de behöver ju olika.

Du tänker mer som gamla ”svalen” som man hade förr?

Ja eller att man tänker till och gör det i. Alla har ju lådor, det är inte så många som har skåpdörrar längre. Då kanske man kan leda in lite luft där eller isolera de på något sätt så det kanske är 12 grader eller nåt sånt där. Det är nog det mest revolutionära. Eller att om man bor trångt, förr i tiden hade man ju frysfack någon annanstans. Om det blir trångt så kanske det blir så i framtiden också. Att man har fryshuset i samhället eller du kanske har det i ett hyreshus, någon annanstans. Det beror ju på hur mycket pengar man har om man har råd att bo stort eller litet i framtiden. Gemensam lagning kanske i ett hyreshus, gemensamt kök också, men jag tror inte bara det.

Men då kommer man väl ändå inte behöva lika stort kök hemma?

Nä precis, då kanske det är ett alternativt när man har mindre boyta. Man kan fortfarande göra mat men att man har något kollektivt, jag vet inte.

De flesta köken är ju statiska, fastnaglade i väggen, tror du vi kan komma bort ifrån det?

Nej, jag har gjort många solitärkök. Nu pratar jag i Sverige men så fort du åker utomlands så ska du ta med hela ditt jävla kök och även vitvarorna i många länder. När du flyttar, de tar ju med sig grejerna och när du kommer till lägenheten så är det två hål i väggen bara. Och så får du sätta upp ditt eget. Så vi har haft väldigt mycket solitärkök jag gjort som sålt jävligt bra. Men det är ju typ en sån grej med alla de länderna. Det är klart att såna kök finns också.

Men dit kan vi inte komma i Sverige?

Jag tror inte det är något att komma till, att man flyttar in i en lägenhet utan kök. Det är väl bra att det finns ett kök när man flyttar in.

Jo precis, men det är ju ett stort problem att det mesta hamnar på tippen när folk renoverar.

Ja men det har ju med renoveringar att göra. Tänk om du ska flytta hemifrån, så ska du köpa en lägenhet sen ska du köpa ett kök också. Fan det blir ju skitdyrt.

Ja det är ju sant.

Så är det för många utomlands. ”Nää jag har inte råd med köket men jag bor här”. Det är ett problem för många. Därför hade vi såna små grejer, men då är allting med ergonomi och miljö förkastligt. Då gör man mer det som är billigt, inte det som är bra för en.

Ja och i Sverige har vi ju samtidigt gått ifrån den Svenska köksstandarden och har EU-standard.

Ja men jag inte hur många som inte bygger 90 höjd till exempel. Sen har du när det gäller el eller gashällar att det ska vara 55 eller 65. Så det finns en del grejer som styr.

Jag ska försöka hitta en lösning för att göra köket mer flexibelt, kunna göra andra aktiviteter som att plugga etc.

Ja, eller göra det solitärt. Man köper ju kök för att laga mat. Men sen har vi haft solitärkök som sålt väldigt bra. Det kanske är för att folk inte är så duktiga på att skruva upp grejerna på väggen. Det här kan du köpa och montera ihop och ställa upp. Det står ju på golvet. När du snackar om att göra annat än mat så pratar vi väl snarare om matbordet eller förvaringen i rummet.

Jag såg från köksmässan förra året många lösningar för att integrera matbordet till bänken och kunna dra ut och sådär.

Ja det finns ju men det beror ju på att man inte har plats då, även om man har plats så har man köksöar där man kan stå-sitta, umgås och laga mat. Vilket är väldigt trevligt.

Interview #2 with Richard Moberg

Jag börjar närma mig slutfasen av mitt projekt och tar fram ett koncept som jag ska presentera här i början av juni. Jag har gjort ett materialval och kommit fram till att bio-komposit är väldigt intressant inför framtiden. Ni använder ju bio-komposit i erat Miinus koncept.

Det stämmer bra.

Det ni använder, det är producerat i Finland va?

Ja precis.

Vilket företag är det som producerar det?

Det har jag inte i huvudet faktiskt.

Förra gången vi pratade så nämnde du att det går att återvinna det här materialet och att man skulle, basically, kunna panta in stommarna och tillverka nya stommar.

Ja precis, men vi har inget färdigt system för det idag. Vi har lite för låg omsättning än så länge för att man ska kunna starta någon sån grej. Men i praktiken kan man ju riva ner stommarna i små bitar och gjuta, det är därför vi inte vill blanda in någon plast som är återvunnen. Det har varit en ganska vanlig fråga. ”Är det återvunnen som ni blandar upp med?” Nej det är det inte, det är ny plast just för att vi vill kunna garantera ursprunget.

Vet du hur många gånger man kan återvinna materialet?

Det vågar jag inte svara på, men om man säger såhär själva produkten är så pass hållbar. Vi lämnar ju trettio års garanti på stommarna. Pratar man ett normalt kök det byter man ju kanske i sämsta fall var 15:e år om man har någonting som håller rejält. Vanligast är väl att man byter var tionde år det är den cykeln vi vill få bort. Den här slit och släng grejen i just kök som är en sån stor miljöpåfrestning för samhället är det vi vill få ner. Därav lämnar vi våra 30 år då, så man ska slippa byta efter lång tid då.

Så ni satsar mer på longevity, lång livscykel?

Ja long-lasting, vi vill att livscykeln ska bli längre per inköp istället för att få in volymen och sälja till samma kund flera gånger. Det är inte det vi är ute efter utan vi är ute efter en kund som behåller grejerna lång tid. Eller att det åtminstone står kvar lång tid. Det är det hela projektet bygger kan man säga. Det är därför vi inte har så mycket färger eller storlekar på luckor, för att det inte ska finnas så otroligt mycket att välja på.

Jag har tänkt mycket på hur man sätter ihop stommar, olika fästelement och så vidare. Vill man få det cirkulärt så borde man ju försöka gå ner i så få komponenter som möjligt. Jag har tänkt på att man till exempel ska kunna klicka ihop stommarna utan ytterligare fästelement. Tror du det skulle funka?

Där är vi inte riktigt idag om jag ska vara ärlig. Vi har blandat upp bio-komposit med trä av den enkla anledningen att dels måste man ha något att borra i naturligtvis som du kan göra hål i utan att förstöra någonting. Men även för att hålla ner prisbilden. Det är klart skulle man kunna göra en bio-komposit stomme med bara det skulle det vara toppen men nån ska ju betala kalaset också. Bio-komposit i sig är ju inte jättebilligt.

Hur stor skillnad är det i prisklass?

Jag vågar inte sätta någon peng på det. Det jag vet är att man försökt dra ner på material, använda så lite material det bara går när vi gjuter dem. Det är inte släta kanter och så vidare. Det ser lite urgröpt ut för att minimera användningen av volymenheter när vi gjuter. Så jag har ingen siffra där, men om jag säger såhär, stommens prisbild står i ganska stor proportion prismässigt jämfört med träet. Vi vill hålla nere den massan så mycket det bara går. Fördelen nummer två med att använda trämaterial i förbindningsprodukt är att vi kan välja bredd ganska flexibelt. Det är ju det som är en utmaning med bio-komposit, den gjuter vi ju och då måste du ha en färdig form för det måttet. Det finns ganska många måttenheter att välja på i bredd, då skulle det bli rätt många olika formar för alla olika bredder vi använder. Trä är bara att såga till, den flexibiliteten går inte att ha om allt är bio-komposit.

Själva bredden mellan gavlarna pratar vi om nu?

Ja, förbindningslisterna som håller uppe själva stommen. Sen är det ju botten och taken på stommen, samt hyll-planen i mitten. Det är därför de är i trä för att vi lätt ska kunna tillverka rätt mått som kunden vill ha. Det blir ett väldigt flexibelt system, man kan till och med på plats om det är så att det visar sig att stommen är två decimeter för bred i värsta fall, då kan man ju plocka isär den bara. Sen kommer man ner till det måttet man vill ha. Det är ett otroligt flexibelt system på det sättet jämfört mot traditionella stommar som är häftade och limmade.

Gavlarna är alltså standardiserade men inte förbindelserna?

Gavlarna är standardiserade i färg, höjd och djup. Där finns det inte så mycket att välja på. Vi har tre olika djup och vi har fyra olika höjder. Där har vi valt att hålla nere antalet gjutformar till ett absolut minimum för det kostar en slant att skapa den formen. Just när det gäller förbindningslister och sånt så använder vi treskiktslimmad björk vilket blir som en massiv björkbit. Så det är inga fyllnadsmaterial i förbindningslisterna.

Materialegenskaperna för bio-komposit, det har väl både bättre hållfasthet och värmetålighet?

Ja jämfört mot en traditionell stomme, absolut. De är testade i labb upp till 90 grader och ner till -25. Sen kanske den stora fördelen, jag tror inte temperaturen är det största problemet där håller man ju en normal temperatur i ett hem. Det är sällan, ja ett lantställe möjligtvis där man inte har någon uppvärmning kanske. Men fukten är ju ett ganska stort problem för spån och MDF-baserade produkter. Det är nästan ett större problem idag där de som har ett lantställe eller bor på en ö eller liknande har jättestora problem. De byter nästan ut sina möbler var femte år för de har inget alternativ idag fram tills Miinus kom.

På grund av fuktskador?

Ja fuktigheten är så hög, att man inte vädrar ur eller att man inte har värmen på då kommer fukten in och käkar upp produkten. Eller i badrum exempelvis, våta miljöer med hög fuktighetsgrad där är ju Miinus en fantastisk produkt.

Vad skulle behövas för att man ska kunna stänga cirkeln och få in materialet i tillverkningen? Är det en ren kostnadsfråga?

Vad tänker du på då?

Att man ska kunna dela upp stommarna, få in allt material tillbaka till tillverkningen.

Idag är ju vi de enda som tillverkar de här produkterna, mig veterligen finns det ingen annan som gör en liknande produkt. I dagsläget har vi ingen återvinningscykel på det sättet. Mer än att pratar men generellt om den allmänna produktlivscykeln så kan du fortfarande gå med produkten till din återvinningscentral. Så att den återvinns på rätt sätt. Alternativet med en spånstomme är att det slängs i brännbart. Det är ju så man gör idag.

Jag tänker att det blir en avvägning mellan en lång livscykel och att folk vill byta kök så pass ofta som de ändå vill idag.

Ja det är lite det vi måste komma bort ifrån, vi är inte där idag att vi har en egen cykel som vi kan tillverka om eller panta stommarna. Det hade varit svincoolt men vi är inte där idag, vi har lite för låg volym än så länge. Produkten är för ny. Men vem vet det kanske är på ingång att vi behöver ha det.

Jag vill ju tro det, att i ett längre perspektiv, om flera företag kommer med liknande idéer eller smarta material att man kan stänga loopen.

Jag förstår vad du är ute efter, men med tanke på att situationen är som den är så har vi inte lagt några pengar på att ta fram någon sån enhet i dagsläget. Det kan ju hända att det kommer med tidens tand och att det uppstår längre fram. Men just nu är vår produkt så pass ny att så att vi känner att vi vill lägga pengarna på att utveckla den på andra sätt istället. Men jag tror definitivt tanken finns där med att starta någon form utav pantsystem framöver där man kan lämna tillbaka stommar. Absolut.

Appendix 2 – Requirement list

Table 1. Requirement list

Category	Name	Requirement	Specification	Type
		The concept should:		
Circular design thinking				
	1.1	Be designed for longevity	Designed for long life-cycle	R
	1.2	Be designed for service	Designed for refurbishing	R
	1.3	Be designed for re-use in manufacturing	Designed for manufacturing re-use	R
	1.4	Be designed for material recovery	Compostable or recyclable material	R
	1.5	Fit into a circular business model	Feasible in a circular business model	G
	1.6	Be designed for deconstruction	Easy to disassemble	G
	1.7	Incorporate modular design		G
	1.8	Feature recyclable materials		G
	1.9	Be minimized in weight		G
Allow other activities				
	2.1	Allow socializing in the kitchen	In a kitchen context	R
	2.2	Allow working in the kitchen	In a kitchen context	R
	2.3	Allow studying in the kitchen	In a kitchen context	R
	2.4	Feature storage for activity objects	Storage for computer, pens, paper etc.	G
	2.5	Feature power outlets	Used for the activities	G
	2.6	Feature varying surface/table-heights	Standing height, sitting height etc.	G
Space efficiency				
	3.1	Fit into small kitchens	Subjective compact design	G
	3.2	Be compact		G
	3.3	Provide space-saving functions	Functions related to storage etc.	G
	3.4	Utilize all space used for construction	Address all created geometry	G
Aesthetics				
	4.1	Be customizable	Allow user customization	G
	4.2	Be designed timelessly	Broad appeal, long life-cycle	G
	4.3	Promote user interaction	Invite the user to adapt the layout	G