A KITCHEN FOR LIFE

designing a service that engages social housing tenants in using a circular kitchen system

master thesis
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TU Delft

Thesis Title
a Kitchen for Life: designing a service that engages social housing tenants in using a circular kitchen system

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Graduation Project
Delft University of Technology
Faculty of Industrial Design Engineering
MSc Design for Interaction

Graduation Date
09/05/2019

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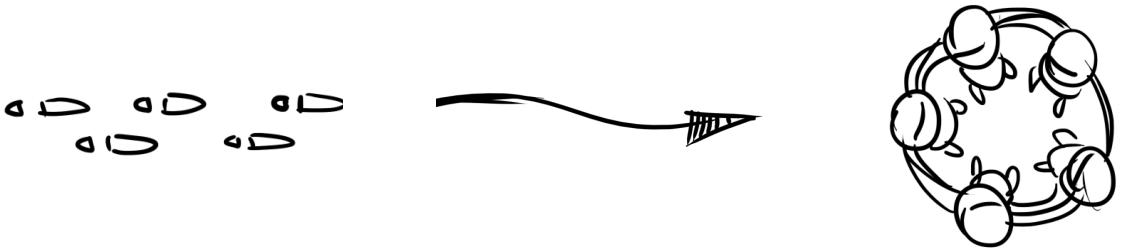

executive summary

introduction

The planet cannot keep sustaining our linear economy much longer. Industries are moving circular to reduce environmental impact. The kitchen industry has to change. CIK (the Circular Kitchen) is a research project that develops a circular kitchen: a product-service system for tenants in social housing in the Netherlands. The product is aimed to be market ready in 2022 and should have significantly less negative environmental impact. The partners in this project are material suppliers, part suppliers, a kitchen manufacturer, a contractor, housing associations and tenants. For a functioning and viable design, all stakeholders must cooperate.

the project

This graduation project started with investigating what tensions the circular kitchen might bring for social housing tenants and finds a solution for this. With an integral approach, the life of the tenants in the kitchen was researched along with the changes that the circular kitchen brings. All aspects of design were taken into account: technology, business and people. The approach for this project, an 'iterative representation of the basic design cycle', is combined with methods from service design and user-centered design. This project is divided in three consecutive cycles. Every cycle contains different phases: framing, envisioning, realization and validation. In each cycle the design is iterated and refined.

cycle a

The assignment and problem definition form the basis and starting point for analyses. CIK, the stakeholders, and the background of the problem are researched. 'Design A' is evaluated in user research. The context of the problem was investigated by using literature studies and context-mapping with tenants. The context-mapping sessions provided a holistic view on the life of the user in the kitchen. It appeared that tenants differ in their perception of the kitchen. Their kitchen has an emotional or functional role and their activity in the kitchen are either individually or socially focused. These findings are visualized in a framework that shows four types of social housing tenants (Figure 1). Additionally, shared values were found among this research group (Figure 2).

cycle b

In cycle B new knowledge that was retrieved from user research is framed to start refining the design. The service-side of CIK needed development: new insights were translated into an integral service concept that tackles conflicts that can arise between circular interest and the tenants. The input of the evaluation of the design with the major stakeholder - the kitchen manufacturer - resulted into the introduction of a new partner that drives the organization as a whole: Het Keukencollectief. An intermediary that guides all stakeholders and is the key to a successful and fertile business.

cycle c

Cycle C is focused on detailing the intermediary (Het Keukencollectief), the service, and the front-end of the service (digital web-app). Research demonstrated that the business should focus on both the basic kitchen and on upgrade possibilities. This formed the basis of a newly created digital platform. A final evaluation of the front-end design of the service showed that the design was attractive for the tenant and functioned as envisioned.

To conclude, this report describes an user-centered design process in multiple iterative cycles resulting in a design proposal for a service system to facilitate a circular kitchen for social housing in the Netherlands. The most important addition to the current project is the design of the intermediary 'Het Keukencollectief' with the front-end service design.

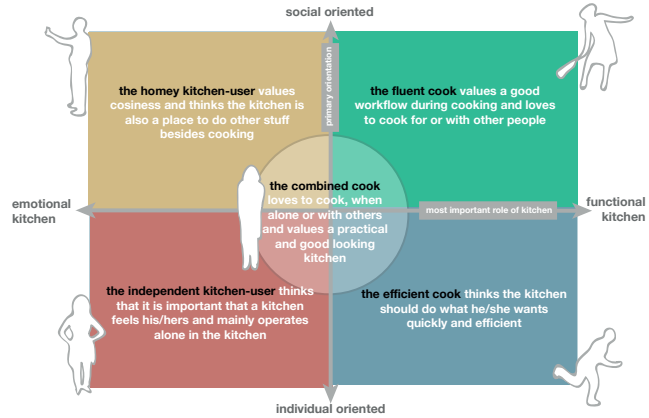

figure 1. the framework showing different tenant types

figure 2.the shared values

acknowledgments

Special thanks to..

My family, for always supporting me. In every way and while going through some rough times every now and then.

My girlfriend, for always being there and being my figurative punch-ball when I am off ranting about everything and nothing.

My supervisory team Conny Bakker & Renee Schuffelers for letting me be me and provide me with their experience and advice in a very personal and rich way.

Bas Jansen for providing me with the opportunity to mingle myself in a circular project with a lot of potential.

All tenants involved in this project, for inviting me in their homes.

who am I?

I am Bas de Rooij. A TU Delft Industrial Design Engineering. With this graduation assignment I conclude my master Design for Interaction at the TU Delft.

I think it is crucial that products are not designed and produced while acting blind for the environment. I want to challenge myself to come up with things that also help the user to live more sustainable. We only have one planet (at the moment), let's enjoy it as long as possible. I think designers need to step up and steer all consumers in the right direction.

I set up this project because I have a strong personal interest in domestic product- and service-design. In my spare time I like to challenge myself to come up with new ways to improve my own home shared with roommates, and the homes of friends and family.

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abbreviations

AMS	Amsterdam Institute of Advanced Metropolitan Solutions
B2B	Business to Business
B2C	Business to Consumer
C02eq	Carbon Dioxide Equivalent*
CEO	Chief Executive Officer
CIK	The Circular Kitchen
DFI	Design for Interaction
DIY	Do It Yourself
GHG	Green House Gas
HA	Housing Association
IDE	Industrial Design Engineering
KCr	Keuken-credit
KC	het Keukencollectief
KM	Kitchen Manufacturer
LCA	Life-Cycle Assessment
LOR&W	List of Requirements and Wishes
MO	Manager Operations
PSS	Product-Service System
TCO	Total Cost of Ownership

* definition available in glossary

introduction

In the following chapters an introduction to the project, assignment and the general approach is described.

“When I moved into my new house via a housing assosciation I noticed that the kitchen was pretty beat up. This is not what I had in mind getting into a new house. The housing association acknowledged that it was old and that I could get a new kitchen. Almost a year passed and in the meantime I fixed all broken things myself. It became a comfortable kitchen and I felt at home. Then the housing association called; I could make an appointment to get my kitchen completely replaced. Wow! But there was a catch; In the new kitchen they would exclude the built-in gas stove and the fridge that I have now. So not only they waited just as long so that I started to repair everything myself, they came with a solution that costs me more money than not doing the replacement! The story is not even finished: when I asked if they couldn’t just get me new drawers and cabinet-doors, they replied: No, if you want us to fix your kitchen. We will need to replace it as a whole.“

-Emma, a social housing tenant in Amsterdam

1 | project introduction

Our planet cannot keep sustaining our linear economy for much longer. At this moment, this becomes more and more clear to the general public. This results in a changing market demand for consumer products. Different industries are already looking for more sustainable solutions to implement in the future.

As Emma’s story indicates: The kitchen industry still needs to change. Kitchen design for social housing has not changed much in the past decades. Manufacturers have optimized the production process to reduce costs to its minimum. This results in kitchens that are hard to repair and are replaced completely when a problem occurs. The majority of the kitchen parts get labeled as waste and end up being scrapped. The life of the kitchen ends here, having a non-sustainable, linear life cycle. To help the kitchen industry become more sustainable, it is time to make them fit the emerging circular economy. A circular kitchen could bring interesting benefits: be economically profitable for manufacturers, take pressure off housing associations and could mean a more personalized product for the end-user.

This graduation assignment is part of a TU Delft project called ‘the Circular Kitchen’ (CIK). CIK is a collaboration between different parties to develop circular components for the implementation of a circular economy in the kitchen environment. CIK is developing a prototype and market-ready product which will be implemented in the Netherlands and Sweden. CIK’s current design is the design-starting point for this project.

While CIK focuses on the functional prototype, this project contributes with a design from the tenants point of view. This report tells the story of a user-centered design process towards a service design. A service that supports the Circular Kitchen and engaging the tenant in using the product. Through background research, user research and stakeholder cooperation a product-service design will be designed and iterated. Methods like context-mapping and concept evaluation are used to align stakeholders and to develop an interesting design proposal.

2 | the challenge

This chapter describes the challenge as provided by CIK. At first the assignment is explained as given. After this the chosen approach throughout the report is described.

2.1 assignment

CIK's aim on this graduation assignment is that it contributes in making the whole CIK design better by approaching it from the tenant's point of view. The goals of this assignment are to find out what tenants expect and need from a kitchen and how this can be aligned with the demands of a circular economy. Also need to be find out if tensions arise, and if/what changes in the way tenants use kitchens. Which changes are necessary and are these acceptable from the tenant's perspective?

The focus of this graduation project lies on the circular kitchen from the tenant's point of view. This stakeholder in the system is not represented yet and research is needed to know what happens in the home of the actual end-user.

2.2 approach

The applied project approach is based on a 'iterative representation of the basic design cycle' where methods from service design and user-centered design are woven into. This iterative approach is described by Rozendaal, M.C. (2018, September 3) Personal communication: PO1-lecture at the TU Delft. This approach is based on doing the design process though multiple cycles or steps, called 'navigating'. The layout of one cycle is illustrated in Figure 3.

A cycle starts with 'framing' knowledge, this means understanding design problems and context, framing and determining design goals. The envisioning phase is follows, solutions need to be found and creativity and fantasy is used. Then the realizing phase commends, here realistic solutions need to be selected and the design is adjusted accordingly. Finally the validation step is reached where the found design and solutions are measured by using criteria and argumentation. When a cycle is finished, a new cycle starts and results in a design iteration. In each step the design is iterated and refined.

The navigation process of this graduation project is illustrated in Figure 4. This project is shaped in three consecutive cycles, that function on show levels of the design. Throughout the report the cycles are mentioned and form as a basis for the layout of the project.

cycle A

The project starts with cycle A, here the assignment and problem definition are taken as a given and form a basis for starting multiple analyses; about CIK, the stakeholders and the problems background. This is used in a preliminary 'design A' what is taken into user research and tested by tenants.

cycle B

The second iteration is cycle B. All new knowledge retrieved from the user research is framed and new design activities are started, an integral concept design arose and is visualized in a service blueprint, at the end of cycle the idea is validated by an evaluation session with a major stakeholder.

cycle C

The report ends with cycle C where the cycle is focused on detailing the most important parts of the design. First research is done on when the product needs attention and how often an interaction takes place, this is used in the existing system design and then an interface is created. This cycle ends with an validation by an user test.

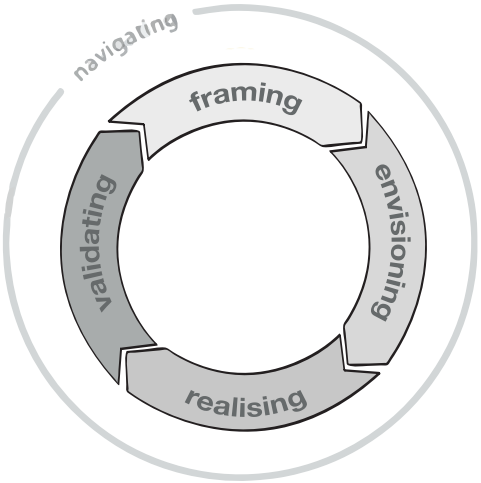
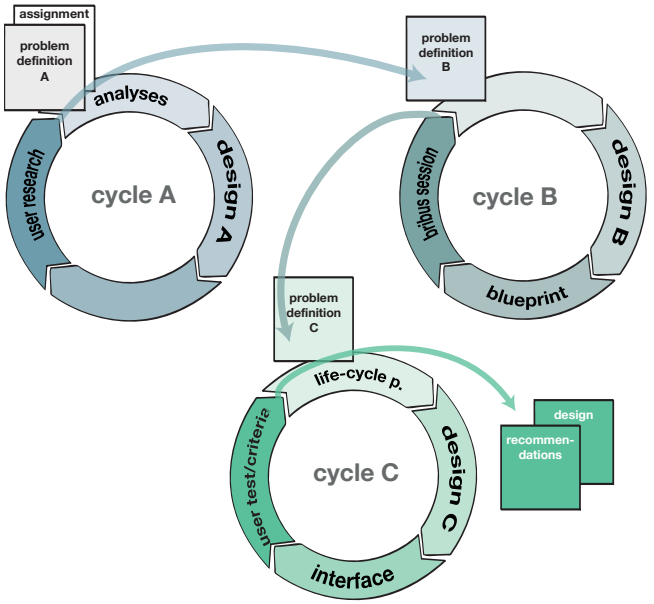


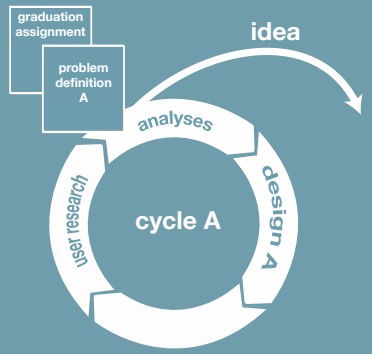
figure 3.a single iterative design cycle

figure 4. all iterative cycles in this project



cycle A

The first iteration is cycle A, the assignment and problem definition are taken as a given and form a basis for starting multiple analyses; about CIK, the stakeholders and the problems background. This is used in a preliminary ‘design A’ what is taken into user research and tested by tenants as validation.



3 | problem definition A

A problem definition based on the assignment and introduction talk is created to give direction on the project. The problem definition is refined in every cycle and parallel to the problem definitions a list of requirements (LOR) is created and updated. The list of requirements is a document with criteria that help with defining what the result of the design-process should be. All new learnings in a phase make the problem definition and LOR more concrete.

method

As a guideline for the problem definition and list of requirements the method described in Roozenburg and Eekels (1998) is used. The downside of this method is that it is developed for designing rather physical products instead of product-service systems. However, the goal of this method still serves the need: creating structure and communication of abstracted information, findings and to define and evaluate the outcome of the design.

introduction to problem

In the kitchen industry too much waste is created during the production and life-cycles of kitchens. While looking from a sustainable or environmental point of view, new solutions should be found to solve this. CIK plays in on this problem with a circular strategy. It is a project with different stakeholders that develops a kitchen which is modular and has a longer life-expectancy than the conventional kitchen. What makes it better for the environment. Primarily this is implemented in social housing in the Netherlands and should be market ready in 2022.

When developing a circular kitchen for social housing, the traditional kitchen system needs to be rethought. “A circular economy is an economic system that replaces the end-of-life concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes.” (Kirchherr, Reike, Hekkert, 2017). Integrating these circular concepts in a kitchen design will bring changes. These changes are not only noticeable in the business model, but also on the human component. This could mean changes in kitchen habits, rituals and other aspects of behavior. CIK did limited research with the tenant involved and speculates that it is a possibility that tension arises between the tenant’s behavior, their vision on kitchens and the current circular kitchen design. It remains unclear if and how tenants are willing to cooperate in such a product system. User research within this field is needed to make the product-system fit the tenants needs and to make the overall Circular Kitchen project a success.

what is the problem?

The problem is the fact that the changes that the circular system and the modular design could bring possible tensions with the end-user, the tenant. This could be cause by the fact that the tenant was under-represented in the development of the kitchen so far. If this problem isn’t recognized, investigated and solved, this could lead to unintended use of the kitchen by the tenants and could influence the system in this way that is less sustainable than the normal kitchen.

who has the problem and what are their interests?

The main problem-owner would be the initiators of CIK, the joint forces of the TU Delft that work from an academic point of view. Their primary goal is to build a functional circular system with a market ready product to demonstrate the possibilities and to seduce industry to change on the longer run. When looking at the problem, it would be in their goal that the tenant is heard and they are cooperate optimally to make the system work. Because this project is a collaboration of multiple stakeholders, and when only looking at one stakeholder the system will not work; there are multiple problem-owners. They have different goals and interests within this project. This makes that multiple problems could be identified and an integral approach needed.

what should be avoided?

On the one hand it should be avoided that not more tensions/frustrations/problems should arise with the tenants that makes the circular system harder to implement. On the other hand it needs to be avoided that the stakeholder interests are aligned in this way that a collaboration is not possible or beneficial for the circular system.

In the next and first cycle of the project, cycle A information is gathered. About the context of the problem, who is involved and what the exact problems and interests for the stakeholders are.

list of requirements

The LOR ‘hangers’ are placed after each cycle and are updated with new information. The first hanger is illustrated in Figure 5. The category where the requirements apply to are stated on top of the hanger. The numbered parts are the requirements themselves. Also, the list is divided in two categories: demands and wishes. The demands are concrete requirements that must be met and wishes are requirements that should be met as best as possible. These are used for evaluation and decision making among acceptable solutions. The requirements are differentiated by their prefix (D/W). The requirements will be used to evaluate the design.

figure 5. list of requirements based on the information so far

0. general

Demands

D0.1 Tensions through changes that CIK brings compared to the ‘conventional’ kitchen should not give problems for the tenants. - (PDA)

D0.2 The service is designed with a user (tenant) - centered approach. - (PDA)

4 | about the circular kitchen

This graduation assignment is part of project the Circular Kitchen (CIK). This chapter explains what CIK is and what the product is that CIK is developing. In this chapter the information is retrieved from meetings with staff from the TU Delft unless referenced otherwise (Jansen, B. Personal communication, November 2, 2018).

CIK is a collaboration between different parties to develop components for the implementation of a circular economy in the kitchen environment. The goal of the project is to create new kitchen design that has significantly less negative environmental impact than conventionally build kitchens, and to implement the product as demonstration exemplars in the Netherlands and Sweden (Jansen, 2018). The developed circular product should function as an example that shows an appealing alternative for the conventional kitchen in the eyes of professionals and residents. Hopefully their interest grows and with this their contribution to other circular components in the built environment (Van Stijn, Gruis, Van Bortel, 2017).

CIK's current design is the design-starting point for this project. CIK used a modular approach using a docking station in which kitchen modules can be plugged in and out. The modules can be changed easily using click-on connections and can be customized to the users wishes. This design is explained in detail on the following pages.

4.1 who is involved?

The collaborating parties in CIK are shown in Figure 6. The faculty of Architecture of the TU Delft initiated this project for the development of the circular kitchen. They found partnership in a kitchen manufacturer called Bribus. This company installs kitchens on a large scale for housing associations and real estate businesses. Dirk Zwager group is a contractor that works with Bribus for installing the kitchens. The housing associations involved in this project are Eigen Haard, Ymere, Woonbedrijf and Waterweg Wonen. They provide social housing and some housing in the free sector. Social housing is supervised by the Dutch government. ATAG will contribute by providing efficient kitchen appliances. The funding for the project is done by EIT Climate-KIC and AMS. The Swedish university Chalmers develops a similar product for the Swedish housing market and shares information and findings.

figure 6. collaborating parties

4.2 design starting point

This graduation project is built on the proposed design by CIK. 'design starting point' describes the kitchen as CIK designed it in 2018. In chapter 7, 'design A' the first adjustments are made to make it fit the process of this research.

The Circular Kitchen incorporates a product-service system for tenants in social housing in the Netherlands. Compared to a 'normal kitchen' CIK is designed to be modular. A normal kitchen is installed and hard to (dis)assemble or repair. Often a professional is needed to do adjustments to a kitchen or large parts need to be replaced to repair small damages. CIK is built this way that every part is easily assembled, disassembled and replaced. This part-flexibility can also be used for configuration change or customization of the kitchen parts. The service side of CIK is a platform has potential to provide additional or replacement parts, repair-manuals and much more. This is explored in the next sections.

The kitchen itself is named a 'component' and is based on a docking station in which modules can be plugged in and out (Figure 7). The modules consist of a frame which holds a 'module infill' and a 'style finish'. The service side of the system offers a platform for the tenant to customize and repair kitchen parts, add extra modules or to change kitchen style (Figure 8).

how it was developed

A very important requirement for the new design was that the quality of the kitchen is just as 'good' as the previous kitchens for social housing. But the main aim of the design was that it would become a circular product. To make the kitchen as circular as possible, a modular approach is chosen. This means that most parts are standardized and easily (dis/re)assembled. The modularity also offers potential for implementing circular design strategies such as ease of maintenance, upgradability, adaptability and possibly even product attachment. These strategies are described by Bakker, Den Hollander, Van Hinte, Zijlstra (2014). But how is this modular compared to 'normal' kitchens? All modules are very easily changed and moved, this can be done by two persons without needing tools. Most parts within the module can be replaced separately without damaging the other parts. The modular approach will need to be incorporated in a pretty complex system. With a service side for the tenant and other stakeholders but also a supply side, making it possible for the parts to be looped back to manufacturers. More about this in the next sections.

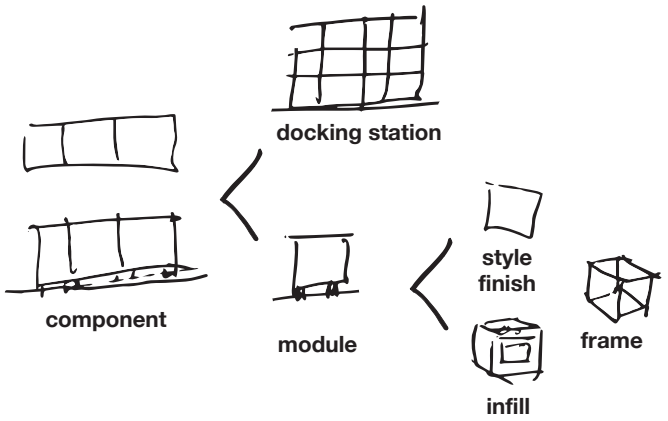
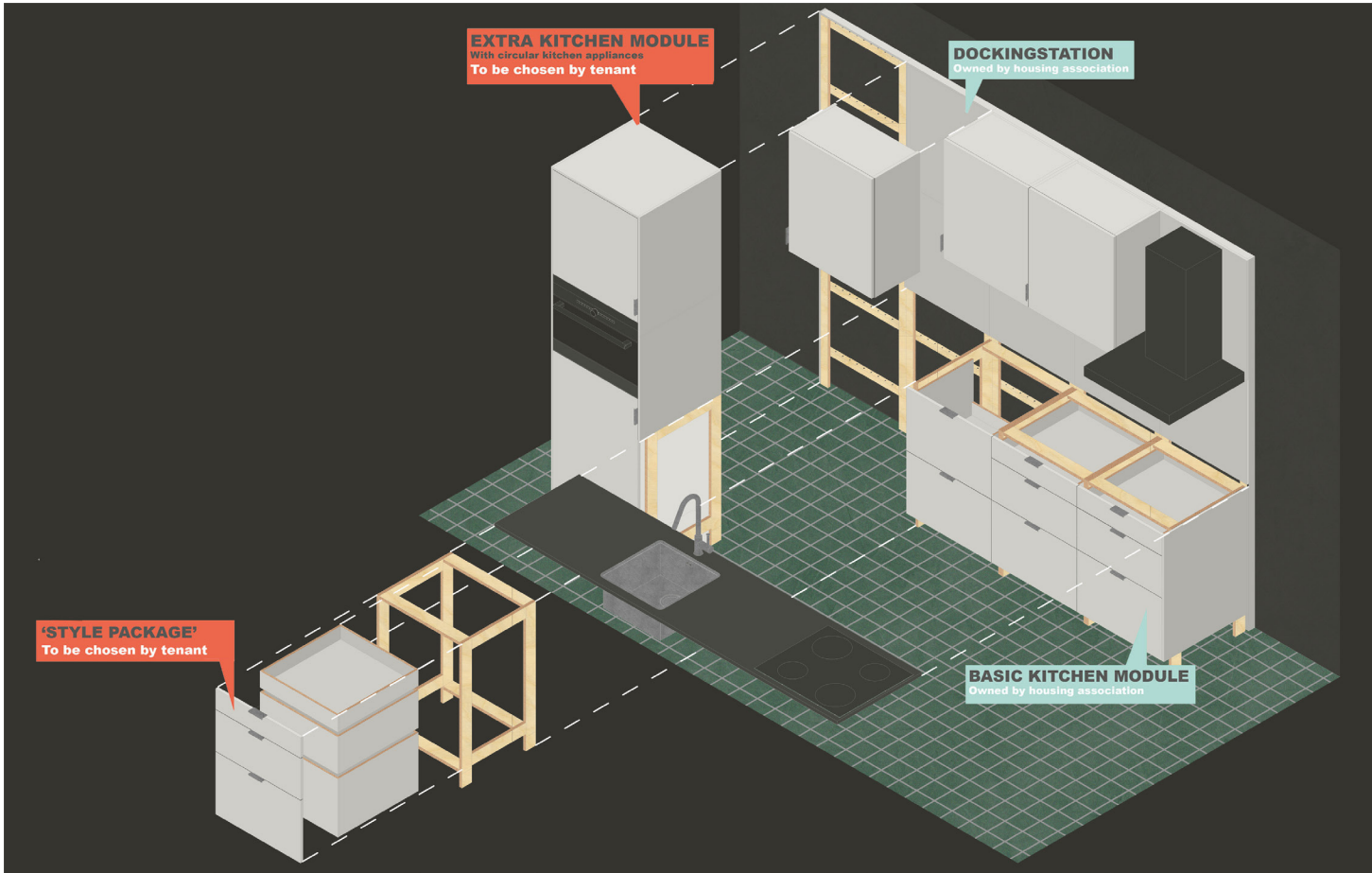


figure 7. the full kitchen build-up

figure 8. design starting point



the product side

The kitchen is best illustrated by prototype 1 (Figure 9-11). The kitchen consists of a docking station with different modules. This section is summarized, detailed technical information could be found in appendix 3.

modules

As mentioned previously; a module is based on a frame, with a variable infill and a style finish.

- The modules are connected to the docking station with simple ‘click-on’-connectors. These connectors are milled into the module and can be attached/detached by pressing and sliding without use of tools. (Figure 9) The different module-parts (frame, style finish etc.) are also connected with these connectors. All module parts can be replaced/changed separately because there is no use of glue.
- The modules can be placed in different size-configurations, this brings advantages in ergonomics and sustainability. By adjusting the kitchen configuration it can be used by different tenants over longer periods of time.
- The modules contain an infill. This can be configured in different ways. In a basic kitchen all bottom cabinets will have drawers, but these can be upgraded. It could be changed in for example a built-in refridgerator or another type of appliance.

style package

The style package includes all style finishes from the kitchen; the module front and side covers. An easy changeable style package offers the tenant the opportunity to get a fresh look or go with the latest kitchen fashion.

material

In the first prototype not all design-choices are as sustainable as they could be. The focus now is on a working circular system and a minimal viable product. But thanks to the modular approach there is a lot of freedom in future material changes. When a material seems more beneficial than the current material, the changes can be done relatively quickly.

- In prototype 1 most parts are made from wood. The frame, plates and fronts are made out of formaldehyde-free multiplex.
- Most multiplex parts have a HPL coating (High pressure Laminate) that is relatively durable and easy to clean. At the moment the HPL is glued on the parts but this will be easier disassembled in the near future.

figure 9. detaching a module without use of tools

figure 10. the circular kitchen prototype 1

figure 11. side view and docking station

business model

Key partners in CIK's business model are material suppliers, part suppliers, the kitchen manufacturer (KM), an intermediary party, the contractor, the housing associations (HA) as clients and the tenants as end-users. The kitchen manufacturer seems to be one of the most important parties involved (Van Stijn et al., 2017).

financial arrangements

Bribus and CIK think that at this moment the most viable model is the one illustrated in Figure 12. The kitchen manufacturer purchases parts and materials to produce the kitchen from suppliers agreed upon that all material and parts are looped back after use. The KM also offer the docking station and basic kitchen to the housing associations under agreement that at end-of-life stage these are taken back with a certain take-back fee. An additional service subscription is offered to provide maintenance services. The KM also produces additional kitchen modules and upgrades that are offered to tenants via an intermediary party. This party manages the business to consumer (B2C) activities and builds on a joint venture between the KM and HA For these extra kitchen upgrades it is possible to implement a variety of financial constructions as lease, sale with deposit, pay per use etc. (Van Stijn et al., 2017).

This project uses this business-model as a starting point. With this business-model the following scenario is the most likely: The intermediate will most likely be a collaboration of the kitchen manufacturer and the housing association. The housing association determines what the exact contents of the basic kitchen will be. The system enables that the tenant can choose what the kitchen looks like and if/how they want to upgrade the base kitchen. The upgrades can be leased from the kitchen manufacturer. A contractor installs the docking station and kitchen basics. The kitchen manufacturer offers a maintenance subscription to the housing associations together with a Do It Yourself (DIY) platform.

How the exact business-model looks depends on future financial arrangements.

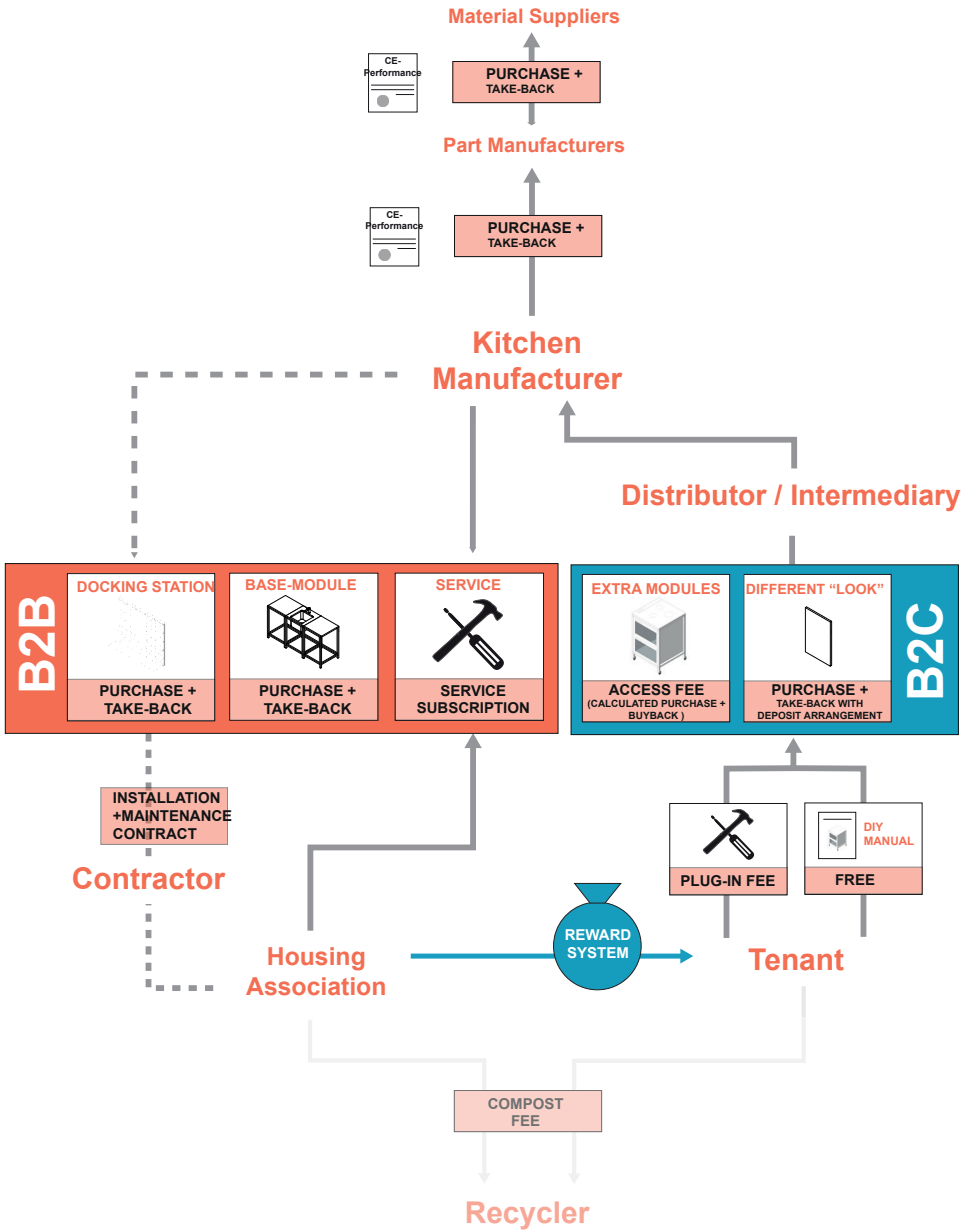


figure 12. the proposed business model (CIK 2018)

the service side

The service side of the circular kitchen is currently referred to as ‘B2C’; Business To Consumer. The B2C is where this graduation assignment will focus on.

A benefit that the modular design brings is the option for DIY-installations and maintenance. It is suggested that this brings forth less environmental impact than the conventional situation where a mechanic is sent to the tenants home for every kitchen adjustment or repair. The tenant can choose to do upgrade-installments him/herself and can take care of maintenance through an online platform. If a part is broken, a replacement is shipped to the tenant’s home and the broken part needs to be sent back. The platform also offers freedom for the tenant in configuration and style choice. Possible upgrades to the basic kitchen are style changes or the adding and customizing of modules. This way the tenants can choose if they want ‘a base’-module with the basic or a different style finish. But for the DIY-activities the tenant probably needs to be engaged. How can the tenant be motivate to partake? This is something that is researched in this graduation project.

the supply side

A circular system requires that resources are looped back on the moment they are not needed anymore. With the business model from the previous section, CIK proposes the supply chain model from Figure 13. This is based on the butterfly model that is discussed in section 6.3. This model includes supply chain and reverse supply chain to make the system circular.

For small/easy returns/swaps a local ‘return street’ is installed. Small maintenance or replacement of modules could be coordinated from a local point. The local ‘return-street’ is also responsible for taking back, sorting, reselling and lightly refurbishing of upgrade-parts. This (dis-) assembly-facility also takes care of sending back the parts to the kitchen manufacturer. At the KM a central ‘return factory’ is installed where all parts and material are sorted, refurbished, re-manufactured or dismantled and transported back to parts- and material-manufacturers to be recycled or re-manufactured (Van Stijn et al., 2017).

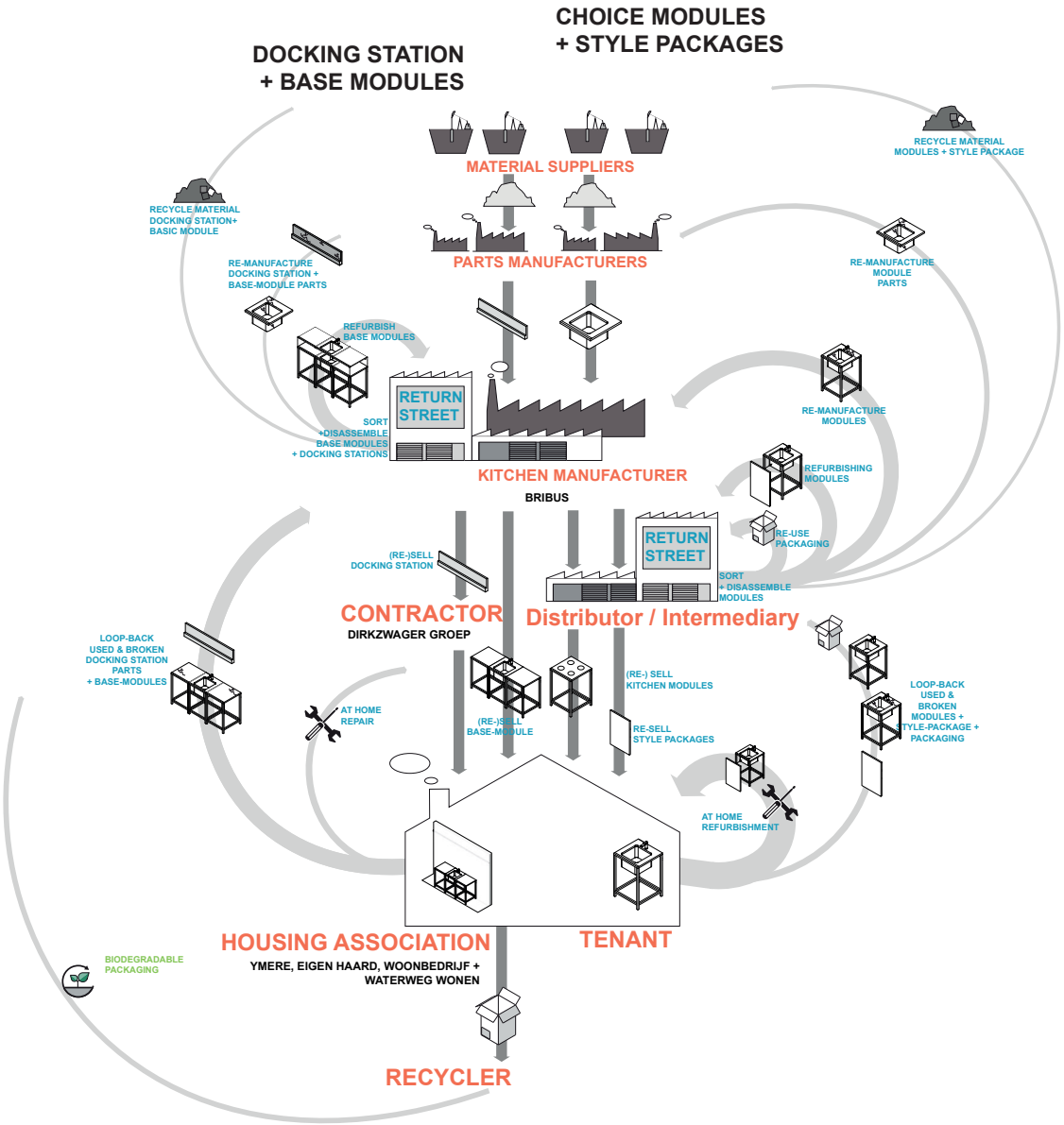


figure 13. circular supply chain (enlarged in appendix 3)

4.3 sustainability through circularity

Putting a system in the market that works, that is as circular as possible and that can adapt to sustainable innovations. That is the primary aim of CIK. The approach includes gaining sustainability through circularity. The circularity in the current design is mostly through extending the life-time of the kitchen by making it modular with accompanying benefits. Not all loops are completely closed, but the system can function as a good starting point for becoming a circular system that has a less environmental impact than continuing the current linear system.

expected environmental impact

Implementation of CIK is expected to lead to reduction of resource use, pollution and greenhouse gas (GHG)-emissions. A case-study shows the following results if CIK was implemented in social housing in the region of Amsterdam:

- CIK would save up to a total of 1,9 kilotons of waste in social housing stock each year. That is saving 10 kg of waste per kitchen/year. This is a reduction of 94% on stock waste in comparison with the conventional kitchen model.
- CIK would bring the CO2eq* emissions from the production of the kitchen itself (without appliances) to a reduction of 78% emissions compared to the conventional kitchen.
- When CIK would include circular and energy conserving appliances the emission for the appliance-itself will lead to a 50% drop, and 26,5% on use related energy.

If CIK was implemented in Amsterdam the system would lead to the drop of 1,4 kilotons CO2eq emission per year. When more sustainable appliances were including it is could lead to a saving of 9,4 kilotons CO2eq per year for the appliances, and 10,1 kiloton of CO2eq per year for the use related emissions. A more detailed version of the case study is shown in appendix 4 (Van Stijn et al., 2017).

choice for DIY

A big benefit in the Do it Yourself (DIY) possibility of the Circular Kitchen is easier to construct and deconstruct. This is could bring interesting options for the system. When choosing for integration of DIY in the system the following benefits would accompany this decision:

- Positive environmental impact: In the old social housing kitchen-system a mechanic is sent to a tenant's home when something is broken. In this design the tenant can do maintenance themselves, what has almost 4 times less environmental impact (calculation in appendix 14). Besides this it offers increased efficiency in the (de-) construction process (Van Stijn et al., 2017).
- Save money: The housing associations can save a lot of money by not being forced to send mechanics to tenants home for every repair.
- Engagement: The DIY-possibility appears to be desired by some tenants. It is perceived as a quicker solution to their problems, with less hassle in arranging the mechanic and without the need to stay at home for the maintenance to be done. This insight arose by performing user research, discussed in a following chapter.
- Social solution: It is a possible solution for the growing scarcity of (specialized) skilled workers (Van Stijn et al., 2017).

material

In material decision-making it was concluded that higher end materials that are known to live longer, are too expensive and are less environmentally friendly than 'normal' multiplex. Other, more 'exotic' alternatives are not yet economical beneficial enough to use this product. Multiplex expected to be more durable and sustainable then the chipboard that is currently used in the majority of the kitchens.

4.4 future developments

Implementation of this design will be primarily focused on social housing in the Netherlands. The first functional prototype is launched in 2019 and the product is aimed to be market ready in 2022. After implementation further development is expected with potential spin-offs. An open source development without patents is aimed for. For example for international implementation or the free sector housing market.

takeaways

I think designing a viable circular product should indeed be the priority of CIK. The design starting point is a good start, and this should be continuously evaluated and evolved to a system as circular as possible. The modular approach is a good strategy because it offers opportunities for a desirable system with a lot of potential for economical and environmental impact. Specifically the adaptability to sustainable improvements, the options to expand the whole product in every way. The design as a given included with the supply and business models will be taken as a given into the analyses phase and optimized for the goals of this project in design A.

There should be critical note to the impact-calculation provided in this chapter. Within this calculation it is unclear what exact assumptions are made. Since CIK is fully in development and new calculations still need to be published, these results should be used with caution.

*definition available in glossary

5 | stakeholder analysis

In this chapter all stakeholders are identified and described. This project uses an user-centered approach. However the other stakeholders should also be taken into account during the decision making process.

The stakeholders in this project are mapped in Figure 14. The funding and universities are now involved but will be outside of the ecosystem when the system is implemented. The Figure shows that there could be different levels on which the stakeholders interact, this is based on the proposed business model from section 4.2. This could be changed in design iterations based on new insights.

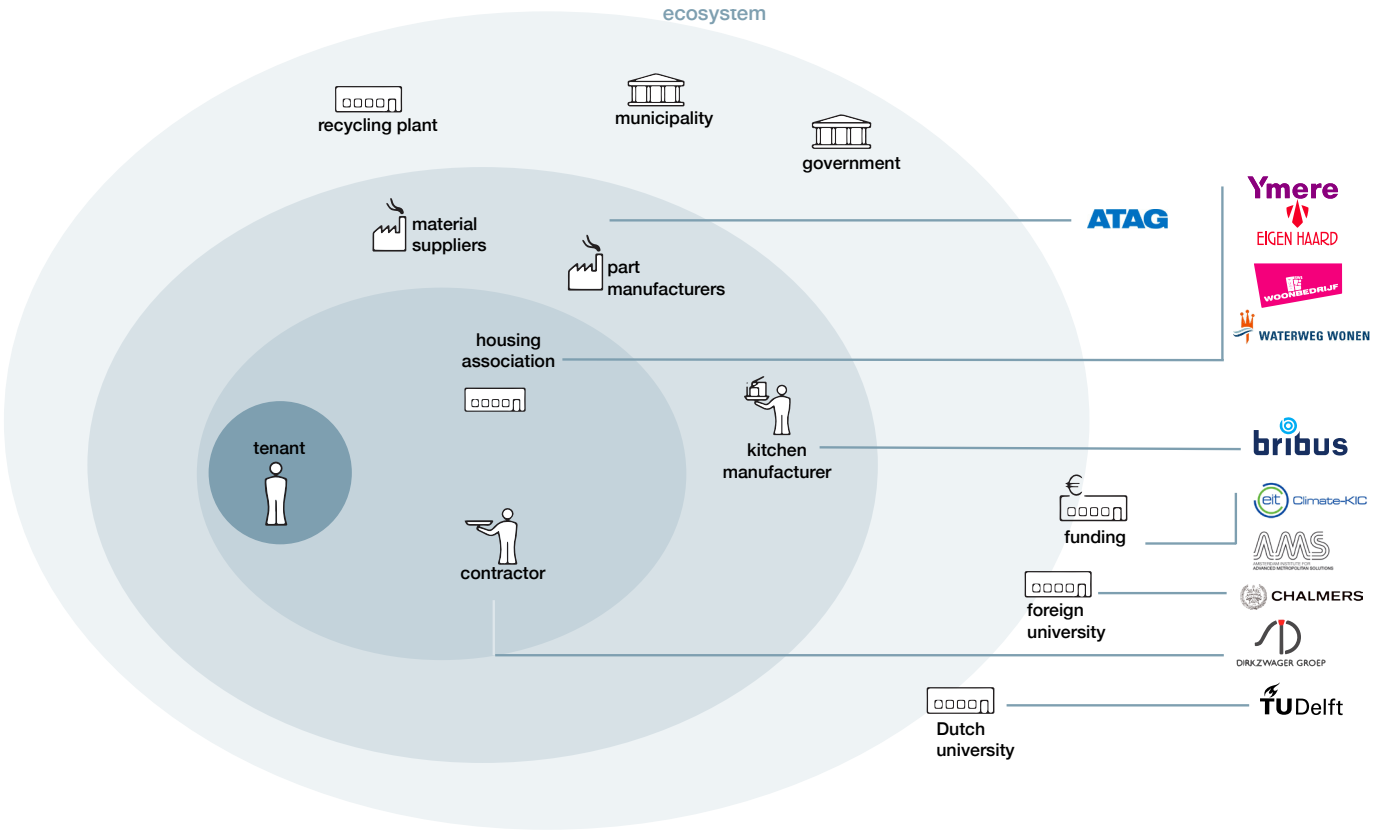


figure 14. identified stakeholders. visual style based on (Design United, 2013)

5.1 who are they?

the tenant in social housing

In 2018 there were 2 million social housing residences in the Netherlands. Most tenants in social housing have a low income and a big part of this group receives monthly rent allowance from the Dutch government. To qualify for social housing a tenant's income must be under 41.000 euro per year (InfoNu, 2018). Dutch housing associations have different tenants with different contract-policies. But nationally there are different contacts depending on tenant's income and life-phase. Overall statistics about tenants are limited, but for example association 'de Key' has 75% contracts for unlimited time and 24% for students and starters with 5-year contracts. The average age for unlimited 'normal' social renting is 55+ and for the starters and students it is 24 years old (De Key, 2018).

housing associations and the Dutch government

The 2 million social housing residences are owned by 350 housing associations (InfoNu, 2018). The housing associations are the parties that are responsible for the real estate, the tenants, renting out and managing all the houses. There are 4 associations involved in the circular kitchen. These associations are responsible for the social housing in Vlaardingen, parts of Amsterdam and Eindhoven. This summary about these stakeholders will be applicable for almost all 363 housing associations in the Netherlands. Housing associations are so-called authorized institutions ('toegelaten instellingen') without a profit objective under supervision of the government. A difference between these associations is that some originate from a partnership company and some from an association or foundation. Legally this makes a big difference but with the government's supervision and recent rent-legislation changes, the associations want the same: Quality living in a livable neighborhood for everyone and affordable housing for tenants with a low income. Some associations are also active in free sector housing including selling and renting out free sector real estate. New legislation in 2015 obligates the associations to focus on the social housing and separate commercial activities legally or administratively (Huurwoningen, 2019) (Technischwerken, 2017) (Rijksoverheid, 2015-a) (Rijksoverheid, 2015-b). The Dutch government, in specific 'the Ministry of Internal Affairs and Kingdom Relations' is responsible for carrying out the housing-legislation and wants that civilians can live affordable, safe and sustainable houses in a neighborhood where everyone counts, participates and where they can live peacefully. This ministry relies on the civil servants of the municipality to carry out their policy (Rijksoverheid, 2019).

5.2 what is important for them?

the kitchen manufacturer

Bribus is the involved kitchen manufacturer in The Circular Kitchen. Bribus is a company that claims to build tailor-made kitchens, for every target group and every budget, large series of kitchens for apartment buildings or replacement of existing kitchens. Bribus claims to fix it and do all the arrangements from advice to design. They also provide tenant and buyer-accompaniment, delivery, installation and service.
What the exact role of the part and material manufacturers is going to be in the new system needs to be found out. Currently the kitchen manufacturer handles the contracts with these parties. Due to the looping of materials, more refurbishment and adaptability of the design, these contracts might take on a different shape than in the conventional design.

In the new system the role of the contractor, Dirk-Zwager group is expected to be smaller. Since Bribus also handles some service and maintenance, arrangements should be made here.

funding

CIK is funded by AMS and EIT Climate-KIC. AMS Institute is an Amsterdam based public-private institute where talent and professionals develop interdisciplinary metropolitan solutions (AMS, 2014). AMS sees this as a 'Stimulus Project'. The aim of it is to give AMS partners support for innovative research with large upscaling potential. These projects should realize short-term research output, which functions as a catalyst or new concepts (AMS, 2017).
EIT Climate-KIC is a knowledge and innovation community, supported by the European Institute of Innovation and Technology working to support innovation that helps society adapt to climate change. EIT Climate-KIC brings together the most effective groups to create the innovation that can lead to systematic change (EIT Cimate-KIC, 2019). Important to keep in mind for this project is that these parties need relatively quick results, clear and appealing communication and that the core message would be sustainability.

tenant

In a short test conducted with social housing tenants the first reactions to the circular kitchen were relatively positive. They liked that the kitchen was a more sustainable alternative while offering more flexibility and choice. The conditions that they mentioned were the following: (Van Stijn et al., 2017)

1. (In)Direct costs should not be higher than a 'conventional' kitchen.
2. The basic kitchen quality should not be lower than the 'conventional' kitchen.

kitchen manufacturer

Bribus is a family owned company that values an environmentally friendly production process. Realizing aesthetic, responsibly produced kitchens is their main goal (Bribus, 2019-a). Bribus is looking for concrete steps to do their business sustainably and dare to make less economical decisions for ecological or societal reasons (Bribus, 2019-b). Bribus tries to translate their long-term vision into concrete product and process developments. The goal of the kitchen manufacturer in The Circular Kitchen project is to gain new insights for their vision through this project (Bribus, 2019-c).

housing associations

In general each association has its own approach, but they all want their tenants to be satisfied. Tenant-satisfaction is one of the most important values. This is their image, what is used for comparison with other housing associations and what is used for evaluation by the government.

The housing associations think the most interesting things from CIK are the fact that it offers more freedom for their tenants, the ease of repair of the components is a big advantage, the claimed durability that is mentioned is seen as a big advantage, the flexibility, interchangeability fo the components within their housing stock and potential convenience for asset management is a big motivation to consider implementation of CIK. During the development of CIK also certain conditions arose from the housing associations that must be met before HA would implement such a system (Van Stijn et al., 2017):

1. Most important: There should be a equivalent or lower TCO (total cost of ownership)
2. Long term relationships with supply partners are desirable. But the HA think it is important not to be stuck with one industry party.
3. The kitchen must be safe, hygienic and 'vandal'-proof.
4. The product should be scientifically assessed as a more durable and circular option.

takeaways

Since this project has an user-centered approach the tenant is the starting point. Because the tenant was out of scope in CIK until now, it is important to maintain this focus. But for a good working and viable design all stakeholders should be taken into account. In the new system the biggest stakeholders are going to be the housing associations and the kitchen manufacturer. As mentioned in 'design starting point' (section 4.2) these parties are going to collaborate on the service side. How this collaboration should look is investigated in this report, and flows out of the final design.

The next step on the path to this design is getting a clear view on the project's context and a good representation of the most important stakeholders. For this step to be achieved the following activities are planned:

- Facilitation of generative sessions with a diverse group of social housing tenants from different social housing categories and housing associations.
- A concept evaluation session with the kitchen manufacturer to evaluate and optimize the design based on their insights and feedback. During these sessions, it is important that I show them the relevance of taking the tenants needs into the design and decision making process.

For an even better representation of the stakeholders an additional evaluation session with housing associations would be very desirable, but unfortunately this did not fit within the time-frame of this project. For the project this choice has been made because the priority lies with the tenant and the kitchen manufacturer.

All stakeholder conditions mentioned until this far will be taken into account when (re-)defining the list of requirements for design and decision making.

6 | background research

Knowledge is needed from themes within the context and background of the circular kitchen. The themes will be explained, connections in-between themes will be described and insights will be taken into further design decision making.

To help address this knowledge, several goals are defined relevant for this project:

- Find out how kitchens are developed over the years and what is to be expected in the future.
- Define what user behavior plays a role in the kitchen and what is needed to enable a transition with a circular product.
- Investigate what tools and strategies are suitable to be used to design products and services for a circular kitchen context.

To achieve these goals a review of relevant literature in combination with theme-research was conducted to get a grip on the current knowledge available. Within the scope of circular and modular kitchens there are many different themes relevant for this design project. The most important ones are identified and displayed in Figure 15. The scope is displayed in this way because some topics are part of each other, but are also overlapping and interconnected. Knowledge subtracted from these themes could contribute to this project. In this chapter a summary of this research is displayed. The research is a combination of pragmatic, contextual and online approach on several themes and an analysis of scientific articles on the more academic subjects.

6.1 bake to the future

Kitchens and behavior in the kitchen go way back. But how did we get where we are now? This is a summary about the development of the kitchen since people started to cook on fire.

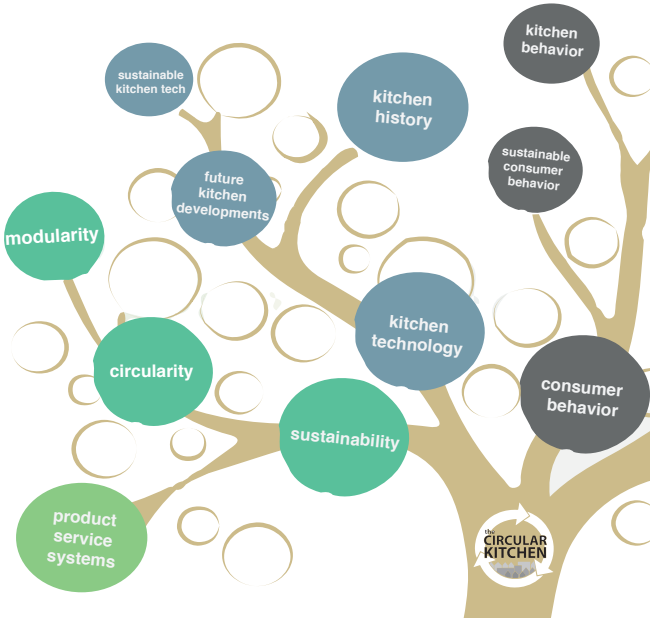


figure 15. the research-scope

image 16. a 1950's kitchen. Image by Expolounge

bake

Humans need to eat. Before cooking was invented 1.8 million years ago, people spent loads of time on chewing tough raw food. Something that is still visible in the behavior of our primate relatives. Cooked food is softer so the body uses less energy to digest it. Cooking on fire allowed humans to devote more time to productive activities, ultimately allowing the development of tools, agriculture, and social networks. Besides making eating faster and easier, it also gives a person more caloric benefit from food. "To this day, cooking continues in every known human society. We are biologically adapted to cook food. It's part of who we are and affects us in every way you can imagine: biologically, anatomically, socially." According to Wrangham of Harvard University in an interview with the Harvard Gazette (Bradt, 2009). When cooking was invented people started on open fires outside and on the ground. Later on, simple constructions were built out of stone and wood. In the middle ages metal cauldrons were used to hang over the fire, these made people gather because of the source of heat, light, safety and food. Technological advancements were mostly aimed on reducing labor and time, the first stoves in the 18th century were fueled by wood. Later the industrial revolution catalyzed the development and coal-fueled stoves arose. Heat capacity increased and cooking time records were set. Air pollution and climate change caused a decline in coal stoves, gas entered the kitchen market. This allowed ovens to become smaller and lighter and by 1920 gas ovens became the domestic standard. A first version of an electrical oven was introduced soon after this. World War II brought forward major manufacturing advancements that brought huge impact on the kitchen. Demand for kitchen technology grew and inspired homeowners to start showing their kitchens and equipment. "The kitchen became cleaner, better organized and easier to work in. The people using the kitchen took pride in it and it became inviting and it got a more prominent role in the household." according to Ramos (2016). In the years between 1960-1970 societal influences changed the style of the kitchen. Interest in home cooking grew and caused that in the kitchen people started to improving their culinary skills, using and showing of their designer cooking tools. The kitchen became the place for social activity (Ramos, 2016).

future

The 21st century showed returning interests like craftsmanship and hobbies in the kitchen. Bloggers and entrepreneurs use social media and the internet to show their experiments in the kitchen. A parallel trend in connectivity, integrated appliances and using wireless technology in the domestic environment brings rapid changes to the kitchen (Reagan, 2015). But this is just one development. Looking at future development of kitchens, different topics can be distinguished. Future experts and trend watchers speculate on specific points that will change.

One is about interconnectivity of smart-appliances. It is expected that our complete household will be about technological teamwork. Devices pass information from one to the next (The Times, 2017-a). This way you wake up with a warm coffee, get home to a warm oven or look at your smart-phone what you have in the fridge. First versions of these systems already appear on the market (Siemens, 2018). In other research, people appear to grow a need for personal health and well-being in the domestic environment also involving the kitchen. A space where food and health technology will come together (Global Kitchen, 2017). IKEA and IDEO offer a different perspective, they state that people will need the tactile pleasure of the kitchen in the future while the new technological innovations let people feel robotic and sterile. They identified the desire for 'mindful design' in the future (IDEO, 2015). Also, there seems to be an increase in demand for professionalism in cooking. This could have different reasons: Technological evolution has allowed domestic kitchens to be able to afford appliances that could be found only in professional kitchens. Also, digitization facilitated access to professional chefs, their expertise and recipes through new media and platforms. (Global Kitchen, 2017) Some also suggest that 3D food printing brings towards more professional and intricate food.

image 17. a tactile interaction in a 'mindful kitchen design' (IDEO, 2015)

"Just like Gordon Ramsay cooked it." (The Times, 2017-b). Others think that the invisible systems instead of the obvious kitchen gadgets will be the true innovative technology. Meabh Quoirin, CEO of a trends lab in an article of the Sunday Times: "The entire system that brings food to our tables will be overhauled, starting with packaging." The awareness of health and environmental issues around ingredients rises. This indicates a development of sustainability in the kitchen environment. People source what they eat closer to or at home and food needs to be transported less (The Times, 2017-b). Sustainability can also mean that kitchens process waste more Eco-friendly, use resources more efficiently and use limited energy. Also kitchen appliances and parts are produced in a more sustainable (circular) way (Ktchnmag, 2018).

takeaways

In general it is useful to see that the kitchen itself did not change much over the years. People needed to eat in the past and need to eat in the future. Food needs to be cooked and the kitchen was and seems to stay the primary tool to facilitate this need.

Trend-watchers claim all sorts of innovations will be happening in the kitchen environment with a very steep focus on technological innovations. But specifically with the aim of CIK with the focus on kitchens in social housing, not all future developments are useful and are going to happen in every household. It is handy to know what part manufacturers are working on and what is possible technology-wise to solve potential problems in the system to come. But a smart 'inter-connected' kitchen is not less interesting for this project. It is not (yet) within the budget of social housing and also kitchen users are quite skeptic about more technology in their kitchen. "With the kitchen often a hub for families and friends, habits there can be hard to change. And many people see the kitchen and mealtimes as a haven from their otherwise always-connected lifestyle according to the New York Times (2018). On the other hand however, is the sustainability.

These are the most important insights from this section:

- In the past the basics of the kitchen did not change significantly. For a long time a kitchen just had a fridge, stove, space to work etc. Only some style aspects changed. A 'conventional' kitchen should still be the basis for the future.
- Clearly some people see the benefit of smart-technology for functional purposes, but on the other end there is a skeptic group that see this technology come in the way of their emotional kitchen values. It seems to be a fundamental difference in values in the kitchen environment. Something that should be explored in user research. It might be interesting to look for other ways to achieve the same effect that this technology has.
- The development of kitchen users and industries that work towards more sustainable solutions indicate that it is the right momentum for CIK and that there is willingness from users and the industry.

6.2 why should I want something that is not mine?

With the rise of more and more product-service systems with the goal of improving environmental impact it becomes more clear: Within every system the user plays a role that can not be ignored. But how does that relate to sustainability in the built-environment? "There is clearly a strong need to accelerate behavioral research in built environment sustainability; it is apparent that it is people, rather than technologies, who are the key to embracing circularity." (Pomponi & Moncaster, 2016). This section is about product-service systems and consumer behavior in the kitchen.

"A Product-Service System (PSS) is an integrated bundle of products and services which aims at creating customer utility and generating value." - (Tukker, 2015). A business model that incorporates a PSS allows companies to create new ways to add value and competitive advantage; by fulfilling stakeholder needs in an integrated and customized way, while enabling others to concentrate on core activities and they can build partnerships/relationships with stakeholders, enhance loyalty, and have potential to innovate faster (Tukker, 2004).

Product-service systems incorporating acces models like renting, leasing and sharing have potential environmental benefits since, in principle, the same service level can be achieved with the use of fewer items (Tukker, 2015). But the environmental impact potential depends on a lot of factors. For example in some PSSs with product lease, the system can lead to less responsible user behaviour and results even in an increase of environmental impacts (Tukker, 2004).

figure 19. Swapfiets, an example of a PSS with lease-construction

image 18. fixing a kitchen that is not yours, would you do it?

CIK also leans towards working with a PSS incorporating lease-contracts. It can be useful to find out what can be expected when dealing with consumers who use things that are not theirs. These are defined by Tukker (2015):

- Products that are leased seem to be used with less care than products that are owned. Also rented, leased or shared products may be returned earlier in comparison to a product that is owned.
- The added value of comfort, convenience and the experience of ownership, might be lower than that of an self-owned product. Consumers value owning things and having control over their belongings.
- One of the biggest issues in working with a PSS for consumers is to lose control over things and life itself.
- Caused by high labor intensity, PSS can be more expensive than a product that is operated by a consumer.

But despite these (dis-)advantages, the share-economy seems to grow and become more popular among consumers and companies. Specifically lease products offer seems to grow significantly (NOS, 2019).

To overcome these (dis)advantages something is needed and since this is a behavioral issue, changing behavior is needed. In literature there are several approaches, summarized by Niedderer, Mackrill, Clune, Lockton, Ludden, Morris, Cain, Gardiner, Gutteridge, Evans & Hekkert (2014). In four basic approaches to change consumers behavior. These approaches also form categories for design approaches to asses a situation and match them to users needs.

1. Making the desired behavior easier for a user
2. Making the undesired behavior harder
3. Trying to get users to want to perform particular behavior
4. Trying to decrease users tendency to perform a particular behavior.

For example Swapfiets (Figure 19). A company that gives out lease-subscriptions on bikes with the guarantee that you always have a working bike. Their system uses fines as their primary tool for influencing their clients behavior. And mostly use these fines to decrease the cyclists tendency to be careless with their product (Swapfiets, 2018). Within the described approaches there is a difference between rewarding and punishing to influence the behavior. Since a bicycle in the private market is a very different product, it needs to be evaluated what would work best in the social housing context. This is included in the user research.

takeaways

The interest and offer in product-service systems with the accompanying lease-contracts is growing significantly. Parallel to this, the knowledge about how people handle these kinds of systems is growing.

These are the insights from this section:

- Products that are leased tend to be used with less care than products that are owned and may be returned earlier in comparison to a product that is owned. This is a challenge to overcome, probably by using the behavior changing techniques as described.
- The added value of comfort, convenience and the experience of ownership, might be lower than that of a owned product. Consumers value owning things and having control over their belongings. This might be an opportunity; by increasing the experience of ownership, undesirable behavior could possibly be decreased, something that will be discussed in further research.
- A big issue for consumers in working with a PSS is to lose control over things, a focus point; give the idea of being in control of certain things.
- A PSS can be more expensive than a product that is operated by a consumer, economical benefits and possibility for scaling need to be evaluated in design and decision making.
- The approach for influencing behavior change described by Niedderer et al. (2014) could be used in decision and design making.

6.3 sustainable kitchen or cook sustainably?

Sustainable developments seem to gain ground in the kitchen industry. On different levels developments can be identified. But let's zoom out first: The terms sustainability, green, circular, refurbishment and such are used a lot these days, correctly and incorrectly. But what do they mean? Exact definitions can be found in the glossary in the back of the report.

Long story short: to save our planet we need to live, consume and produce differently. In a more sustainable way than our ancestors did. Sustainable development is a term that refers to three aims: creating environmental quality, economic prosperity and social equity as benefit for current and future generations (Kirchherr et al., 2017). In the 'conventional' linear economy, a product is manufactured, bought by the customer, used and discarded when value for the user disappears. Resulting in maximum waste and a growing need for virgin resources. To maximize positive environmental impact a system-wide approach is defined: the Circular Economy. A system that replaces the linear 'end-of-life' concept with reducing, reusing, recycling and recovering materials in production/distribution and consumption processes (Kirchherr et al., 2017). The circular economy changes the whole economic system and circulates products at their highest level of value. The new circulating systems is producer-led but the consumers behavior becomes an important influence (Wastling, Charnley, Moreno, 2018). Important for manufacturers is to realize that circular business models also can enable economically viable ways to continually reuse products and materials, using renewable resources where possible (Bocken, De Pauw, Bakker, Van der Grinten, 2016).

A schematic representation of the circular economy developed by the Ellen MacArthur Foundation is shown in Figure 20. This left side is the biological cycle, for circularity in consumables. The right side shows the technical cycle, suitable for kitchens. On this side the loops should be read with a hierarchy, materials and products should be designed in a way that they keep as close to the inner smaller loops. Here the value loss is minimal (Bakker et al., 2014)

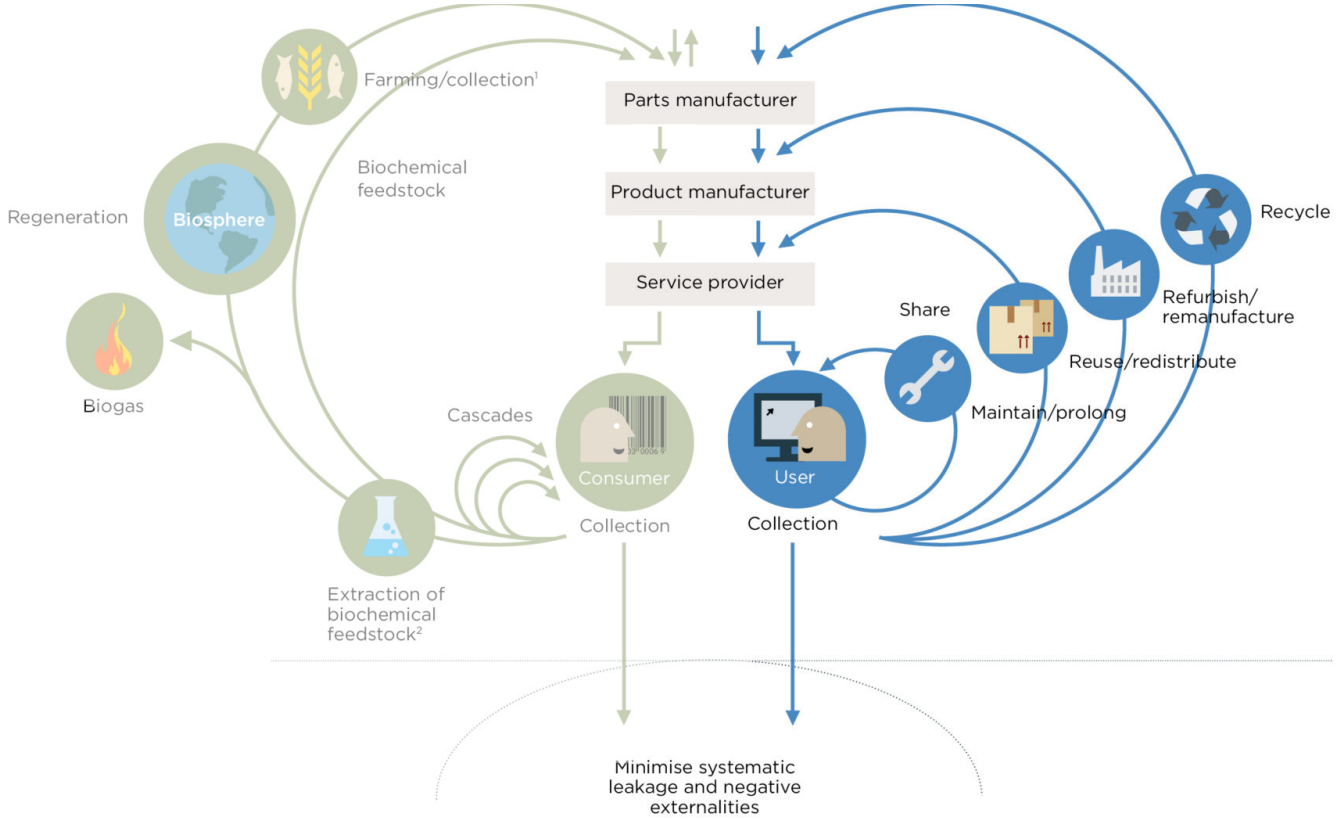


figure 20. the butterfly model, original is displayed in appendix 5 (Ellen MacArthur Foundation, 2019)

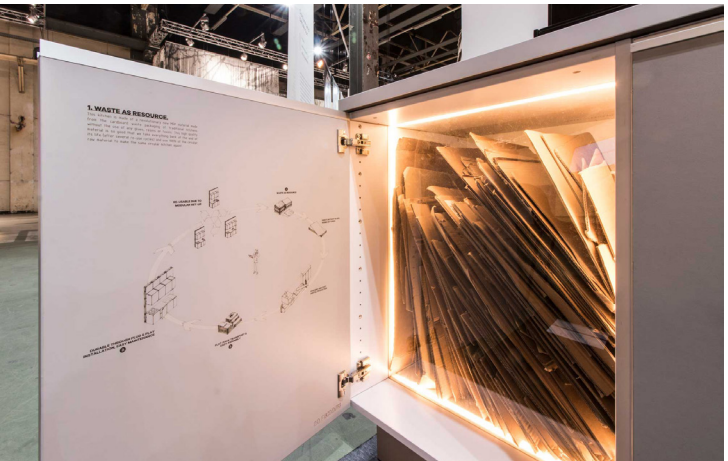
The shorter loops have the potential for maintaining the highest level of value with the minimum level of leakage. Leakage is something that needs to be minimized in a circular system. It can be defined as: products or their components/ materials that flow out of the system to the biosphere that cannot be recovered (Den Hollander, 2018).

A short analysis of the current developments in the kitchen market show that there are several approaches for a more sustainable kitchen. These approaches work on different levels at the same time. The approaches are circular kitchen production, appliance resource use and sustainable user behavior. These are explained in the next sections.

figure 22. IKEA's circular kitchen called kungsbacka

figure 23. Lendager's circular kitchen

figure 24. The New Makers & TRIBOO's circular kitchen



circular kitchen production

When orientating on sustainability in production of the kitchen there are several parties already trying to develop kitchens with a circular approach. It appears that 'a circular kitchen' still has a lot of interpretation-space. Some examples of companies that claim that they are developing a circular kitchen:

- Keller, a Dutch kitchen manufacturer who claims that they have optimized their kitchen production in a sustainable way. Reducing CO2 emissions and using production waste for energy. The circular component is that the old kitchen is processed into 'useful raw materials' (Keller, 2019). **Keller seems to lack a vision for adjusting their product or production to maintaining higher levels of value, the shorter loops in a circular production. When only focusing on recycling, the system is minimally circular with significant value drop and leakage. And ecologically seen the recycling is probably far away from being a closed loop.**
- IKEA claims to be on its way to become a fully circular business. They see sourcing recycled products as a starting point for incorporating circular aspects. An example for this starting point is the kitchen kungsbacka (IKEA Nederland, 2017). That is produced with recycled PET and wood as resources for the base material and laminate. For the future they are developing a circular supply chain and are trying to develop innovative production techniques (Figure 22) (IKEA,2017). **This last part seems to be very interesting, this is what is needed to make a circular product. It is good to start with recycled resources, because 'up-cycling' waste is still more sustainable than taking virgin material. But without thinking about the end of life of the KUNGSBACKA, the new product still has a relatively linear life cycle.**
- Lendager Group, is an architecture company that designed a kitchen that, in a collaboration with Dinesen (custom floor producer), uses the floor residue-material for re-purposing in a 'circular kitchen design' (Figure 23) (Reform, 2019). **This could be classified as recycling (or up-cycling) as well. Just like Keller there seems to be no intention to guide the process after their product left their doorstep, what makes the new product's life-cycle linear.**

image 21. a person separating organic waste to create compost

- The New Makers & TRIBOO, designed a modular circular kitchen with the focus on the material that is taken back and brought back in the system with minimal leakage (Figure 24). They use wooden material that is made from cardboard packaging and they guarantee to take it back at the end of it's life. They claim to use 100% of this material to make a new kitchen (TRIBOO, 2019). **This is an interesting approach, my question would be: how durable is this material? The energy and resources that are used in maintenance and replacement of the material, do they weigh up against the benefits? If the parts need to be taken back too frequently it could be a not so sustainable approach.**

appliance resource use

The resource use of the kitchen itself is something where environmental impact could be influenced. This would mean, gas, water or energy by parts and appliances. Within this project-context stakeholder ATAG would be responsible for this within the appliances in collaboration with the kitchen manufacturer Bribus. It is important to keep evaluating performance on LCA data to maximize positive environmental impact. As mentioned in 'expected environmental impact' (section 4.3) by offering circular and energy conserving appliances a lot of impact could be made on the appliance resource use.

sustainable user behavior

Also there is the sustainable behavior of consumers in the kitchen. The society is not yet equipped for kitchen-users to become fully circular. But there are already some guidelines for kitchen users to become as sustainable as possible. A kitchen user could improve his/her sustainable behavior by:

- Separating waste as best as possible while following local waste disposal guidelines
- Use resources efficiently (water, food etc.)
- Make sustainable material and food choices
- Use appliances efficiently (Bhamra, Lilley, Tang, 2011)

But a circular designed product does not automatically lead to sustainable use of the product. According to Wastling it is very important to keep the users behavior in mind when designing a circular system: “Products should not only be designed on how design principles allow products to fit within in a circular economy system, but also with how products fit within people’s needs, desires and patterns of behavior.” (Wastling et al., 2018). This indicates the relevance of this project withing CIK and that of the user research in chapter 8.

Conclusions and insights are discussed in the section ‘takeaways’.

takeaways

Since the focus of CIK and the graduation assignment is more on the circular aspects of the system instead of designing for sustainability, the topics on circularity are examined a bit more thorough.

These are the useful insights from this section:

- The shift for a circular system is producer led, but the consumer’s behavior is very important for a successful circular kitchen. This confirms the relevance of the service-side of CIK within the system.
- There are already other companies that produce circular kitchens. Among these companies different approaches can be identified. Compared to these ‘competitors’, CIK chooses to focus on making a circular kitchen with a modular approach to achieve a realistic, durable and adaptable product. As described in ‘design starting point’ (s. 5.2) the focus lies on viability and durability within a short time-frame. CIK has a vision to establish a circular supply system (just like IKEA and New Makers), which provides a relatively durable design and has the flexibility for improvements towards more sustainable choices. By combining these features, CIK could gain a competitive advantage, because none of the competitors includes a service system and/or are focused on the social housing market with the option to expand.
- For the circular kitchen it is good to facilitate and stimulate waste separation, efficient resource and appliance use, but the most important part is that the tenant is using and partaking in a circular system by following the system’s guidelines.

A general insight gained during the background research is that knowledge about consumer-behavior in the kitchen is very limited. In literature a lot is written about food contamination, cooking habits and cultural cooking differences. Knowledge about what people seek and value in a kitchen seems to be underrepresented. Specifically about tenants in social housing (in the Netherlands). This is researched within the user research phase in this project.

7 | design A

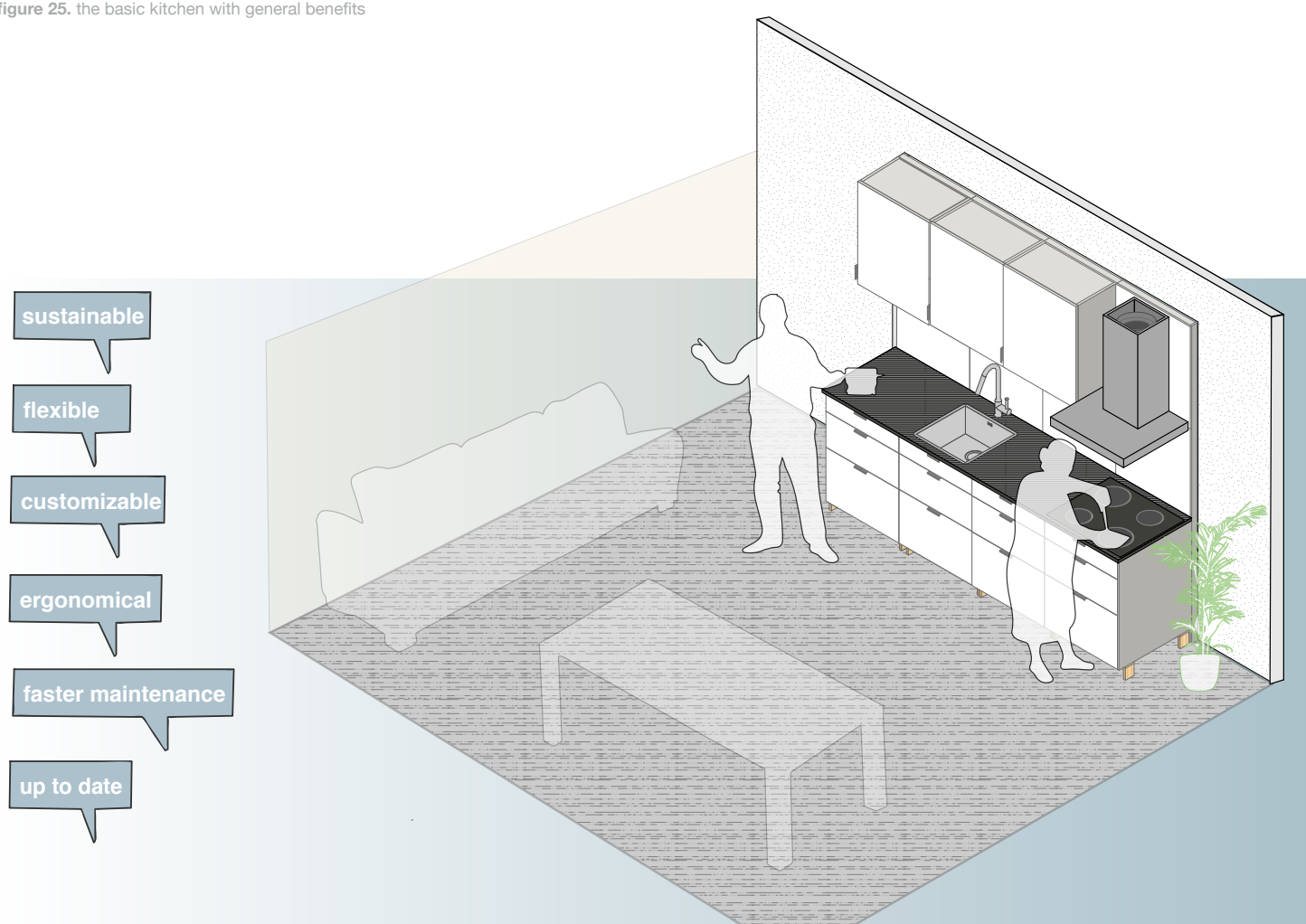
In this chapter the first steps in envisioning and realizing of the gathered information is done. CIK's design starting point and the first insights from of the analyses are captured in multiple visualizations.

This chapter is interpreted as a design step, but could also be seen a visual summary of the gathered insights. The decision has been made to call it a design because the information gathered at this point needed to be bundled and visualized. At this point nothing within CIK is absolutely certain and choices and assumptions need to be made. To make it suited to be evaluated in the next chapter: user research, this step was essential.

The main goal of the design A is to make the current design appealing a suitable for communication in user research. The user is visualized in the kitchen and the benefits and possible opportunities for the using are visualized for communication.

The following Figures show different aspects of the design from the side of the tenant, the service side as well as the product side. Figure 25 shows the basic kitchen in the most basic color and configuration. This will probably be the standard lay-out that tenants will acquire at home. The speech clouds on the side are the most important benefits of the kitchen presented as benefits that they can relate to.

figure 25. the basic kitchen with general benefits



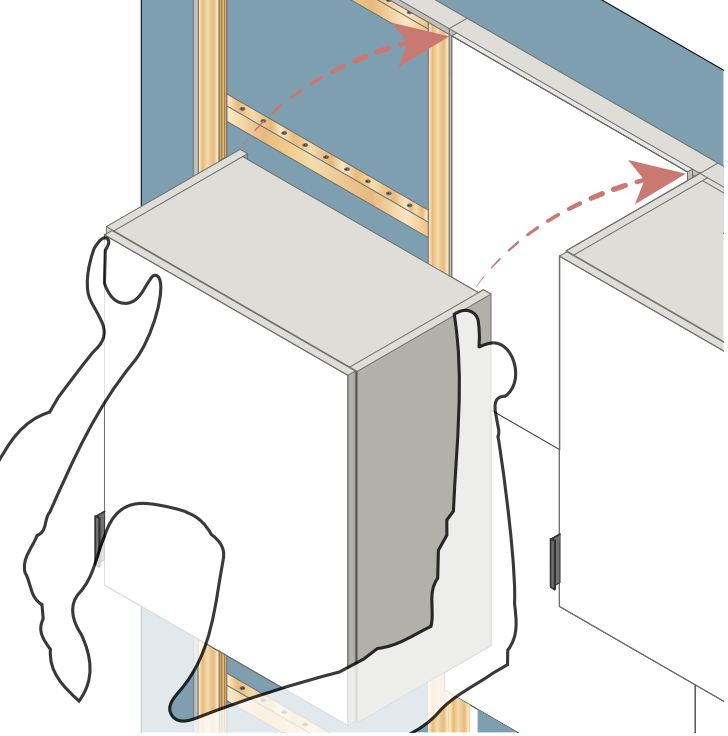


figure 26. attaching the modules

figure 27. basic kitchen with different configuration

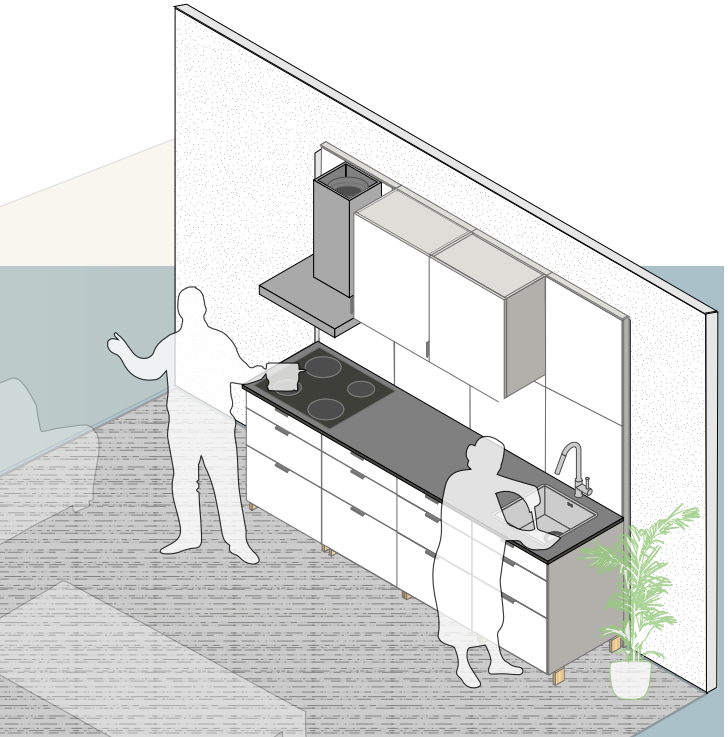
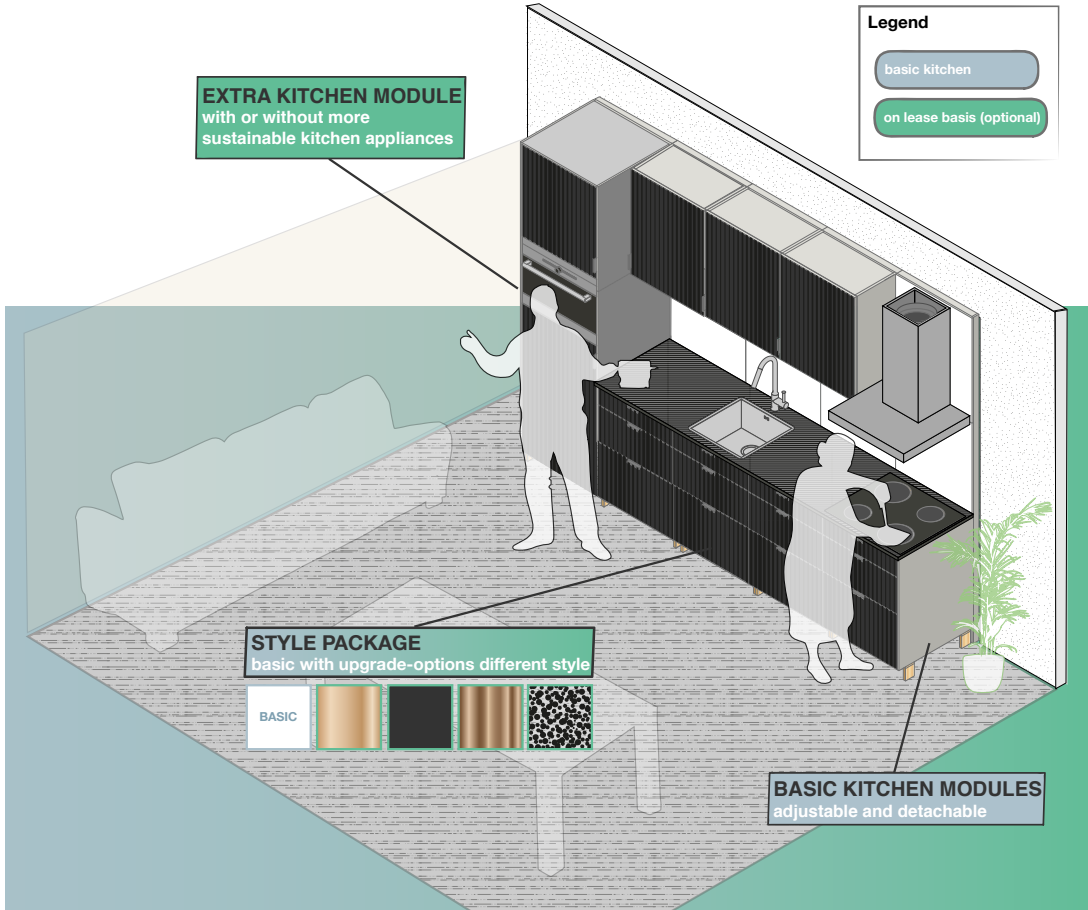


Figure 26 resembles the action to attach the modules to the docking station. It indicates the ease in repairing and the changing of parts.

Figure 27 shows the basic kitchen with a different configuration to show the flexibility and the possibility to change the kitchen within the same household.

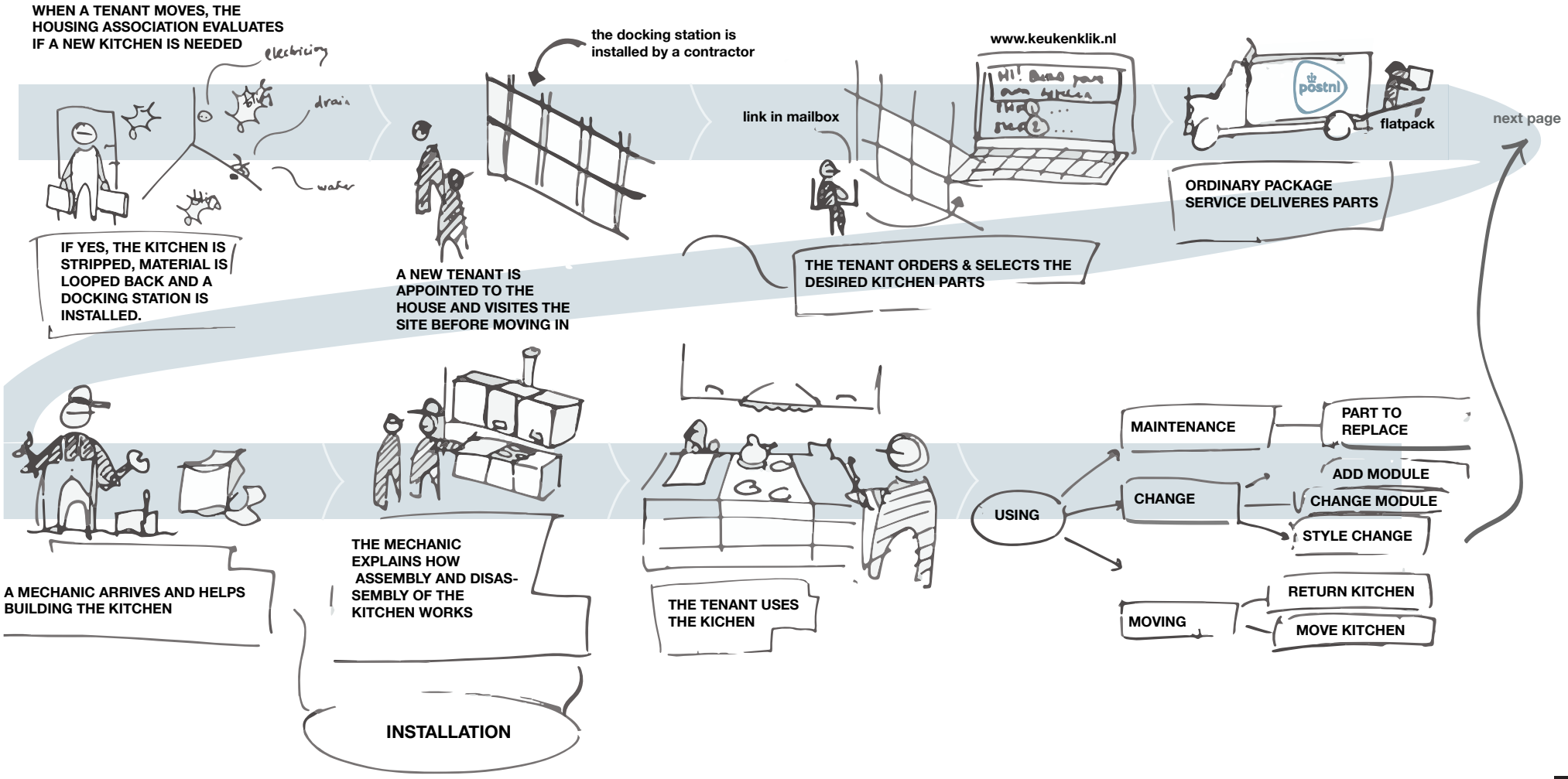
Figure 28 shows upgrades: lease options for extra modules or appliances in the same kitchen. This example shows a different style package, an extra cupboard module and an extra in-built appliance. The colors in the legend show that the kitchen is based on the basic kitchen.

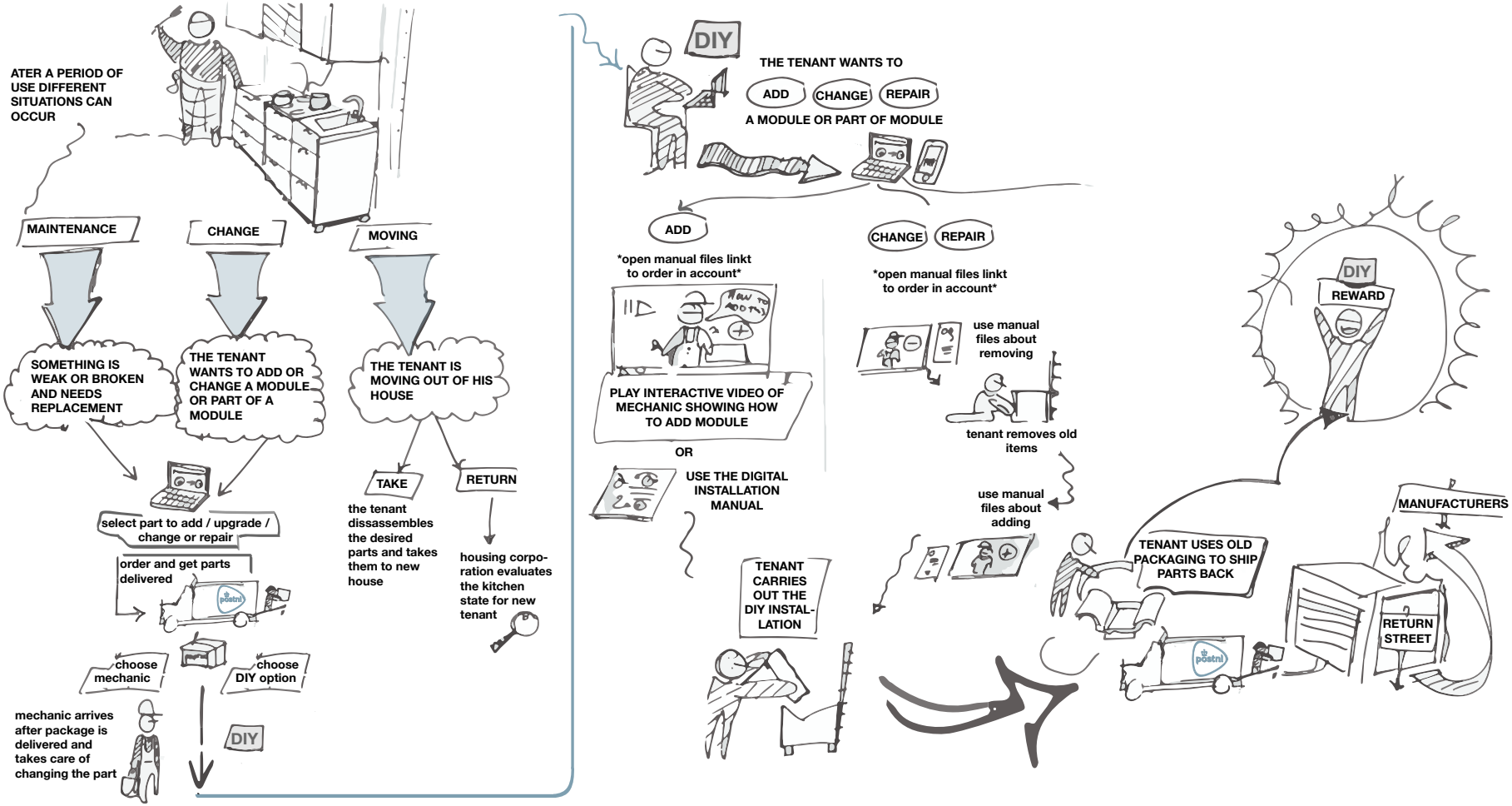
figure 28. basic kitchen with lease options



7.1 customer journey

During this phase a first sketch of a possible customer journey is created. This page shows the basis for the service design in the shape of a customer journey. The customer journey explains the possible steps if tenants would receive the circular kitchen with the design as given in design A. This design is iterated and refined in each design step.




ATER A PERIOD OF USE DIFFERENT SITUATIONS CAN OCCUR
MAINTENANCE
CHANGE
MOVING
SOMETHING IS WEAK OR BROKEN AND NEEDS REPLACEMENT
THE TENANT WANTS TO ADD OR CHANGE A MODULE OR PART OF A MODULE
THE TENANT IS MOVING OUT OF HIS HOUSE
select part to add / upgrade / change or repair
order and get parts delivered
choose mechanic
choose DIY option
mechanic arrives after package is delivered and takes care of changing the part
DIY
TAKE
RETURN
the tenant dissassembles the desired parts and takes them to new house
housing corpo-ration evaluates the kitchen state for new tenant
DIY
THE TENANT WANTS TO
ADD
CHANGE
REPAIR
A MODULE OR PART OF MODULE
ADD
open manual files linkt to order in account
PLAY INTERACTIVE VIDEO OF MECHANIC SHOWING HOW TO ADD MODULE
OR
USE THE DIGITAL INSTALLATION MANUAL
TENANT CARRIES OUT THE DIY INSTAL-LATION
CHANGE
REPAIR
open manual files linkt to order in account
use manual files about removing
tenant removes old items
use manual files about adding
TENANT USES OLD PACKAGING TO SHIP PARTS BACK
DIY
REWARD
MANUFACTURERS
RETURN STREET

8 | user research

For this project user research is conducted. The goal of the user research is to gain insights in challenges that emerge during the implementation of a circular kitchen with the current design.

8.1 method

Context-mapping is selected as the method for this research. The aim of context-mapping is not just to gain contextual information, but also to mold it into a form that is useful to design current day human-centered designs. This information should be rich and broad, but it is also important that it leaves space for the creativity of the designer (Visser, Stappers, Van der Lugt, 2005). As Visser et al. (2005) argue: “Conventional user study techniques, such as interviews, observations and focus groups, show explicit and observable knowledge about contexts”. These conventional techniques, have the limitations that they only offer a view on people’s current and past experiences, but don’t show anything about the future. To learn about possible future experiences, peoples’ dreams, fears, aspirations and ideas need to be included in the research (Visser et al., 2005). For the development of the Circular Kitchen information from the tenant’s kitchen behavior including future vision is needed. To get a good idea on what this means, context-mapping’s ‘generative sessions’ are used. The outcome will function as a basis for determining the angle of this projects design for the circular kitchen.

objectives

The generative session is set up in a structure as described by Sanders & Stappers (2012). After discussing and observing current day experiences, past experiences and memories are recalled as a creative trampoline to discuss future experiences of the participant. (Figure 29) When looking at the challenges defined in the ‘problem definition A’ (chapter 3) the following questions are formulated:

1. What does tenant’s current behavior look like in the kitchen?
2. How did tenants use their kitchen in the past? (habits/ learnings)
3. How do they see their future (dream)kitchen?
4. What do they think of the circular kitchen design?
5. How can the tenants be encouraged to cooperate in the proposed service system?
6. What do they think of circularity/sustainability?

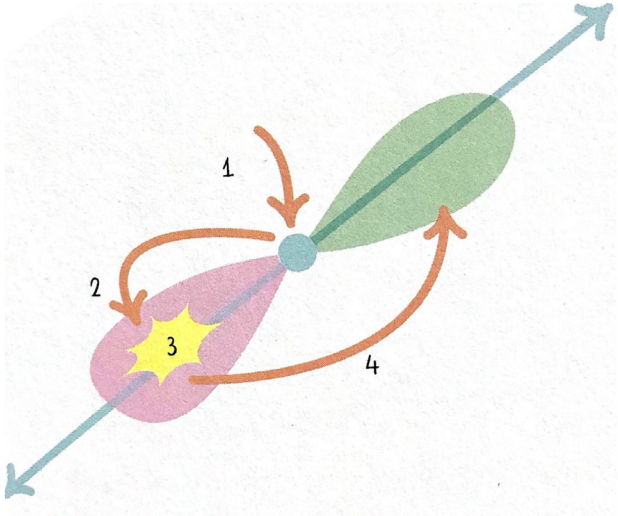


figure 29. the path of expression (Sanders & Stappers, 2012)

8.2 preparation

During the planning of the generative session participants needed to be recruited. As the method described the freshly recruited participants could be prepared for the session with a sensitizing booklet.

recruitment and sample

A combination of ‘opportunistic’ and ‘purposive’ sampling is used to find diverse participants (Sanders & Stappers, 2012). For recruiting participants, the personal network of the researcher and the network of a cooperating housing association from Eindhoven was used.

The selection of participants that serves as the representative for this research was based on multiple criteria with the aim of creating a diverse group. As mentioned in chapter 5: ‘stakeholder analysis’, the social housing population has a relatively low income in common. Because a very large variating user-group remains, a wide spread in other criteria is important. For generative design research sample size is small. So 10 people were selected. The selected respondents in the sample are all social renters in the Netherlands with a spread in life-phase (age), contract category, city-size and housing association. Figure 30 shows characteristics of the sample.

sensitizing

Sensitizing is the first step before a context-mapping session. It is used to immerse the participants in making observations and reflecting on the experience they have in specific domains (Sanders & Stappers, 2012). At home the participant feels free and relaxed and can focus on their feelings, attitudes and routines. It also enhances the quality and quantity of contributions that the participant will have in the generative session. For sensitizing a method is used from Visser et al. (2005), described as a diary. The sensitizing workbook is shown in appendix 8.

8.3 the generative session

The appointments for the sessions were made several weeks before the 'session-week'. The environment to conduct the sessions is chosen to be the home of the participants. This type of setting; 'the context of use' is chosen because it can function as a valuable source of information in mapping the behavior of the participant in the kitchen. Inspiration and the ability to place the session in context is easier when talking near this particular kitchen.

preliminary mapping

Preliminary mapping was done to reduce risk of projecting preconceptions on the participant, to help in formulating instructions and to get ideas for structures in analyzing results. A mind map was created to visualize knowledge on social housing and kitchen use (Visser et al., 2005). Shown in appendix 7.

content of the session

To answer the questions as described in previous section 'objectives' Sanders & Stappers (2012) approach is used; called 'the path of expression' (Figure 29). The path of expression can be used to help the participants express themselves, their dreams and give the desired insights into their experiences. This means starting in the now, current activities (1), then move towards earlier experiences (2) using a 'make-exercise' in shape of a collage assignment to help jig the memory (3).. Reflecting on those memories will help looking at possibilities in the future (4). After this the kitchen concept is discussed. (Sanders & Stappers, 2012) All these elements are present in the session.

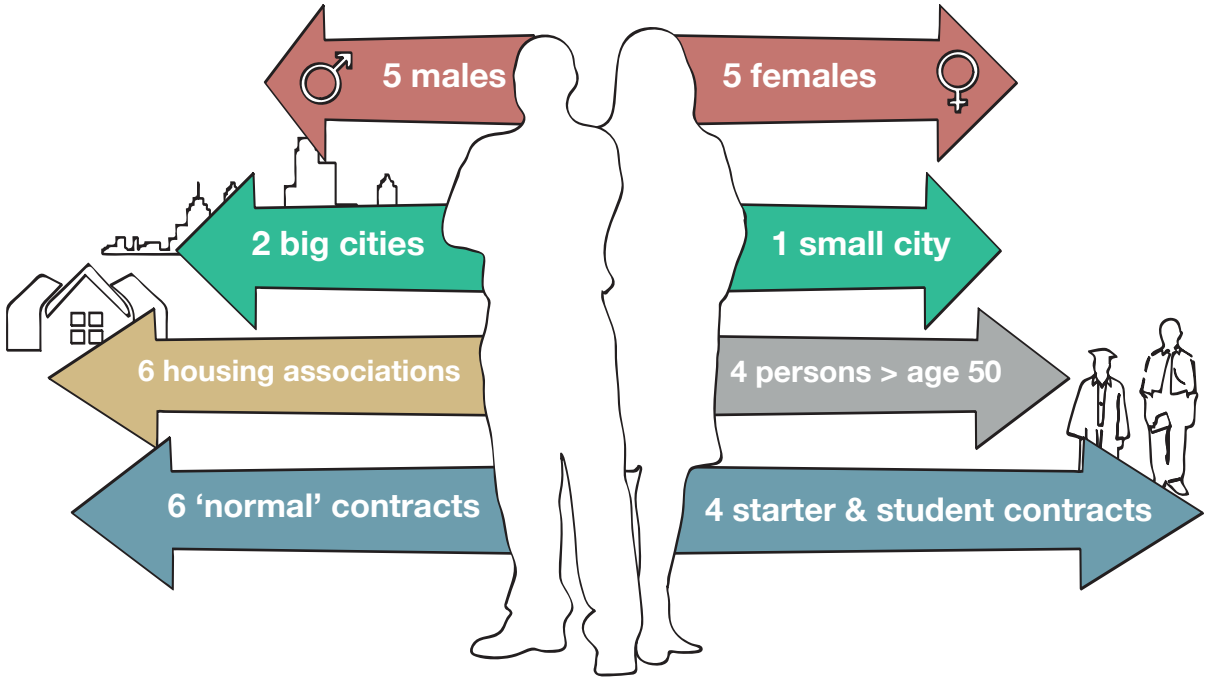


figure 30. info-graphic showing characteristics of the sample

figure 31. a make-exercise in the shape of a collage

Figure 31 shows an example of the collage assignment. For the fluency of the generative sessions a work-plan with script is created. This is shown in appendix 8.

8.4 analysis on the wall

After the sessions all the data was collected and analyzed. The goal of the analysis was to interpret the data, make comparisons to theories, search for patterns, to generalize findings to implement later and to find evidence for design decisions. A lot of different data is found because of the qualitative approach of the generative sessions.

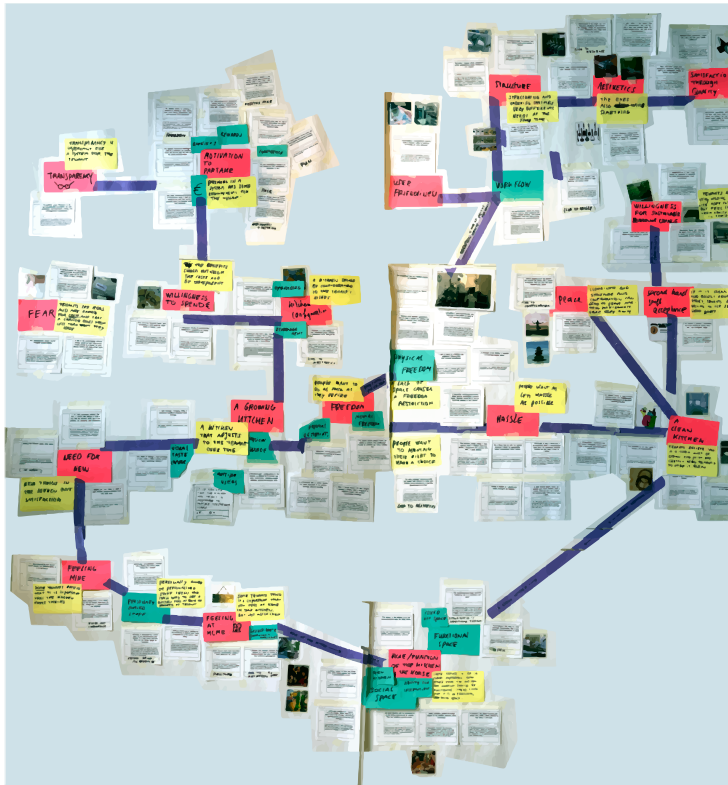
method & process

A method for analysis described by Sanders & Stappers (2012) is used for analyzing this data. Their approach offers several methods that differ in the way they handle diversity and levels of information. The selected method is called 'analysis on the wall'. This fits the project, the sample size and the research goal. This method should provide information and inspiration simultaneously. The most important drawback of this method is that it is not impossible to miss certain insights and that it could be time consuming. This should be taken into account while carrying out the analysis.

The process went through different phases, these are described in detail in appendix 9. The results are shared in this section. First the statement cards were clustered roughly in themes (phase 1, Figure 32), the themes were evaluated, recategorized and links in-between themes were found (phase 2, Figure 33). Then the researcher tried to find patterns, similarities and differences. This resulted in a framework to build conclusions. Then all these things were visualized for communication. More about this in the next section.

figure 32. clustering in phase 1

figure 33. (re-)clustering in phase 2 (enlarged in appendix 9)



8.5 findings and concepts

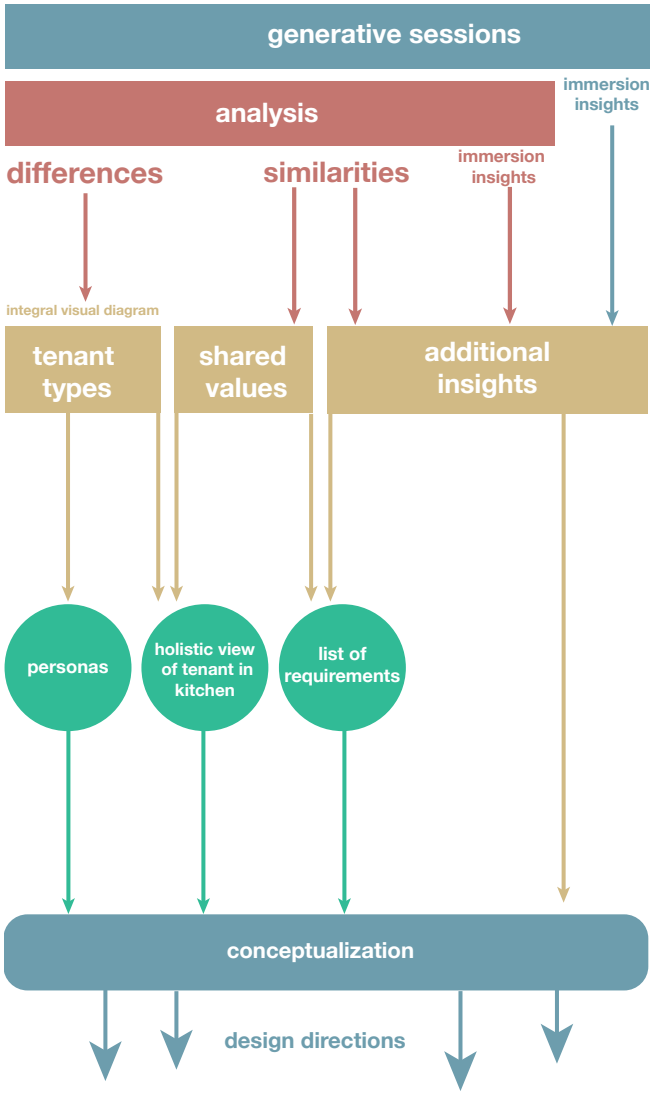
To bring structure to the theme-clusters and links, the method from Sanders & Stappers (2012) was used. The goal was to write a summary about every theme and to create an integral visual summary about the connection in between themes, shaping certain patterns. The findings are captured in these visual and textual summaries providing insights for the remainder of the project. Details of the process of pattern-finding is described in appendix 9.

The findings of the analysis are split up in different parts and are shown in Figure 34 (red parts). The first finding in the analysis is the existence of a pattern of parameters in which tenants have differences. The second finding are the similarities: values and things that are important for the most tenants.

With these findings different categories of insights were identified (the gold parts): a framework with tenant types, a overview of the values of the tenant and additional insights that came through by immersion during sessions and analysis.

The green parts are the tools where the insights are placed in to be helpful during the design process. These will be taken into the conceptualization phase where different design directions are created and evaluated to bring focus in this graduation project. These will be discussed in the next sections.

figure 34. visual summary of findings and continuation



tenant types; the tenant's differences

In this section the first insight-category is discussed. Different tenant types were found and they are framed in a framework that can be defined as an 'integral visual summary'.

During the 'Analysis on the wall' the main insight gathered was striking throughout the sessions as well: tenants differed fundamentally in their attitude towards their kitchen. On the one hand there was the more functional/practical camp and on the other hand a group of tenants that valued emotional factors, like the ambiance, looks in the kitchen and the feeling it gave them. Another clear distinction was the degree in which tenants wanted others to be part of the kitchen. Tenants differ from each other in the degree of certain parameters: emotional vs functional and social vs individual. This theory is visualized in a framework that is shown in Figure 35.

When placing the sessions participants on the graph, they show a good spread. This could mean that there was a good characteristic spread within the sample. It could also refer to the fact that the framework is defined from their insights.

personas

The framework in Figure 35 shows each section of the graph showing the main characteristics of each tenant group. This acts as a base for making personas (Figure 36, enlarged in appendix 10). The method described by Van Boeijen, Daalhuizen, Van der Schoor, Zijlstra (2013) is used. These personas are used as tools in designing the customer journey map later in the process.

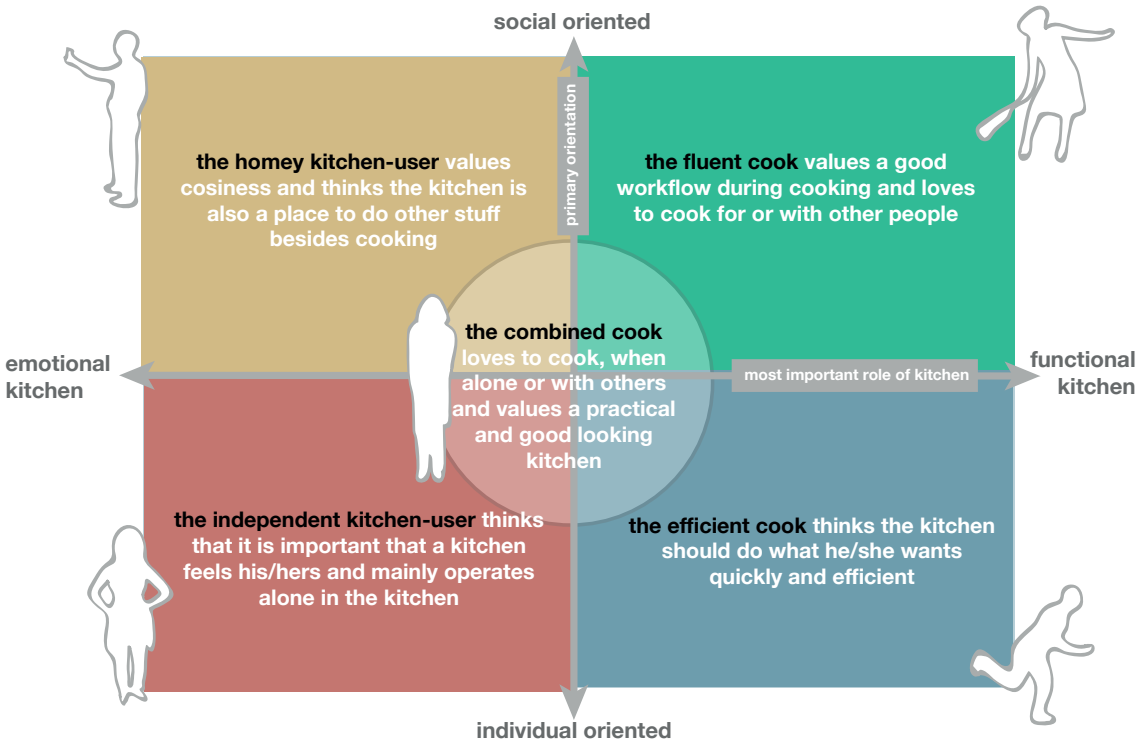
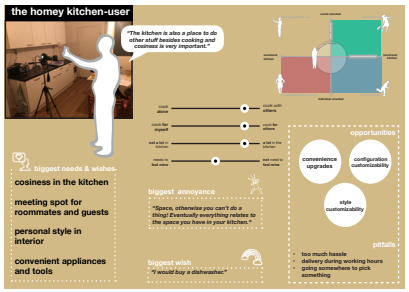
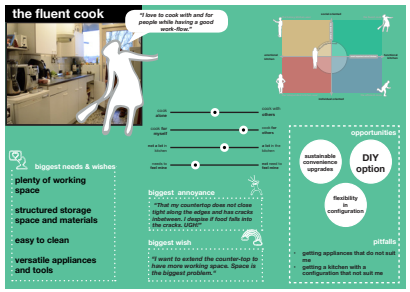
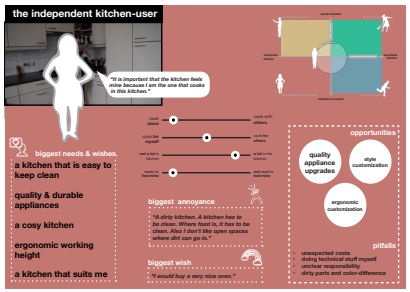


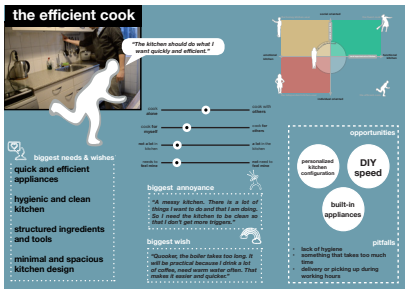
figure 35. the framework showing different tenant types

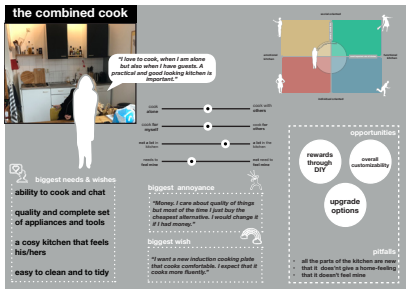
figure 36. the personas derived from the tenant types (enlarged in appendix 10)











shared values; the tenant's similarities

As shown in Figure 34; an insight-category found was that of shared values among tenants. These are explained in this section.

During the clustering process certain themes are identified as primary values: the most important values for the tenants. These themes were named the most frequent by the participants and had most links to the other themes. The primary values are shared values across multiple tenant types. Also, secondary values were discovered. These are important for all the tenant types but less prominent.

The primary and secondary values are displayed in Figure 37. As primary (key) values are identified: 'a clean kitchen', 'as little hassle as possible' and 'freedom of choice'. 'Structured supplies and tools', 'motivation to partake', 'help when restrained', 'worth the money' and 'space to work' were seen as secondary values. The secondary values are also forthcoming in the research but less interlinked with other themes than the primary ones.

The detailed description and summaries of the themes can be found in appendix 9. How these values will be used in this project is described in the conclusion of this chapter.

holistic life view

The next page shows a visual summary of the user research in the shape of a 'holistic life view' this is a tool for communication of the results from the user research.

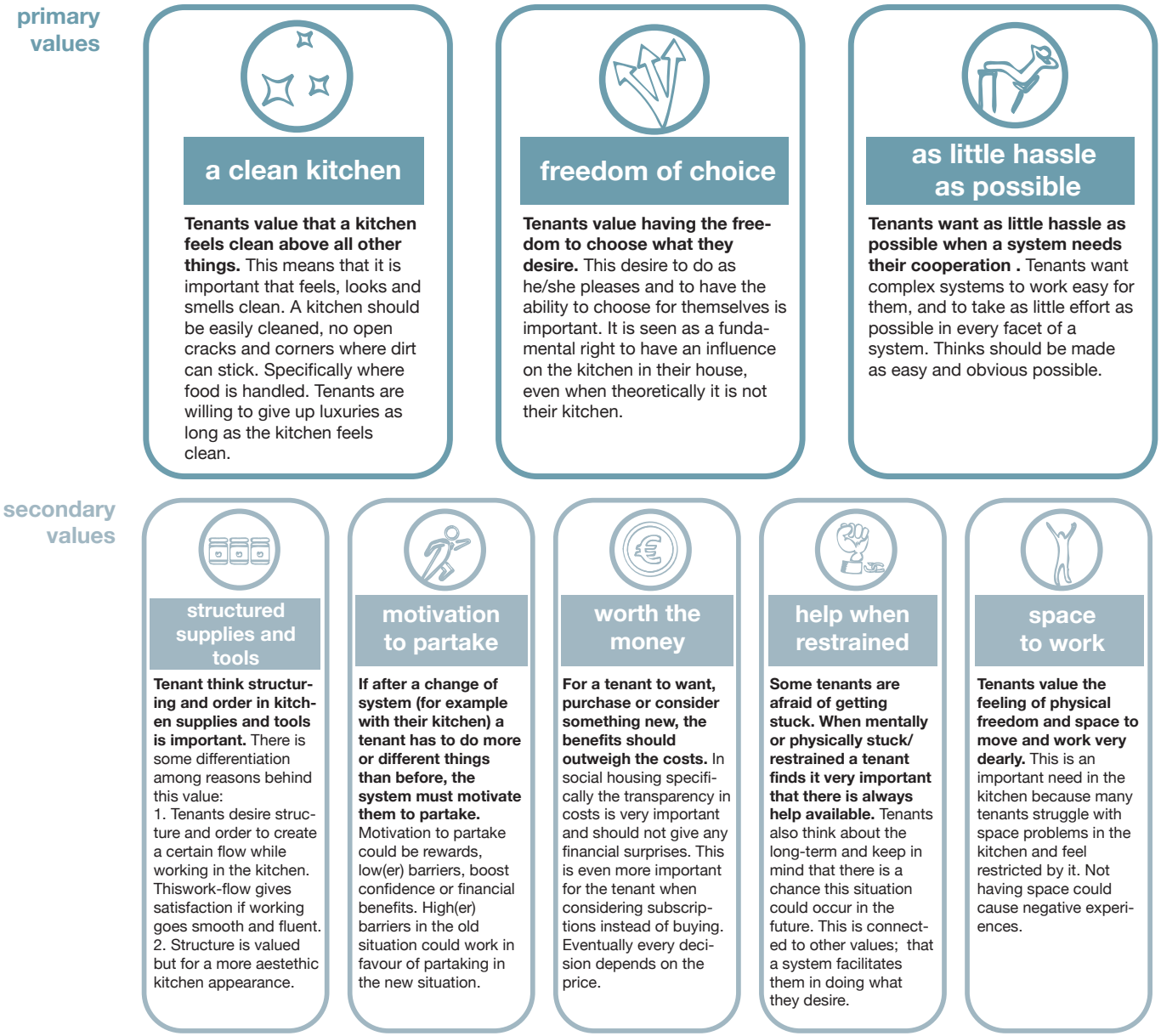
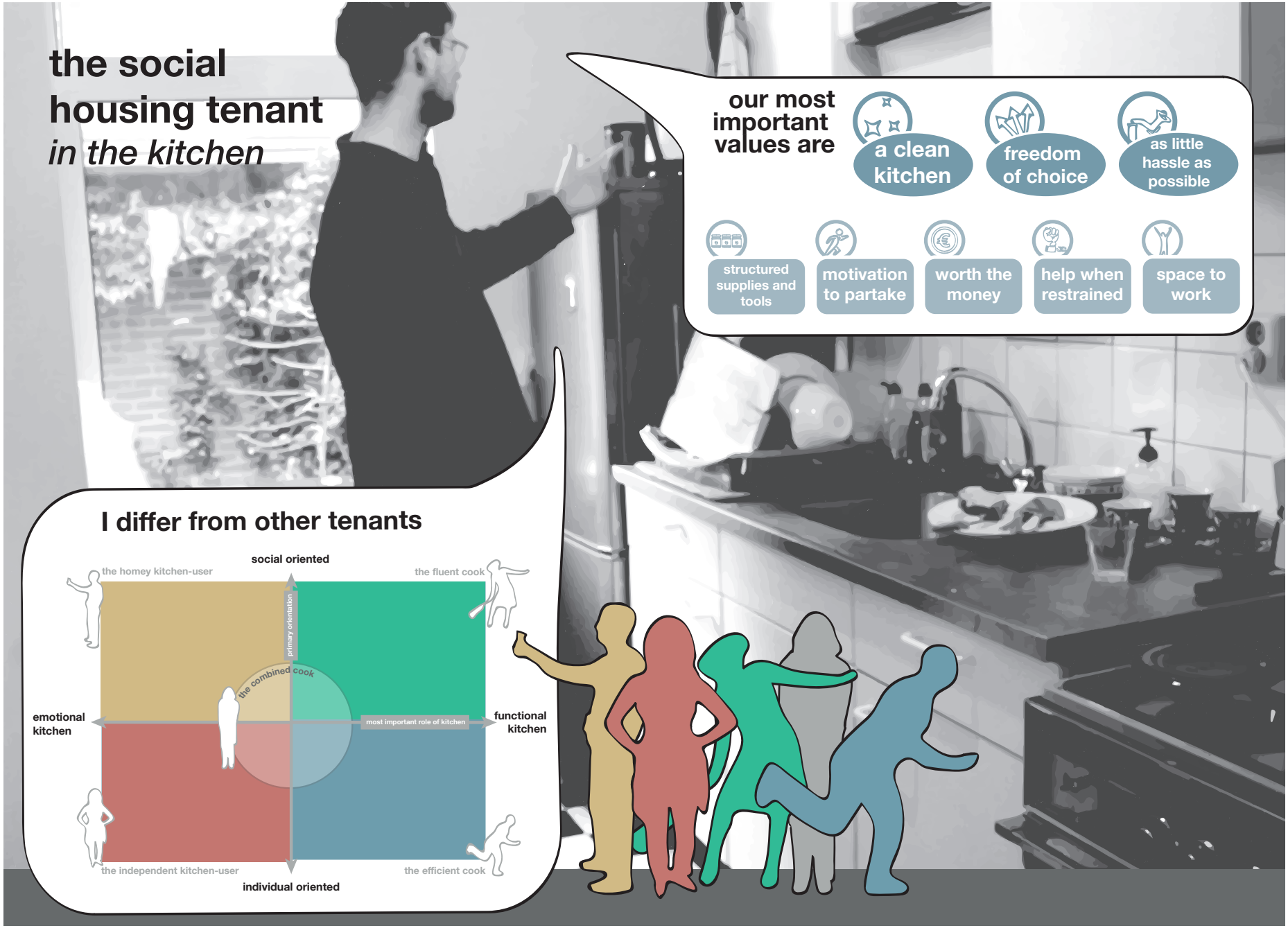


figure 37. the shared values found including description

the social housing tenant *in the kitchen*



additional insights

Beside the differences and similarities among tenants, other insights are found during the analysis (Figure 34) These insights are categorized as additional insights and can also be used in the remainder of the project.

They are insights that could not be placed in the other categories but seem to be this prominent that they need to be considered regardless of the direction in which this project heads. Some came through by pattern-finding, others came through by immersion during the sessions and analysis.

through pattern-finding

- Participants experience risks and will become reserved when they are part of the implementation of a new (service) system. In their experience this could be overcome with simple and clear communication.
- There is a group of tenants who think it is important that the kitchen feels theirs and some think it is important that they feel at home in the kitchen. In future design and decision making this should be considered: flexibility in the ability of placing/taking your own stuff would be a plus. Customizability is a good idea for this user-group.
- Aesthetics and quality are valued highly by participants. This should be kept in mind in future decision making. Something that is hard to realize for social housing, but it could be used to create (tenant) satisfaction. And satisfaction could create engagement.

through immersion

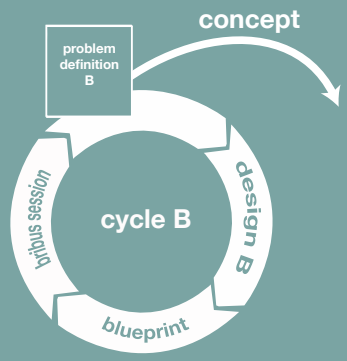
- Some tenants mention a strong willingness for sustainable behavior. Specifically the younger participants. They mention the desire for tools and information to change their behavior to act more sustainable.
- Some tenants mentioned a strong desire to get new things, but if they would get the chance to tweak small things with their existing stuff, they think they might get the same feeling. A solution could be providing them with something that is not new, but new to them. If the system would use second hand parts in a way that the tenant gets something new or extra, that would be an interesting opportunity, according to the tenants. But, a crucial condition for this to work, for them, is that the parts should be clean.
- It is important for tenants that they should not have to do ‘business’ with a commercial company for a basic need. A kitchen is part of the real-estate and feels like a basic need.
- DIY-installation of parts by tenants themselves might stimulate that the kitchen feels more like property of the tenant. This can stimulate product attachment and better care for the material, making the product last longer.
- Multiple tenants mention that there feel a barrier in staying at home for mechanics to come by. This could work in advantage for engaging tenants to do DIY repairs themselves. Multiple tenants claimed to be annoyed by the large visiting time slots of mechanics, the poor reliability and punctuality of the mechanics.
- Multiple participants stated that they are very interested in efficient kitchen-gadgets and tools to efficiently structure and store things in their kitchen. This could be an option in a module or a reward for DIY for CIK.
- The majority of the participants stated that flexibility by a modular kitchen is a very good idea. They specifically like the benefit of flexibility and ergonomics and claim this could function as a motivation to cooperate.
- The option for built-in appliances and minimal design is something that some tenants would value dearly.
- Drawers instead of conventional cabinets is something that the majority of the participants conceived as a very good idea.

takeaways

The most important insights derived from the user research will be used in continuation of the project. These are summarized in the next chapter along with all other conclusions and insight from this research so far.

cycle B

The second iteration is cycle B. All new knowledge retrieved from the user research is framed and new design activities are started, an integral concept design arose and is visualized in a service blueprint, at the end of cycle the idea is validated by a evaluation session with a major stakeholder.



9 | problem definition B

This is a redefined version of the problem definition as stated earlier in the report. While taking all new information into account the aim of the project is made more specific. The italic parts are parts of the problem definition that are the same as the previous version.

The learnings from the cycle a are used to refine the problem definition. All stakeholders and specifically the tenant is investigated, the projects context and theoretical background is researched and the product-system itself is investigated. The learnings are implemented in the previous problem definition to make a new one. The learnings are implemented in the LOR as well. These will function as guidelines in the next cycle.

what is the problem?

The problem where this graduation assignment flows out of is the fact that the changes that the circular system and the modular design could bring possible tensions with the end-user, the tenant.

While investigating the tenants behavior, the kitchen itself isn't changed much over the years. Slow changes are apparent, especially in social housing. This could make the changes for the CIK kitchen a little bit harder to implement and the motivation for cooperating should be sought. Also, kitchen users showed that they have very different ideas about their role of the kitchen, this is something that is investigated in the user research. This should be taken into further design and decision-making: the kitchen users variate in the degree of emotional vs functional role of the kitchen in their experience, but also in the degree of individual or social orientation (Figure 38). When looking at similar circular product-service systems it appeared that these can bring forward the fact that the user is a lot less careful with the product than with self-owned products, this could cause problems, and the tactics to overcome these should be taken into the next cycle. An insight about competitors in the circular kitchen market is that direct competition is still quite absent, multiple parties are also developing what they call circular kitchens, but they work from very different angles. Considering this, it is good for CIK to implement this system on the scale that they're planning and possibly even look at possibilities in the consumer/international market. Also from user research with the tenants several shared values came forward: tenants need a clean kitchen, want as least hassle possible with a new system, get the feeling that they have the freedom to choose, are able to get a structured and organized kitchen, be motivated to partake in a system, what they get should be worth the money, they need help when they are stuck and within the kitchen they value space to work very dearly.

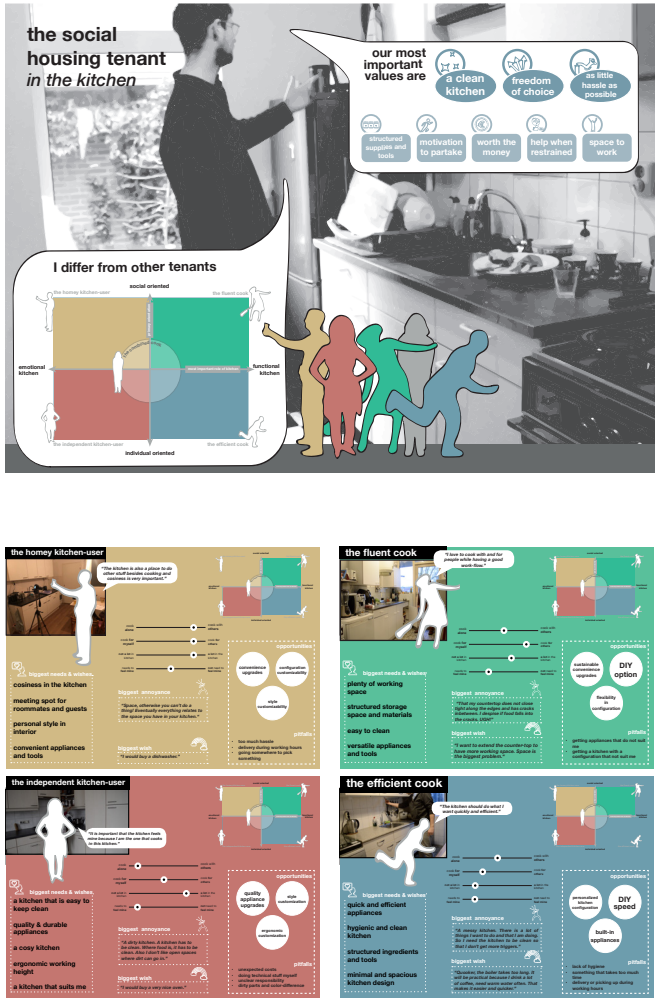
So the expected tensions that needed to be found in the initial problem definition would mainly be that the tenant has a pretty big responsibility in making the circular system work and that the tenants values need to be included and themselves need to be engaged by the system. The initial problem definition can be redefined: For the circular system to work and to get the tenant to cooperate in the system, the tenant needs to be engaged via the service side of the CIK system. *If this problem isn't solved, this could lead to unintended use of the kitchen by the tenants and could influence the system in this way that is less sustainable than the normal kitchen.*

who has the problem and what are their interests?

The main problem-owner are the initiators of CIK, the joint forces of the TU Delft that work from an academic point of view. Their primary goal is to build a functional circular system with a market ready product to demonstrate the possibilities and to seduce industry to change on the longer run. When looking at the problem, it would be in their interest that the tenant is cooperates optimally and is engaged to make the service system work.

Because this project is a collaboration of multiple stakeholders, and when only looking at one stakeholder the system will not work; there are multiple problem-owners. They have different goals and interests within this project.

figure 38. holistic life view and personas



This makes that multiple problems could be identified and an integral approach needed. The exact problems and interests for these parties are investigated and turned out to be the following: the kitchen manufacturer wants to implement more environmentally responsible ways to produce their kitchens and wants to gain insights and partners by collaborating in this project. The housing associations most important interest is that the kitchen is scientifically assessed a more durable/circular option while not having a higher total cost of ownership compared to a conventional kitchen. The tenant wants a working kitchen that is in line with their needs, values, personal perception of role and social orientation.

Since the main problem owner are the initiators from the TU Delft, and in their interest this project will still focus from a tenants point of view and so how to engage them in the service design while implementing the other stakeholders.

what should be avoided?

On the one hand it should be avoided that not more tensions/ frustrations/problems should arise with the tenants that makes the circular system harder to implement. On the other hand it need to be avoided that the stakeholder interests are aligned in this way that a collaboration is not possible or beneficial for the circular system.

This project will focus on the service side. On the service side there are certain changes that the circular system will bring compared to the 'conventional' social housing kitchen. The problem is still that on the service side there are certain changes that the circular system will bring compared to the 'conventional' social housing kitchen. These changes are not noticeable with all stakeholders but specifically on the human component. With the social housing tenant there will be some challenges on the B2C side of CIK. This need to be solved in a design. In the next cycle there will be focused on how this service looks in a concept design and how it engages the tenant while keeping all the other stakeholders interests in mind. At the end there will be an evaluation by the kitchen manufacturer on the concept design. From there a new iteration will be done in the last cycle.

list of requirements

As the introduction to the list of requirements in chapter 3 mentions, the abstracted LOR criteria are placed after each cycle and are updated with new information. What exactly the content means is illustrated by Figure 39, in a requirement template. The list is divided in two categories: demands and wishes. The demands are concrete requirements and wishes are requirements that should be met as best as possible. These can be used for evaluation and decision making among alternatives.

system boundaries

When considering the aim of this graduation project based on problem definition B, the system boundaries are determined. The design focuses on the service side of the design from a tenant point of view and the kitchen itself, the circularity of this and the whole project outcome can not be influenced with only this part of the design. The requirements that are found during this project and can not be influenced will be named, but not taken into evaluation of the design. These are displayed in Figure 40 as lists with the red borders. These are named to indicate their relevance and to provide guidelines for further development by CIK or the other parties.

further function LOR

The demands and wishes that are within the system boundaries, will be taken into account and used to evaluate choices and make a decision. Since cycle A was not a full design cycle, the design could not be tested yet with criteria. The validation was done by the user research and the conclusions implemented in problem definition A. Then the requirements in the LOR could be abstracted for a more specific purpose. In the next cycle, the design result will be tested and evaluated with use of the LOR.

figure 39. legend list of requirements

legend

Requirement Examples

D0.1 <content of the demand> - (<source> (<stakeholder>))

W0.2 <content of the wish> - (<source> (<stakeholder>))

Source Abbreviations

PDA	Problem Definition A
DSP	Design Starting Point
STA	Stakeholder Analysis
BGR	Background Research
UR	User research
PDB	Problem Defintion B
SCE	Stakeholder Concept Evaluation
HA	Housing Association
T	Tenant
KM	Kitchen Manufacturer

figure 40. overview of the list of requirements until so far

1. general

Demands

D1.1 The service side is designed with an user (tenant) - centered approach. - (PDA)

D1.2 CIK should be able to be market-ready in 2022. - (DSP)

Wishes

W1.3 CIK should appeal professionals and residents to grow interest and contribution to other circular components in the built environment as much as possible. - (DSP)

W1.4 The product service system should be as sustainable possible by using a circular approach. - (DSP)

2. stakeholder interests

Demands

D2.1 The design is adaptable for expansion on industry partnerships. - (STA (HA))

D2.2 (In)Direct costs for the tenant should be equal or lower than a conventional kitchen with self-owned material. - (STA (T))

Wishes

W2.3 The interests of all stakeholders should be taken into account as best possible. - (STA)

W2.4 The new system should cause the least problems for the tenants as possible compared to the 'conventional' kitchen. - (PDA)

W2.5 The system engages the tenant to cooperate as much as possible. - (PDB)

W2.6 CIK should be as desirable, feasible and viable for all parties involved as possible. - (DSP)

3. service & system

Demands

D3.1 The cost for upgrades for the tenants should provide significant value for money. - (UR)

D3.2 The system can also be used by physically/mentally disabled tenants. - (UR)

D3.3 The system also works when tenants bring their own appliances into the kitchen (that are not part of the real estate). - (UR)

D3.4 When using/rotating second hand parts, the parts should appear clean and tidy, (looking almost new, while not being it). - (UR)

D3.5 CIK always gives the opportunity to get help when stuck or restrained in communication with the system. - (UR)

D3.6 CIK offers the option for acquiring built-in appliances. - (UR)

D3.7 CIK offers several opportunities for improving the level of sustainability of the behavior of the tenant in the kitchen. - (BGR)

Wishes

W3.8 CIK motivates the tenants to partake as well as possible. - (UR)

W3.9 CIK offers simple, clear and transparent communication as well as possible. - (UR)

W3.10 The design should give the idea of freedom of choice as well as possible. - (UR)

W3.11 The tenant should partake as actively as possible in the circular system. - (BGR)

W3.12 The rented, leased or shared products/parts should be handled with the best care possible. -(PSS)

W3.13 The loss of comfort, convenience and the experience of ownership, that increases with a 'shared' (compared to an owned product), should be compensated as well as possible - (PSS)

W3.14 The impression of having control over their (not) belongings should be given to the tenant as much as possible. - (PSS)

W3.15 CIK should stimulate in improving the level of sustainability of the behavior of the tenant as much as possible. - (BGR, UR)

W3.16 CIK should boosts confidence as much as possible. - (UR)

W3.17 The system should stimulate as much as DIY installment as possible (to stimulate product attachment and positive LCA score) - (UR)

4. outside system boundaries

Demands

D4.1 Tenant-satisfaction level while implementing CIK should stay equivalent or higher than with the conventional kitchen. - (STA (HA))

D4.2 The product-service system should be scientifically assessed and have less negative environmental impact than the conventional kitchen system. - (DSP, (STA (HA)))

D4.3 The kitchen must be safe, hygienic and 'vandal'-proof. - (STA (HA))

D4.4 CIK's quality should be equivalent or higher than the 'conventional' kitchen. - (STA (T))

D4.5 CIK should adress the user's fundamental differences in values in kitchen behavior - (BGR)

D4.6 CIK should have the adaptability for improvements towards more sustainable (material) choices. - (BGR)

D4.7 CIK should have a clean appearance - (UR)

Wishes

W4.8 CIK should be adaptable for adding of smart technology in the future as best as possible. - (BGR)

W4.9 CIK should have an equivalent or lower total cost of ownership than the conventional kitchen for the housing association - (STA))

W4.10 CIK should be easy to maintain clean as well as possible. - (UR)

W4.11 CIK should be adjustable to changing style aspects in the future. - (BGR)

W4.12 CIK should be as aesthetic as possible. - (STA (KM))

W4.13 CIK should provide as much of working space as possible. - (UR)

W4.14 CIK facilitates as much as efficient structure and ordering in the kitchen as possible. - (UR)

10 | diverging towards design B

A diverging phase is passed to find solutions for problem definition B and to give a direction to the project. While doing an ideation, this resulted in multiple ideas for directions. These are shown in appendix 11.

10.1 decision on direction by using the LOR

This decision was planned to be based on the LOR, but next to the relevance of the LOR on this decision, other criteria also played a role. These criteria are the master-specific learning objectives and CIK's lead-designers (CIK's) opinion on the direction (CIK-designer: "Designing a service is the most valuable to us." (Jansen, B., Personal communication. Supervisory meeting, January 24, 2019). When taking all these criteria in mind it appeared that the all of the idea's were short-coming and too limited, the concept to create an integral service design was the only idea that hold up and became the selected direction.

The selected design direction describes the development of the so-called B2C side of the business-model of CIK (shown in design starting point, section 4.2). Within this direction the other insights from user research will be used. In the next chapter the design direction is developed into a detailed service concept that will be evaluated at the end of this cycle.

11 | design B

Design B is a concept that is based on the gathered information in the process until this point. In this chapter the concept will be explained. The concept goes by the name CIK, ‘jouw persoonlijke keuken’.

the concept

CIK ‘jouw persoonlijke keuken’ is a service design that incorporates an approach where the tenant feels personally addressed. This vision is based on the finding that people treat leased products with less care than products of their own. User research showed that some social renters have the tendency to call their rented kitchen theirs. Especially the emotional type tenants that had the opportunity to do personal changes in their kitchen. This concept makes use of this; by creating a personal bond between the tenant and the kitchen the tenant uses the kitchen with more care and shows less ‘vandal’-behavior. Since this project is aimed to create a kitchen for life, this might be an important contribution. The personal approach should be implemented in all levels of the service-system. By embracing this personalization it will create a personal feeling for the product.

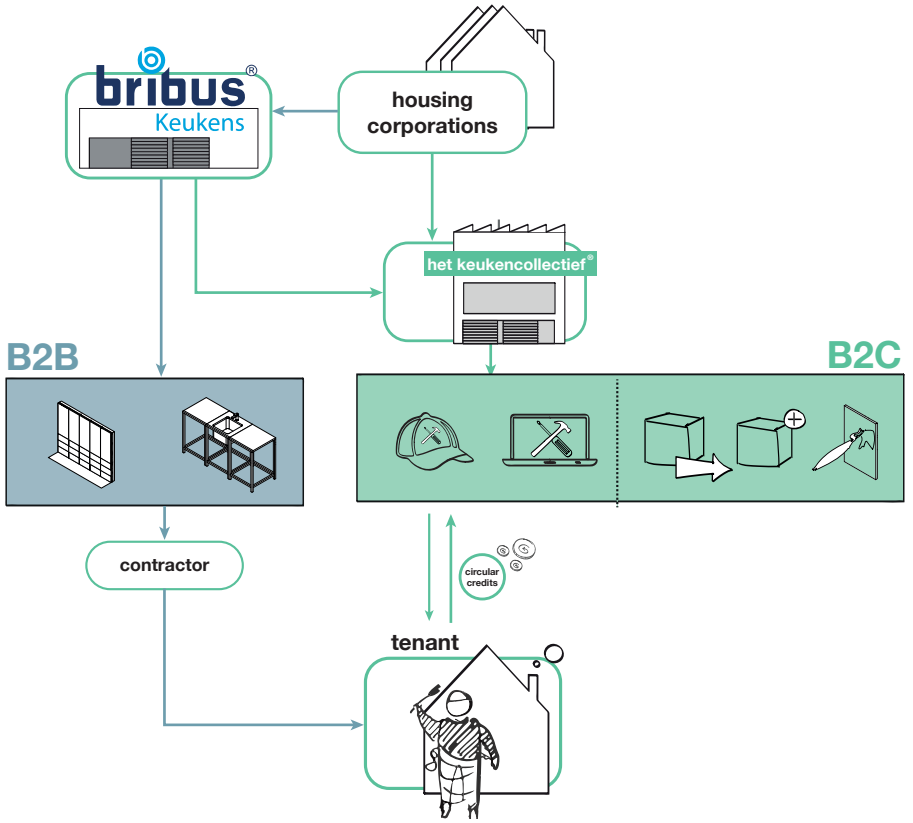


figure 41. the business model for design B

the product-service

This concept is a product-service system with a business model that is divided into a B2B side and a B2C side (Figure 41). A new party is introduced that is called the ‘Keukencollectief’. This party is an intermediary in the system, this is a company responsible for smooth guidance of the system. KC (het Keukencollectief) is also responsible for good collaborations between the stakeholders. Bribus is the party that is responsible for the production of the kitchen itself.

B2B

In the B2B side the basic kitchen will be directly delivered by Bribus. Local contractors are hired to prepare the residence and install the docking station. When the docking station is installed, the contractor, a handyman from the housing association or a Bribus assembler installs the basic kitchen parts. Based on logsitic efficiency and arrangements with the housing associations. This process is guided by the keukencollectief.

B2C

The B2C is where the interactions with the tenant take place. Keukencollectief is the face that provides the tenant with CIK. Without a good relationship with the tenant, a kitchen for life is not possible. Via B2C a maintenance service is arranged, where an assembler can be called, someone who can help with technical issues, installation or maintenance. And for the handy tenants: it provides a platform that provides the tenant with the means to do repairs themselves. The B2C side also provides the tenant with the means to make the kitchen even more personalized: make layout changes, add extra modules

or order a style change. These are called upgrades.

why keukencollectief?

Het keukencollectief was put into the system because in the user research the tenant showed a need for not doing business with a commercial feeling party about a product that is part of their home. Something they have a fundamental right to. Also there is the fact that there are a lot of parties in the system that operate on different levels. To make this work fluently, a new party needs to be introduced that takes on responsibility and guides interests in this process.

11.1 the product

The product is a basic kitchen with the facilities to make it yours, to personalize it and to upgrade.

The standard is a basic kitchen with 3 high-cabinets and 4 lower cabinets, white finishing, neutral grips, sink, extractor hood and induction cooking plate. (Figure 42) The basic kitchen is as simple as possible, with the core necessities that are needed to enable the tenant to use his/her kitchen in a sustainable way.

Research indicated that the housing associations think it is important to have the opportunity to change/expand the basic kitchen layout themselves. Changes to the basic kitchen could also be provided via the B2C side. When a housing association wants to provide something that is different from the basic kitchen, it can be arranged through this channel.

upgrades

The system also facilitates upgrades for the tenants. The exact possibilities are shown in Figure 43. The tenant can add extra cabinet modules, add built-in energy/resource efficient appliances, add modules or change the style package.

For style packages there is limited but sufficient choice. A middle way between the housing associations that want to offer a great amount of choice and the ones that want to make it as simple as possible. The offer should be sufficient while giving the tenant the impression that he/she has the freedom of choice, that was indicated as very important for the tenant in user research. This is also beneficial for the comprehensibility of the rotating stock and supply chain. But technological innovations to change colors could change this offer in the future.

The offer in energy/resource efficient appliances is added in the upgrade possibilities. Tenants show a need to contribute to a better environment. If you make this visible and let the user feel that they are contributing to a circular kitchen, the message and purpose of the new design is conveyed more visibly. People might be better aware why a circular kitchen is what it is.

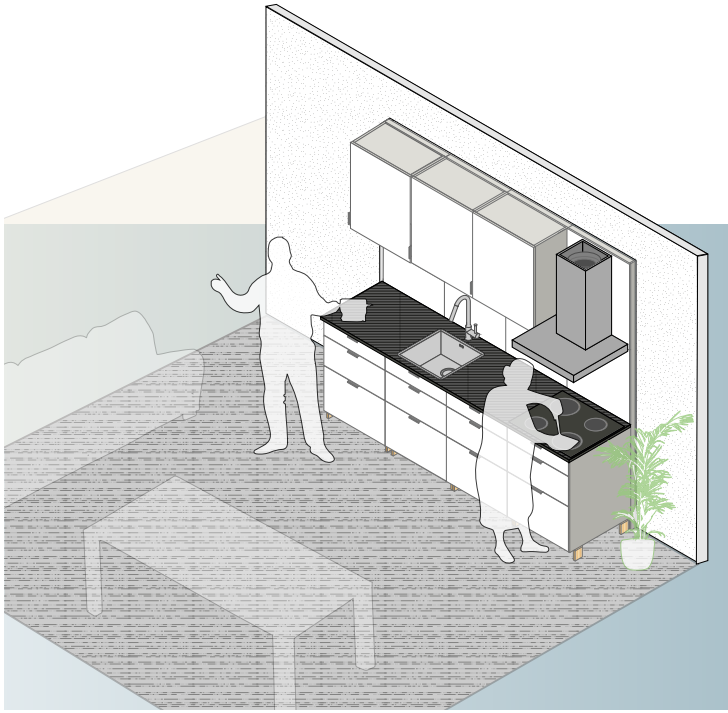


figure 42. the basic kitchen

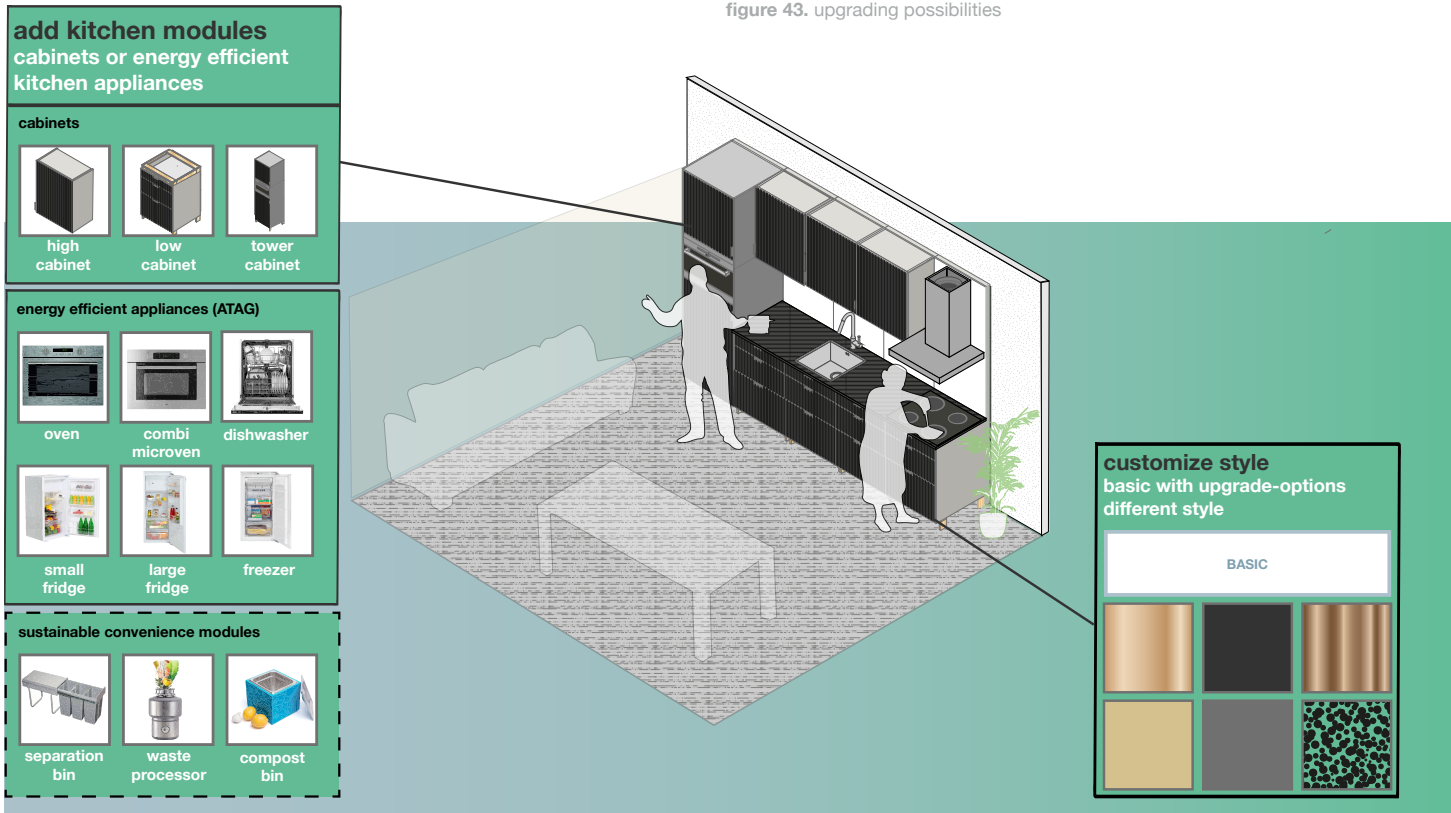


figure 43. upgrading possibilities

11.2 business model

The financial structure is shown in Figure 44. The system is mainly built on partnerships with purchase and take-back guarantee. Every part or material should be agreed upon to be taken back for a certain fee for the circular system to work. This also counts for the B2B side, the standard kitchen that is purchased by the housing associations.

The housing associations also have a partnership with keukencollectief for the maintenance service. This maintenance is always available for the tenant. This could include sending a mechanic (assembler) to the tenants house when needed, but also the facilitation of a platform to do changes and DIY maintenance.

The tenant leases appliances and upgrades from the Keukencollectief. This financial structure enables them to have a kitchen they otherwise can not afford. In this system it is very important to make the product 'vandal'-proof.

circular credit system

A currency is introduced in this system called the circular credit (CC). The circular credit is used for preventing undesired behavior and to give a positive stimulus to actions needed for the circular system to work. Tenants can swap credits for rewards that they want to have. Rewards can be style upgrades, food packages or new kitchen tools. After e.g. a certain DIY operation (repairing a cabinet door) the housing association saves money by not needing to make use of the maintenance service (sending a mechanic). They buy a certain amount of circular credits from the Keukencollectief that are rewarded to the tenant who did a specific desired action.

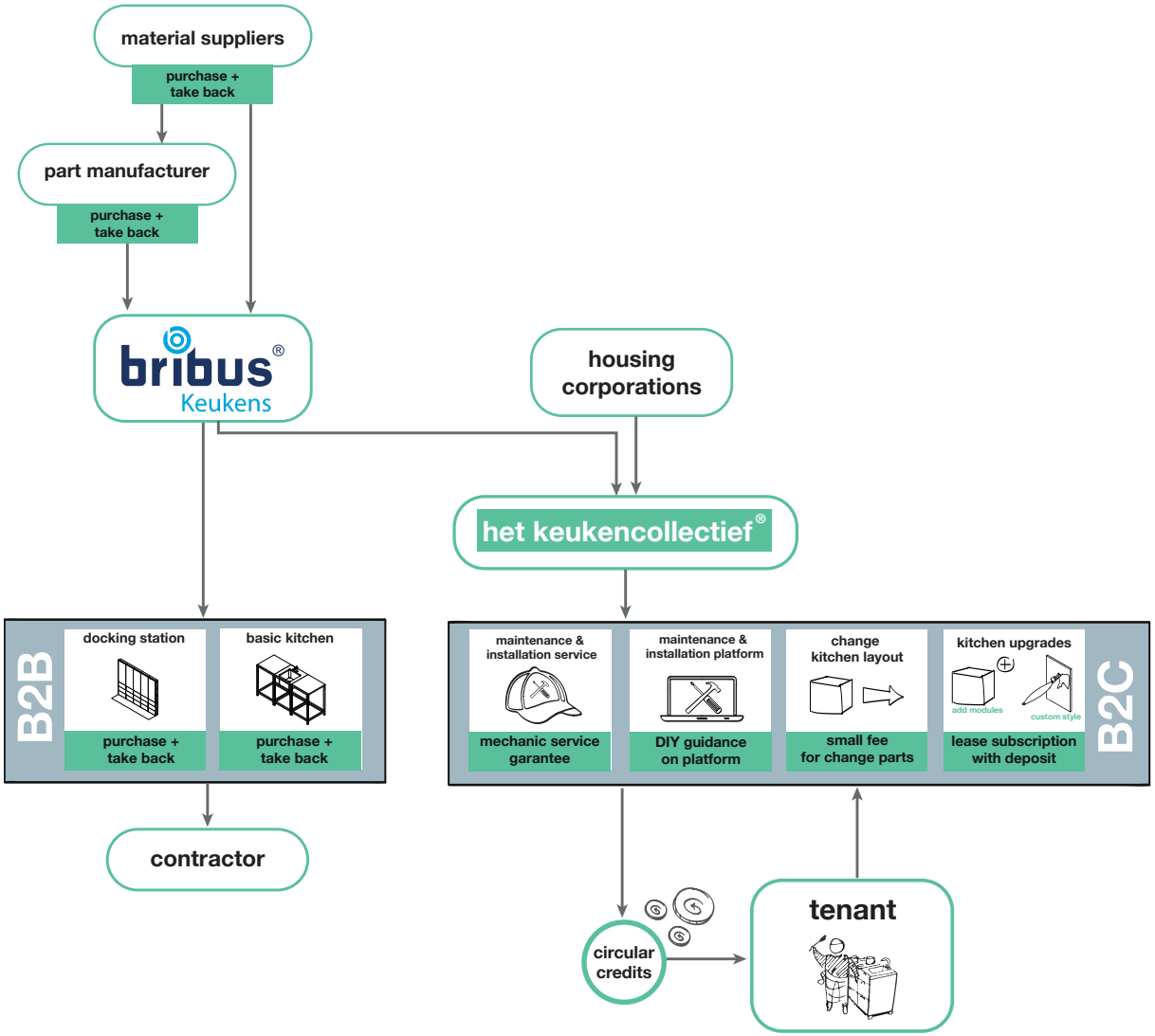


figure 44. the financial structure of the business model

11.3 circular supply chain

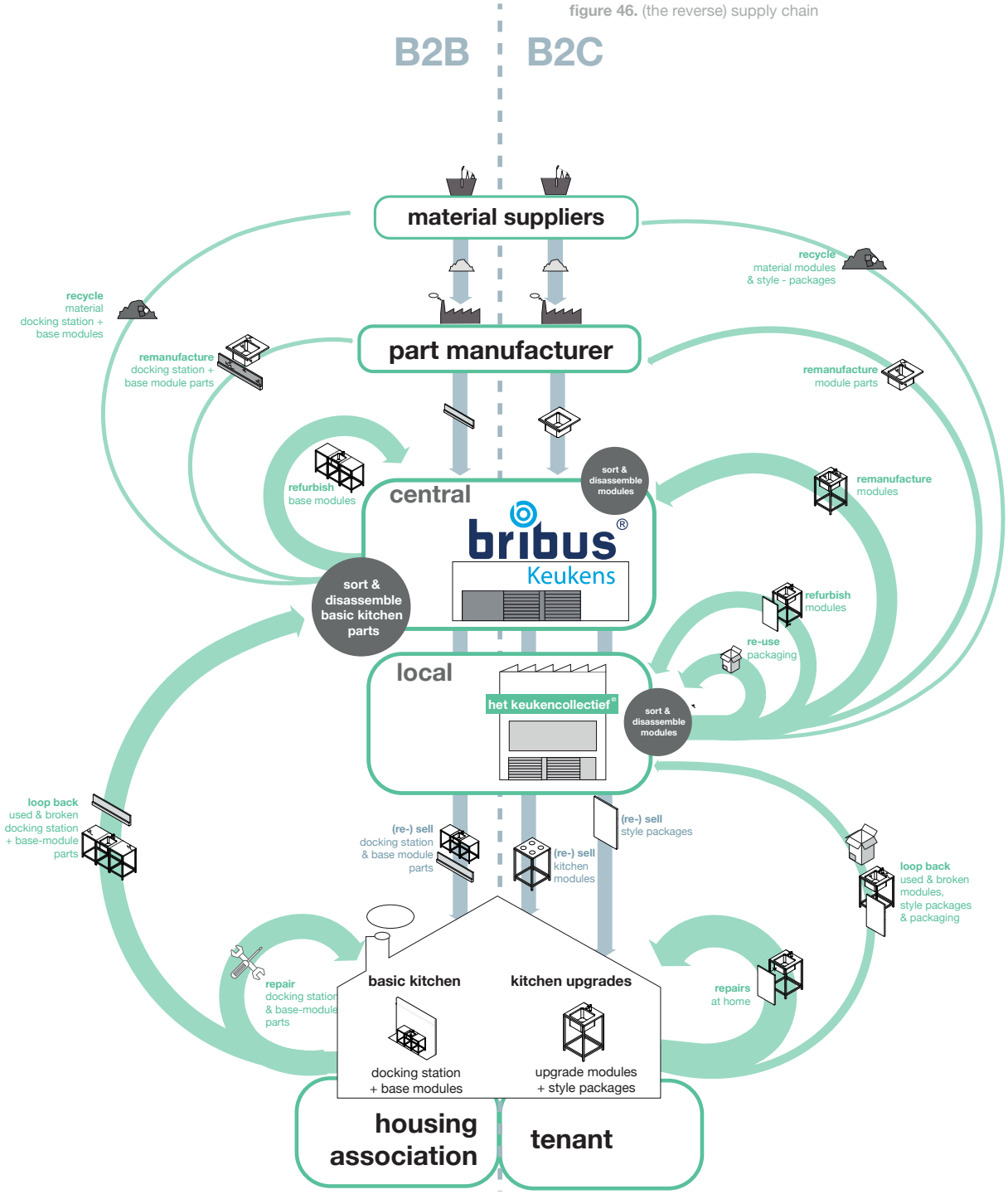
A circular supply chain is installed to make the whole concept possible. There is one central manufacturing point managed by the kitchen manufacturer with different local (keukencollectief) hubs placed on tactical places. A diagram is shown in Figure 46.

Most parts are (re-) produced in one central point: the bribus headquarters. This will also be the main center with the largest machine-park for re-manufacturing and recycling parts when lower levels of value are reached. This is also the place where the long(er) term stock is present, where parts are sent back to material and part manufacturers.

Locally the Keukencollectief-points are used as logistic-hubs. This could be combined with a showroom, a point to do minor refurbishment or maintenance of parts. This could also be a trade center for second hands parts, a place where people can spent their circular credits or a desk where they can get help or information. The assemblers can use this as a home base to step on their electric bike or van. It is also possible to make this an integrated point inside a building from the housing association (comparable to integrated postNL points in read-shops, Figure 45).

figure 45. a postNL integrated service counter in a read-shop

figure 46. (the reverse) supply chain



11.4 jouwCIK digital platform

The system is facilitated by an online web-app that is linked to a database. This link enables efficiency and a targeted help in an user-friendly interface. This all happens via a very digitally, personalized environment: the jouwCIK web-app (Figure 47).

By creating a clean, trusted-feeling and easy-to-use digital environment, jouwCIK facilitates doing changes and ordering by the tenant themselves. This platform is flexible and updatability for future changes. It comes in the shape of a web-app with the possibility for AR & VR integration. The web-app is designed in such a way that there is always a quick path (with suggestions) but also the possibility to follow a more profound personalized path for the tenants who desire more options during their CIK experience. For the less digital-skilled tenants there is always a way out, the possibility to call the 'keukencoach' who can evaluate every situation and who can arrange everything. The interface also incorporates personal elements. When connecting to the user and making the tenant do adjustments themselves via this system, you create a feeling of ownership and more durable behavior with the kitchen. The web-app is based on an existing animation program from bribus called 'studio B' that already digitized every kitchen they have in their portfolio. Making it easier to implement and to start it up. Compared to other kitchen configuration programs (e.g. IKEA keuken planner), this web-app thinks for the user, gives suited suggestions and works a lot simpler.

How does it work?

Your profile is linked in the system to your kitchen. When logged in, you find an exact representation of your kitchen that you can adjust. By using a few simple clicks you can for example repair, move or add a module. When an order is complete you finish with a delivery planner and the choice for an assembler-visit to do it for you or a do it yourself (DIY) approach. Providing you with the so desired circular credits. After a specific order, manuals and order files are linked to a part and pushed forward in the interface. The tenant does not need to think about these complex thing with finding the right files etc. When choosing for a DIY approach you can choose to get help of an interactive instruction video or a 'traditional' digital manual. A couple of screens are shown in Figure 48.

figure 47. the web-app jouwCIK

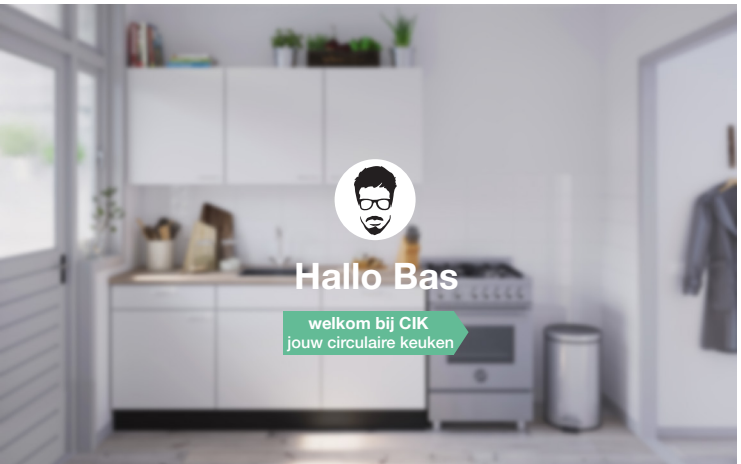


figure 48. screens showing the jouwCIK interface

11.5 what next?

The concept offers in many ways flexibility for improvement. Figure 49 shows a scenario how this basic system could work even more sustainable and efficient in the near future.

Of course it all depends on future developments and innovations, but it is good to be ready for these kinds of improvements and to create an adaptable system for easy implementation later on.

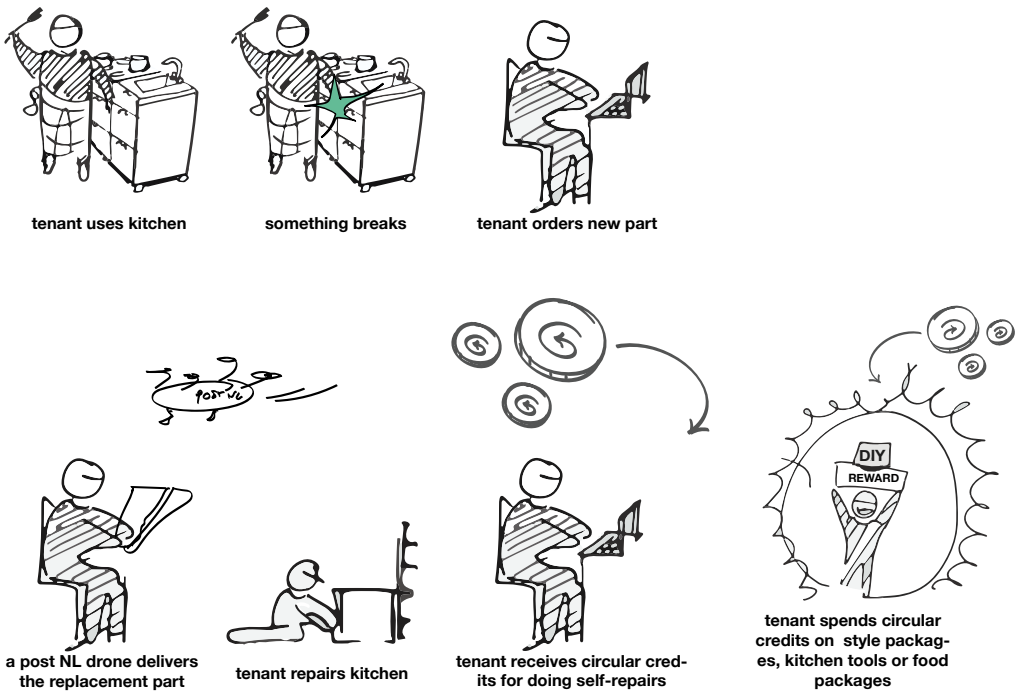


figure 49. future improvements on the concept

takeaways

Why is this concept viable? These are some points that show the benefits:

- The whole service can be built on the existing service from Bribus: 'Bribus Extra'. A lot of the elements needed are already out there (mechanics, logistic points, etc.)
- Targets a new target group: (social renters that want to spend something on their kitchen)
- It can function as a platform for up-selling, something that is now impossible to do.
- The digital system offers high flexibility and easiness to expand.
- System is suited for expansion for private and international market with minor changes and expansions.
- Facilitates a circular system in the kitchen market that is not already existent.

However, this concept still needs to be tested with stakeholders and tweaked accordingly. This will be done in the next sections while working towards design C.

12 | stakeholder concept evaluation

While designing a system with multiple stakeholders it is important to evaluate a design from multiple viewpoints. In CIK, Bribus is probably going to be the party that also controls the service side of the system and directly keeps in contact with the tenants. This still depends on the exact design and decision making about the service.

12.1 plan

The goal for this session is gaining Bribus's vision and insights on the conceptual service design for aligning stakeholders in this project and optimization of the service-design. Bribus is a major stakeholder in the service, but needs the tenant's point of view for a good working system. What do they need to consider? Who are we working for? What kind of people can we expect? My role is to design the system in cooperation with this stakeholder and be the designer with user insights as ammunition. I want to involve Bribus in refining the design.

Additional sections from the session project plan, including method and script can be found in appendix 12.

12.2 process

The session started with a presentation on the progress of the graduation assignment until this point. During the presentation the CEO and MO commented and on several topics and dialogs followed. After the presentation the service blueprint design was explained and discussed, what brought up some new feedback-points to take into further design and decision-making.

12.3 results

During the session a lot of useful feedback was gathered. This was transcribed and evaluated. A summary of the most important remarks is visualized in the blue speech clouds on the next page.

bribus® Keukens

priorities in CIK

Bribus's main aim on the CIK is to start using less material in the production and maintenance of the kitchen. It is very important to do repairs on part level instead of module level. For Bribus upgrades and customizables is of lower priority.

role keukencollectief

Bribus sees themselves being the Keukencollectief. A collaboration is less obvious because housing associations want less responsibilities. But if 'Keukencollectief' is the working-name for Bribus, that would be great.

circular supply chain

It is better to loop back all parts from the local point to a central point to refurbish it. Because of the machinery and storage. But what you can do locally, you should do. You can use these local points as logistic hubs. Then it is better to start working from existing locations, Bribus already has two local locations.

flexibility in the basics

Bribus thinks the basic kitchen should be adjusted to the tenant. For example, a basic kitchen adapted to the four presented tenant types. That is why the flexibility in the proposed platform is what we look for.

start small work out big

An interesting future vision with attractive upgrade possibilities, but at first we need to keep this small. A lot of regulations keep us from doing business with the tenants. If these aspects are too dominant, the housing associations might get the feeling that they are not able to realize it, then we will hit a brick wall in building a partnership.

circular credits as solution

Generally, the service looks like Bribus had in mind. All elements are in there. But still, there are a lot of barriers to overcome, and the key to these barriers might be the circular credit system.

circular credits as solution

A circular credit system would be a good solution for the payment and regulation barriers. It is a good tool for the whole service concept. Not only in the kitchen but also in the rest of the house. The CC-system can be a good tool to align industry, housing associations and other stakeholders.

personalized approach

Personal approach is a good idea! By giving the tenant the idea that it is their kitchen, this person could use their kitchen more durable and sustainable.

kitchen click-interface

Good idea, but you need to click for the parts so you need to simulate the exact situation as the tenant has at home and it needs to be updated. Possible, but complex. But indeed, with the looping system a database with parts is already needed. This is basic. So this might make it easier.

12.4 conclusion

The session was successful in terms of achieving the goals that were set: gaining Bribus's vision and insights on the concept as a basis for aligning the stakeholders in CIK by optimization of the service-design.

For bribus the biggest priority is to make the system manageable, have a minimally functioning product, have something that is expendable and have a more sustainable production and maintenance. They see themselves doing this for the most part. Also, they had a hard time maneuvering around the rules and regulations that the government depicted for social housing. This makes it very hard to innovate the (real-estate) products that are bought by housing associations. They thought the circular credit system as the most important improvement in the concept and would like to see this developed further to open up possibilities in the system.

what are the next steps according to Bribus?

Possible action-points are established based on the angle of Bribus. This is a list that flows from this concept evaluation.

- Focus on further development of the circular credit system. What does this mean for the tenant and the other parties involved? How can the HA still be financially responsible? And strive to test this in a prototype. What if it applies to the whole residence instead of only the kitchen? How do other systems reward-system work? Looking closer to housing regulations that apply. How can the circular credit system maneuver through these restraints?
- Focus on bringing flexibility to the basic kitchen. Adjust the current service design to a more flexible basic kitchen for different tenant types with help of circular credits.
- Give more shape to the Keukencollectief. What if it is a working name under Bribus? How should the logistics look in this case?

But is this the way to go? And is this beneficial for CIK? Zooming out is needed, this is done in the section 'takeaways' to the right.

12.5 evaluation design

The session brought forward interesting angles on the project, and emphasizes the different interests of the stakeholders in the project. The design seems to fit the demands and wishes that were set, the will need to be adjusted and complemented. This was very important for example for 'taking the interests of all stakeholders should be taken into account as best possible. ' and to take the wish 'CIK should be as desirable, feasible and viable for all parties involved as possible.' in account. But a neutral stand-point needs to be taken. Their remarks on the concept must be taken into account but their position should not be made too dominant in the project. The overall wishes and requirements to the project are still leading and the user-centered process needs to resumed.

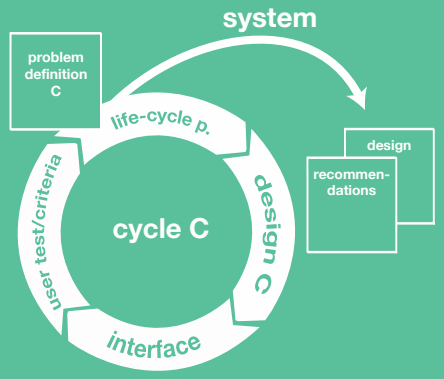
takeaways

An interesting finding in this session is that Bribus wants to take the role of intermediary party on themselves. While considering previous insights and keeping the the overall picture in mind, this might not be a good idea. User research indicated that they do not like to do business with a commercial party over their fundamental kitchen right. Besides this, it is to be questioned if the means and (service) skills to be an intermediary party. For this system to work, it has to be approached on an integral way, and not with the focus only on reducing production impact.

Their comments about practical matters and production are taken into further development. A central (re-) production point seems a more realistic choice and their already existing local points could be very useful for setting up the system. Also, their positive response to the credit system should be taken into account. This credit system could make the service concept more feasible on the short term with the regulations. Interesting indeed. But this might be a too complex and comprehensive subject to work out within the time-frame of this project. Overall they seem to be quite flexible and innovative and are willing to talk. A good party to be partner in a potential circular system, because close internal and external stakeholder collaboration is very important (Sumter, 2018). If this project would be extended, the next step would definitely be having a similar session with housing associations. Since this is not the case, the indirect knowledge from the kitchen manufacturer will be taken into further decision making.

cycle C

The report ends with cycle C which is focused on detailing the most important part of the design: het Keukencollectief. An additional analysis is conducted that is used to substantiate certain design decisions in the existing design. The digital platform is refined and the cycle ends with an evaluation of a prototype.



13 | problem definition C

After cycle B, the new learnings are used to make the problem definition more concrete. All learnings until so far were implemented as best possible in a concept design and this was evaluated by a major stakeholder. The learnings are implemented in the previous problem definition. The learnings are also implemented in the LOR as validation at the end.

what is the problem?

The problem where this graduation assignment flows out of is the fact that the changes in the circular system and the modular design could bring possible tensions with the end-user, the tenant. While investigating the tenants behavior, the expected tensions that are would mainly be that the tenant has a pretty big responsibility in making the circular system work and that the tenants values need to be included and themselves need to be engaged by the system.

In this cycle a concept was developed and an evaluation was done with a major stakeholder, the kitchen manufacturer. The evaluation gave several insights to improve the design in to fit their interests. It emphasizes the different interests of the stakeholders in the project. Bribus struggles a lot with the interests from their client, the housing associations. And had the priority on implementing this as functional as possible and on a very small scale to make it workable for their clients. Also their focus was very on optimizing their production and maintenance impact. In this Bribus wants to take the role of intermediary party on themselves. When looking at previous insights and the overall picture this might not be a good idea, user research indicated that they do not like to do business with a commercial party over their fundamental kitchen right. Besides this, it is to be questioned if the means and (service) skills to be an intermediary party. A central (re-) production point seems a more realistic choice and their already existing local points could be very useful for setting up the system. Also, their positive response to the credit system should be taken into account. This credit system could make the service concept more feasible on the short term with the regulations. But a neutral stand-point needs to be taken. Their remarks on the concept must be taken into account but their position should not be made too dominant in the project.

Based on these insights the axis in the web of the system needs to be developed further, and brings us to a new definition of the problem for solving in the next phase. The previous problem can be re-framed: For the circular system to work and to get the tenant to cooperate in the system, the tenant needs to be engaged via the service side of the CIK system. But to get the parties to collaborate in a good way an intermediary is needed, but who is this intermediary party? If this problem isn't solved, this could lead to problems in collaboration of the stakeholders, that could influence the circular system to collapse or dis-function.

who has the problem and what are their interests?

The main problem-owner are the initiators of CIK, the joint forces of the TU Delft that work from an academic point of view. Their primary goal is to build a functional circular system with a market ready product to demonstrate the possibilities and to seduce the industry to change for the long term. When looking at the problem, it would be in their interest that the tenant cooperates optimally and the service system and intermediary works optimally for all stakeholders involved.

Because this project is a collaboration of multiple stakeholders, and when only looking at one stakeholder the system will not work; there are multiple problem-owners. They have different goals and interests within this project. This makes that multiple problems could be identified and an integral approach needed. The exact problems and interests for these parties are investigated in more detail and turned out to be the following: the kitchen manufacturer wants to be involved in an economically interesting opportunity, produce their kitchens more sustainable, do maintenance with less waste while being in control of their own supply chain and the full system. The housing associations most important interest is that the kitchen is scientifically assessed a more durable/circular option while not having a higher total cost of ownership compared to a conventional kitchen and also have a high tenant-satisfaction rate while optimally making use of their residences. *The tenant wants a working kitchen that is in line with their needs, values, personal perception of role and social orientation.*

what should be avoided?

On the one hand it should be avoided that not more tensions/ frustrations/problems should arise with the tenants that makes the circular system harder to implement. And also need to be avoided that the stakeholder interests are aligned in this way that a collaboration is not possible or beneficial for the circular system.

what next?

Since the main problem owner are the initiators from the TU Delft, and in their interest this project will still focus from a tenants point of view and how to engage them in the service design while implementing the other stakeholders. **This is why in the last cycle of the project there will be a focus on the Keukencollectief and the interface that functions as the front-end within the service design. The Keukencollectief is a vital part of the concept, and could function as a good addition to the CIK project. The way I look at it, it is a missing partner in the current CIK that will function as the key in connecting the tenant with the system, and making this circular mission a success. In this last cycle the tenant will reflect on the proposed design. These conclusions will be used in a recommendation for CIK.**

list of requirements

Figure 50 shows a refined version of the list of requirements after cycle B. The insights from the design process and the session that function as an addition to the existing list of requirements are added and made bold and green. A category more based on the interface that will be part of the next design is added. This is based on abstractions of the other requirements.

This list is used in the end of cycle C as an evaluation on the final design.

figure 50. overview of the list of requirements

5. general

Demands

D5.1 The service side is designed with an user (tenant) - centered approach. - (PDA)

Wishes

W5.2 The design facilitates a circular product-service as best as possible. - (DSP)

6. stakeholder interests

Demands

D6.1 The design is adaptable for expansion on industry partnerships. - (STA (HA))

Wishes

W6.2 The interests of all stakeholders should be taken into account as best possible. - (STA)

W6.3 The new system should cause the least problems for the tenants as possible compared to the 'conventional' kitchen. - (PDA)

W6.4 The system engages the tenant to cooperate as much as possible. - (PDB)

W6.5 CIK should be as desirable, feasible and viable for all parties involved as possible. - (DSP)

W6.6 **Housing associations should have as little work as possible on the kitchen. - (SCE)**

7. service & system

Demands

D7.1 The cost for upgrades for the tenants should provide significant value for money. - (UR)

D7.2 The system should still work when tenants bring their own appliances into the kitchen (that are not part of the real estate). - (UR)

D7.3 CIK always gives the opportunity to get help when stuck or restrained in communication with the system. - (UR)

D7.4 CIK offers the option for acquiring built-in appliances. - (UR)

D7.5 CIK offers several opportunities for improving the level of sustainability of the behavior of the tenant in the kitchen. - (BGR)

D7.6 Parts should be looped back from the local point to a central point to be refurbished/re-manufactured.

D7.7 CIK facilitates repairs on part level instead of module level. - (SCE)

D7.8 There should be dealt as clever as possible with all the social housing rules and regulations. - (SCE)

Wishes

W7.9 The system should address and made suitable to the different tenant types as well as possible. - (UR, SCE)

W7.10 The system should work as best possible for physically/mentally disabled tenants. - (UR)

W7.11 CIK motivates the tenants to partake as well as possible. - (UR)

W7.12 CIK offers simple, clear and transparent communication as well as possible. - (UR)

W7.13 **The system takes on a personal approach as much as possible. (SCE)**

8. digital platform

Demands

D8.1 The platform offers simple, clear, and transparent communication - (UR (abst))

D8.2 The language can be understood by social renters. - (UR (abst))

D8.3 The interface approaches the tenants in a personal way- (UR (abst))

D8.4 Give the idea that the kitchen is the tenant's property - (UR (abst))

D8.5 The tenant should see the effect of the selected change on their current kitchen environment. - (UR (abst))

D8.6 The tenant should see the effect of the selected change in terms of environmental-impact. - (UR (abst))

D8.7 A multi-way verificiation should be built in when a tenant selects a certain part for a change. - (UR (abst))

D8.8 The platform suits the different tenant types. - (UR (abst))

D8.9 The platform gives the opportunity to get help. - (UR (abst))

D8.10 The platform facilitates ordering built-in appliances. - (UR (abst))

D8.11 **CIK should simulate the exact kitchen layout situation like the tenant has at home and keep it updated. - (SCE)**

D8.12 **CIK should link the platform to a database that is linked to the supply and PLM system. - (SCE)**

Wishes

W8.13 The system works as easy and obvious as possible for the tenants - (UR)

W8.14 The design should give the idea of freedom of choice as much as possible - (UR (abst))

W8.15 The platform offers appealing benefits for money as much as possible. - (UR (abst))

W8.16 The platform supports physically/mentally disabled tenants as much as possible. - (UR (abst))

W8.17 The platform stimulates waste separation, efficient resource and appliance use as much as possible. - (UR (abst))

W8.18 CIK boosts confidence as much as possible. (UR)

W8.19 There is as much as tools and information available via the system to change their behavior to become more sustainable as possible. - (UR (abst))

W8.20 There are as much flexibility in the platform for implementing placing/taking of tenant owned items as possible. - (UR (abst))

9. outside system boundaries

Demands

D9.1 CIK should be able to be market-ready in 2022. - (DSP)

D9.2 (In)Direct costs for the tenant should be equal or lower than a conventional kitchen with self-owned material. - (STA (T))

D9.3 CIK should have an equivalent or lower total cost of ownership than the conventional kitchen for the housing association - (STA)

D9.4 CIK's kitchen should use less material in the production and maintenance of the kitchen then they are doing now. - (SCE)

D9.5 CIK should link the interface to a database that is linked to the supply and PLM system. - (SCE)

D9.6 When using/rotating second hand parts, the parts should appear clean and tidy, (looking almost new, while not being it). - (UR)

Wishes

W9.7 There should be done locally as much as possible. - (SCE)

W9.8 There should be done as much as possible from existing Bribus locations. - (SCE)

W9.9 CIK should appeal professionals and residents to grow interest and contribution to other circular components in the built environment as much as possible. - (DSP)

W9.10 The tenant should partake as actively as possible in the circular system. - (BGR)

14 | product life cycle planning

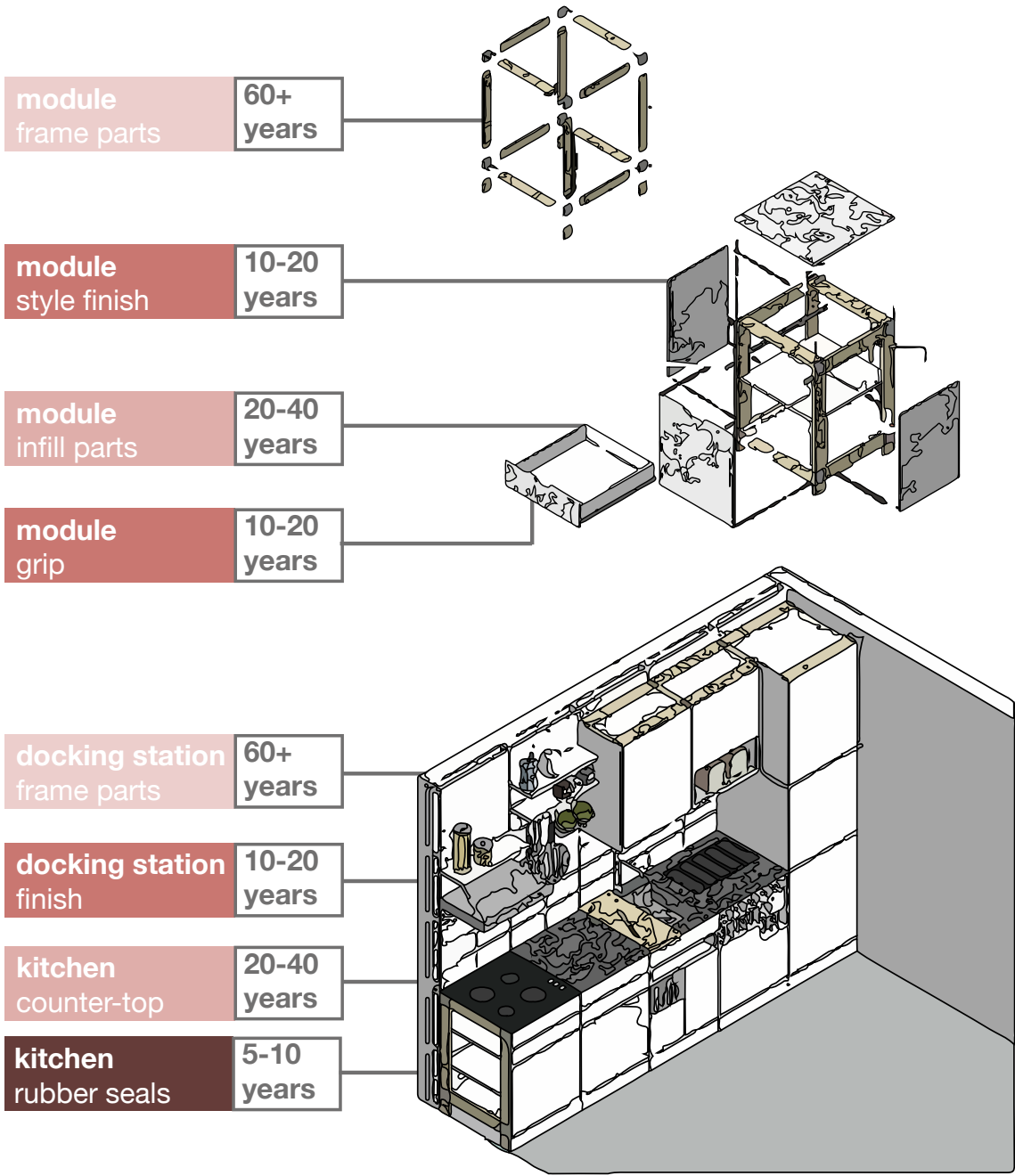
Reality calls. The design has incorporated DIY elements, maintenance decisions and a lot of upgrade possibilities. But in the stakeholder concept evaluation session was suggested that the two biggest stakeholders (KM&HA) think that this system should operate on a small scale: "Start small, otherwise you hit a brick wall with the housing corporations." They want to focus on the standard kitchen and only thinking about maintenance. This is a noble and good approach, but this graduation project wants to implement a viable approach, something that can grow, and really can change the kitchen industry as a whole. This information is not explored very thoroughly in the project but could be very important for the design of the service system. This chapter is an additional analysis to define which parts are expected to need attention, thus bringing forth interactions, determine if this is sufficient and what needs to change.

14.1 life-expectancies

Parts and materials have different life expectancies. With the current conventional social housing kitchen, it is expected that a kitchen can be used for around 20 years before completely replaced (Van Stijn et al., 2017). With the modular strategy that is used to extend the life-time in CIK, the life expectancy should be determined per part.

During the development of CIK material and design choices were made while aiming for that the most durable parts, also live the longest. A desired life duration was established for each part and materials and designs are chosen on. But these expectancies on wished life duration are still speculations (Jansen, B., Personal communication, March 22, 2019). Figure 51 shows these estimations for each part. Note that this Figure is based on CIK's estimations in collaboration with Bribus. Further research is needed to confirm their life

figure 51. desired/expected part life



duration. ‘Kitchen rubber seals’ was something that was not present in the estimations, but the rubber seals is something still in development and should replace the old way of using kit for covering cracks. In this case the life of kit is used (Van Huut, 2011). The material is similar and the users behavior towards it would be the same, but it is easier to remove and to replace.

14.2 basic kitchen life planning

In the previous section the word ‘life-time’ and ‘life-expectancy’ is used. In the case of this circular and modular design, this means that the life-cycle of this specific part might be over, and that a recovery-action is required to let the part enter a new life-cycle. More about this in the next sections.

life-cycle-duration categories

Within the design different categories exist, with different life-cycle-expectancies and recovery-actions needed to get the part back in the life-cycle. Based on Figure 51, interpreting these different life-scales, a categorization is established and illustrated in Figure 52. This Figure shows the categories, that correspond with the parts by color, the expected life duration and how long this is translated in how many use cycles (will be discussed in the next paragraph). Besides this, the possible influences and causes on the parts are stated. Basically for every part moist, temperature and wear and tear could influence the need for recovery. Moving parts are more susceptible to wear and tear and impact, invisible parts are more influenced to moist and temperature, visible parts are more influenced by detergent and sunlight (Wonengids, 2012) (Ritmeester, 2019). These categories will be used in the life-cycle planning in the next paragraph.

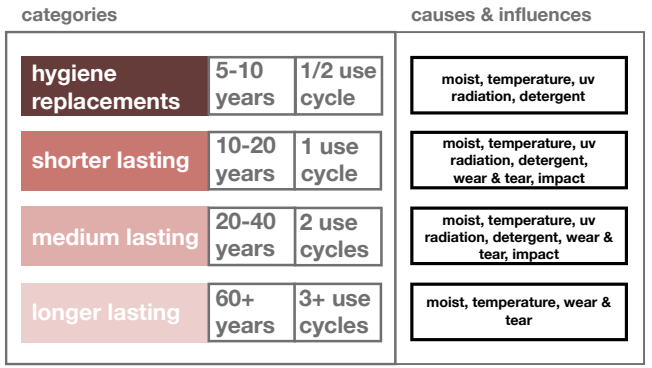


figure 52. life-cycle-duration categorization

life-cycle planning

The average duration of a social renter living in a residence is about 15 years (Blijie, Groenemeijer, Gopal, Van Hulle, 2013). The time between the moment that a tenant moves in and moves out is defined as 1 use-cycle for the kitchen. When looking at the full life-cycle CIK, there are different moments when a certain category need attention. This is displayed in Figure 53, this shows a timeline from the moment that CIK was installed for the first time. The different parts and categories need attention on different moments throughout time. The timeline also shows the recovery action that is required to get the parts back in an use-cycle. Within these recovery actions, the Figure shows if a DIY recovery is an option. Note that this Figure is based on when the kitchen only configured as the standard/basic kitchen, without any upgrades.

When interpreting this timeline, it can be seen that in the basic kitchen, a tenant needs to change the rubbers every 5 years, and after 10 years some finishes needs to change. After 30 years a mechanic needs to change the counter-top, but in this case already 2 tenants used the kitchen. And this could be even more, since the use cycle duration is the average.

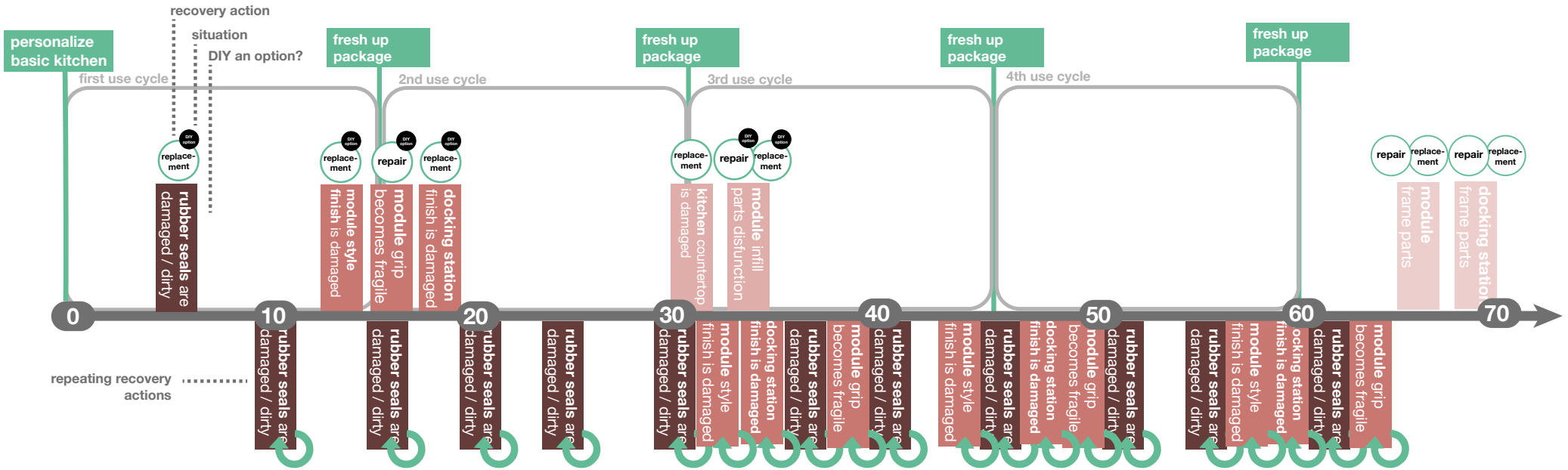
All these recovery actions could be executed relatively easily with the modular kitchen design. In design B a do it yourself (DIY) maintenance approach is implemented. As stated in section 4.3, it brings benefits and user research pointed out that some tenants are interested in the option to do repairs themselves when rewards are available.

What also can be seen in the timeline is that a systematical freshing up might be a good idea. From the user research it appeared that people value a clean kitchen very dearly. Tenants don't like getting dirty belongings from others. This can be encountered when moving into a residence, when getting second hand parts as replacements or after about 5 years of use of the kitchen. Since the rubber seals, the finishes and the grips of the kitchen are the parts that need the most attention. These 'hygiene replacements' are probably the most determinative for the cleanliness image of the kitchen. It might be a good idea to acknowledge this and offer a systematical solution for this. This could increase tenant satisfaction, kitchen quality and engagement in the system.

conclusion

The diagram shows that the frequency of recovery actions in a standard kitchen is quite limited. This means that the interaction that the tenant has with the proposed service side in design B might be once in the five years, with a few possible adjustments here and there. If the proposed service side in design B the system communicates once in the five years, the system would not be viable at all. This could be a benefit for the housing corporations and for the kitchen in general. It is an inert product lasts for a relatively long time. But this could not be beneficial for the business model around it. A small circular kitchen business only focused on the standard kitchen for social housing is a good idea, but will not survive the challenges of an integral circular business model. The risk with such a small scaled venture is that it has a limited environmental impact potential, they will lose competitive advantage on the long term (the market is changing towards more access models) and at last: a small venture has a bigger risk of being scrapped due to budget cuts in economically tough times. Traction needs to be created to make it interesting for the market and for investors.

figure 53. product life-cycle planning basic kitchen



14.3 upgrade life planning

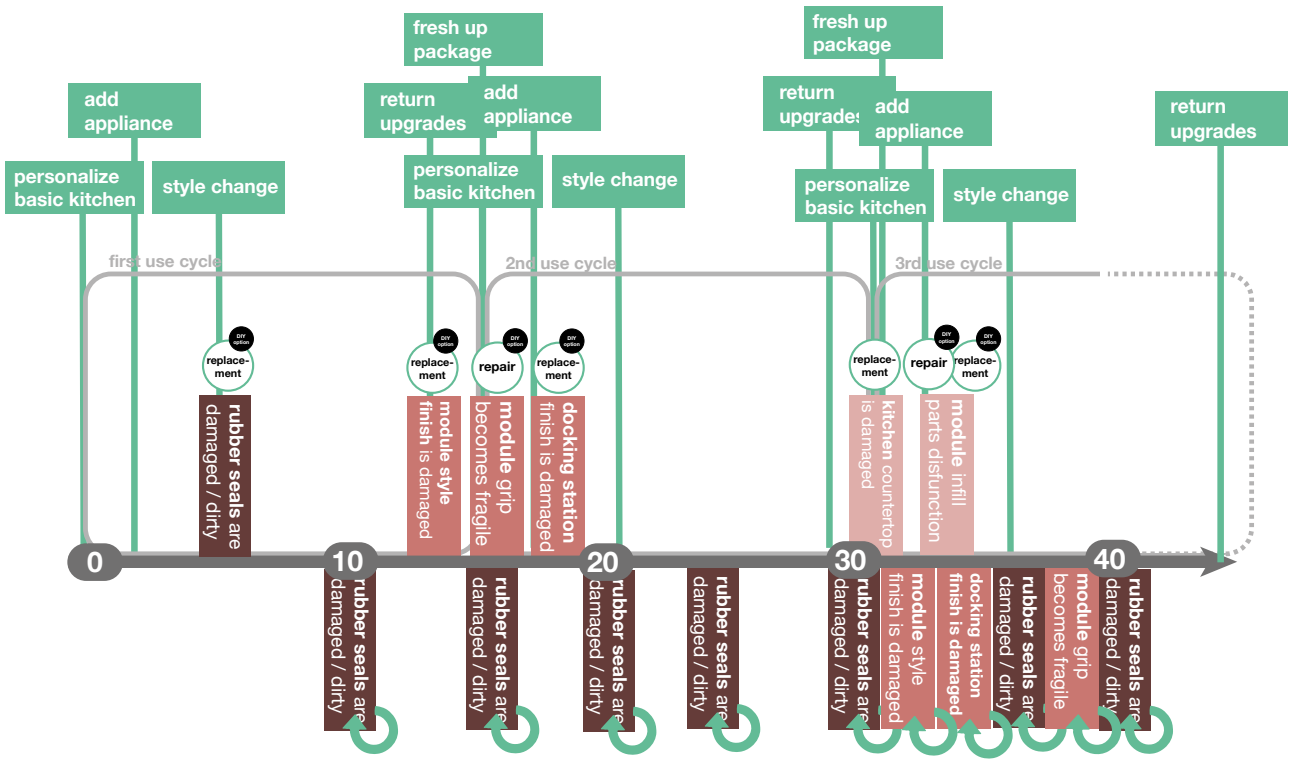
A way to create traction is to grab the concept with both hands and implement a full service package for the tenant with options to grow. If this circular system would become a viable business proposal, then more interaction with the tenant is needed. User research showed that tenants are willing to cooperate in the proposed system and see a lot of benefits for themselves. But for them to be engaged in this system, an excellent service is needed. The keukencoach, an updated interface, a chat-box, customer service and good people can only be afforded in a complete viable business model. So the excellent service side is only viable when the system is scalable in the current market and others. In the final design there should be enough interactions to make the system and the circular credits work. The option for scaling to upgrades and expansion to new markets might be needed. All partnerships and the excellent service needs to be funded and should be worth the investment. Since expansion to other markets should be a secondary possibility, in this section will be researched how frequent the interaction would be when upgrades are implemented in the system.

To find out what the frequency is when upgrades are implemented in the system, a new product timeline is created. This timeline shows the same timeline as the basic kitchen, but with new interactions that the implementation of upgrades bring. The timeline is displayed in Figure 54.

interaction frequency

User research showed that tenants are definitely interested in these possibilities and extras. But exact data about how many tenants are willing to make use of these upgrades is non-existent. This should be fore-casted, but if a tenant is making use of a tenant on an ideal base, the tenant would have approximately 1 interaction per year in the beginning, 3 interactions around the second use cycle and 5 interactions around the third use cycle.

figure 54. product life-cycle planning with upgrade interactions



It is unclear how many kitchens need replacing when CIK is market-ready in 2022. But housing associations are planning to build around 34.000 new social residences per year (Van der Parre, 2019). If the estimated assumption is made that CIK is installed in a tenth of the new-built social housing in 2022. This would be around 3400 kitchens in this year. If we would take the starting frequency of 1 interactions per year, this would mean that the system would be used 3400 times a year with an average of 66 times a week. This will increase over the years, since more part-categories need to be replaced after 15 and 30 years (Figure 54).

This makes this business a lot more interesting and viable than only implementing the basic kitchen.

14.4 the back-end

All parts and categories have a different life-cycle planning. The product life-cycle planning can function as a foundation for setting up the back-end for the circular supply system. But what happens when they are sent back after this recovery moment?

Figure 55 and 56 show the product life journey of basic kitchen parts and upgradeables. It shows the rotation of use cycles and what happens after the life-cycle of a certain part is over. Note that the amount of use-cycles depends on the part categorization. It is important to see is the complexity and the logistic challenge that it brings.

PLM system

For this taking-back system to work a PLM (product life-cycle management) database and software needs to be designed. This has the following tasks: The damage needs to be determined and classified, logistics need to be arranged, part identification, communication between different parties and much more. For this to work every part needs separate identification.

Gathering data of the materials, and user use is also very helpful in optimizing the product and system. This could be very beneficial in optimizing the design in the future. It is important that it is adaptable and open for changes.

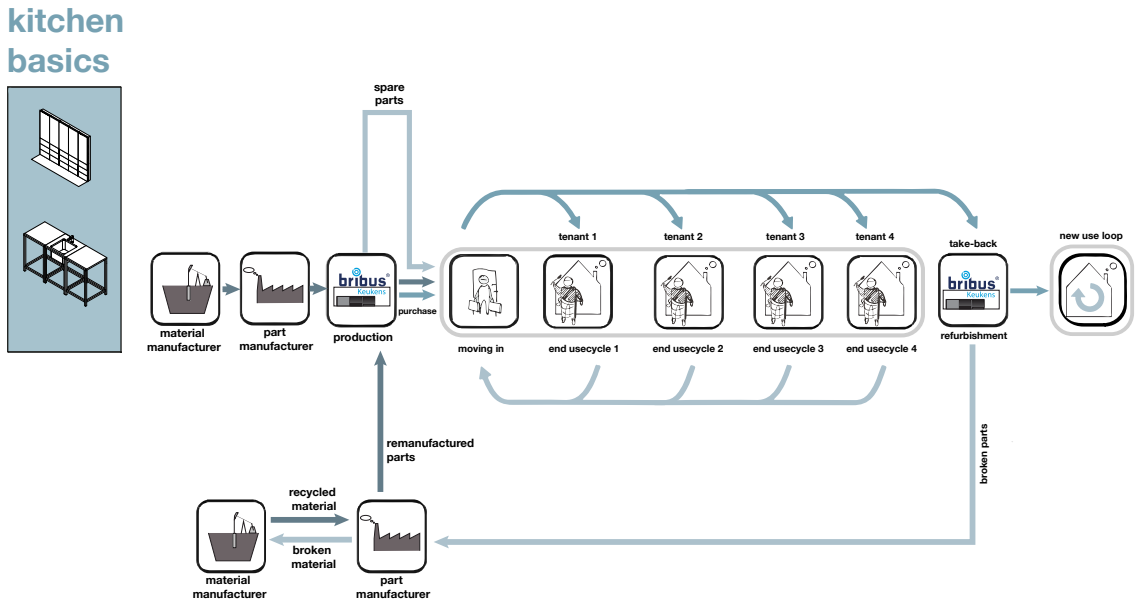
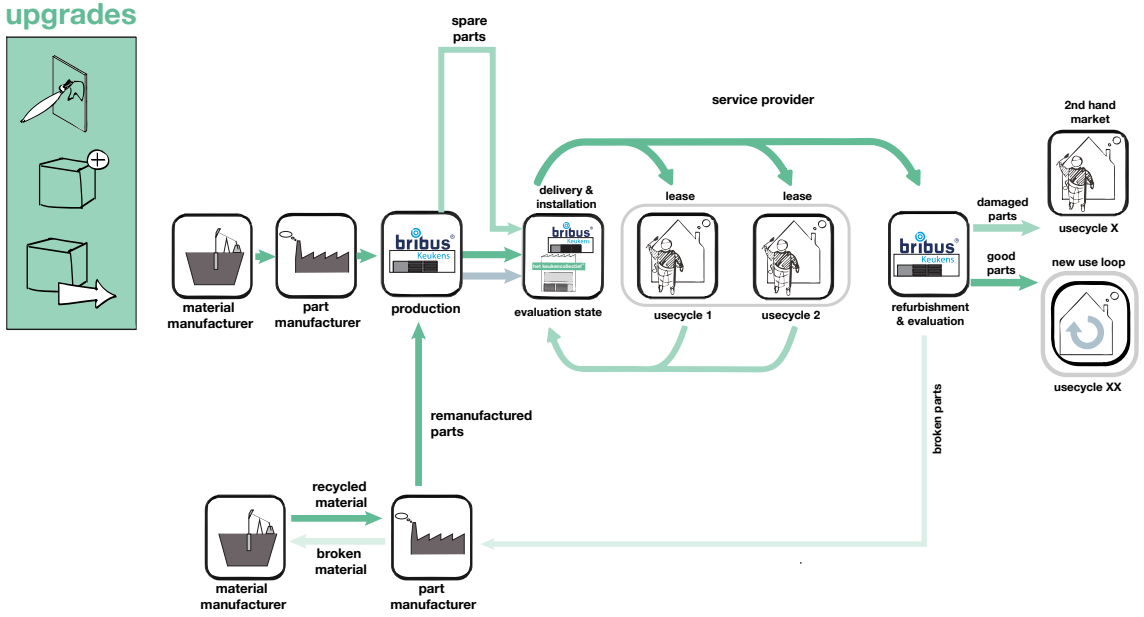


figure 55. product life journey of the basic kitchen

figure 56. product life journey of the kitchen upgrades



takeaways

This chapter is an additive analysis to investigate the details and frequencies for recovery actions. This serves as consolidation for certain aspects that were already part of design B and apparently should be part of the final design proposal.

As mentioned in section 14.2, the frequencies of interaction when keeping the system focused on the standard kitchen appear to be very limited. This will not survive. The proposed solution makes the system a lot more viable. Based on the findings in this chapter the final design step has foundation for the following points.

- Let the keukencollectief be the intermediary party with service experience take on this part.
- Take it on big: Not only bringing the 'hardware'*, the standard kitchen parts but also the 'software'* ,the kitchen appliances into the service model. Something that consolidates some aspects that were already part of design B. To make the system work and to make use of the big positive environmental impact potential that appliances offer.
- Create the excellent service that such a service party demands to create engagement. Possibly even while using the circular credits when enough interaction and traffic is created.
- Stimulate DIY repairs and choices, it has incredible potential for benefits. (section 4.3) It has a good LCA score and could also stimulate product attachment that could increase the life-cycle duration of parts.
- It might be a good idea to provide a free 'fresh-up-package' opportunity for resident-changes after living duration longer than 10 years. This could be very beneficial for their engagement since tenants value the cleanliness of their kitchen very highly. When a tenant changes, there is the possible desire to make it yours, what could give changes to do a 'fresh-up', a style and rubber change to create a clean kitchen.

*definition available in glossary

15 | design C

het keukencollectief®

In this chapter the focus will be on the most important new part of the whole design of the system: het Keukencollectief. This chapter explains the exact role of the intermediary responsible of guiding the system to success.

15.1 what is het Keukencollectief

From user research it appeared that some tenants think that because a kitchen is part of the real estate, they are renting this real estate (house), that they have the fundamental right to have a kitchen. When asking about this fundamental right, it appeared that it is important for social tenants that they should not have the idea that they have to do 'business' with a commercial company. A kitchen is a basic need. If a commercial party takes over the control over their basic need, with the wrong 'tone of voice' this could undermine the system. This is why CIK should not feel about profit, but about helping tenants with their basics needs, while giving them even more possibilities and conveniences in their kitchen. This is were Keukencollectief comes in, the place to address when something is wrong with your kitchen.

the role of het keukencollectief

Keukencollectief is the intermediary party that builds a familiar and positive bond with the tenant. KC arranges the coordination and the service. The manufacturers arrange parts of the maintenance, the product and is responsible for the production and recovery. Everything is tied with partnerships. It is a party that starts with a modest approach but has ambitions to grow and expand. This party needs to be able to overcome the regulation barriers, talking, mediating and taking all interests into a viable business system. As mentioned previously, one of their key tools to success would be the excellent service to create engagement among the tenants. Besides engaging the tenant KC also has the responsibility over the other stakeholders. There are a lot of partners in the project, and they all operate on very different levels with different interests. For a good collaboration there is a party needed to guide this in a good way to put down a good system. KC takes on this task and ties all the strings.

Het Keukencollectief focuses on being trustworthy, having a non-commercial image by taking a personal approach. Keukencollectief provides a service that helps the tenant to have a good quality, continuously working kitchen that fits the tenant's personal needs. Het Keukencollectief is the place where you can go with problems with your kitchen, but also the place to upgrade if you feel the desire. This is also the party that engages and motivates the tenant to partake in the circular system to make it a success.

In the current model, the kitchen manufacturer desires to stay in control over the system as a whole. But since housing corporations do not want to be reliable on just one manufacturer, it needs to be a new third party. It could possible be a spin-out from the kitchen manufacturer, but that might bring the right skills and ambitions for it to work. KC mainly functions as a service partner and intermediary. These competencies and skills are absolutely needed for the circular penetration of this market. As Bribus mentioned about their clients (the housing associations), they are quite reserved in innovation and protective over their tenants. Keukencollectief has the mediating skills to connect these parties. Something that is crucial for the success of the circular system.

15.2 business side

Keukencollectief should not 'feel' like a commercial party to the tenant, but should have a profitable business model to expand and implement the circular system. This should also be interesting for the other stakeholders to invest and get into partnerships. But how is this a viable design? This section will explain the partnerships needed and the financial benefits for the other stakeholders.

partners

The business side from design B is mostly the same, but it is optimized through the use of new information and takeaways gained along the way. The previous design was split up in a B2C and B2B side, in design C this is not the case. Since KC communicates with all parties, there is no clear distinction. Figure 57 shows the different partners in the system. The dashed lines represents information exchange, the solid arrows are direct exchange of good or currency.

KC is the intermediary that manages the CIK-network, partnerships and provides the tenant with help for their kitchen. KC does not physically own or store kitchens or parts, but arranges these and the financial arrangements in-between parties. The kitchen manufacturer takes on the production, recovery, storage and distribution of the 'hardware' of the kitchen. Other appliance manufacturers are responsible for the 'software' parts in the kitchen. A contractor is hired for making the home ready for the docking station and the basic kitchen parts. PostNL is the logistic partner in the process. They have the logistic network and innovative/sustainable vision that could provide for an interesting partnership.

financial arrangements

The system is built on partnerships. These partnerships are quite ambitious so they have to be financially attractive for the partners involved. To make the circularity work, a condition for a partnership is the agreement on a purchase and take-back guarantee. Every part or material should be agreed upon to be taken back for a certain fee. This is especially important for the part/material manufactures around 'hardware' kitchen parts.

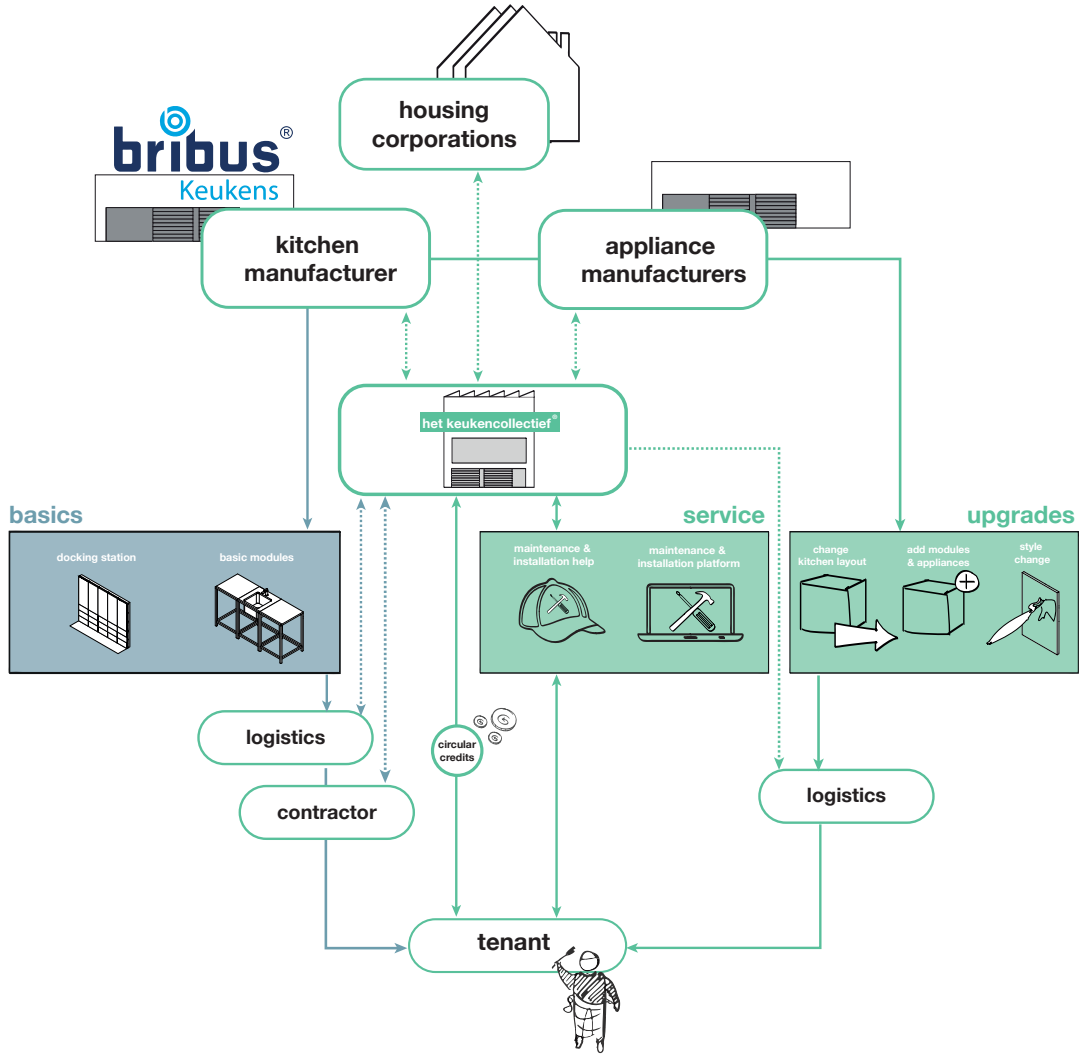


figure 57. business model C

basic kitchen

The housing associations make arrangements with het keukencollectief for the purchase of a certain amount of basic kitchens, the upgrades/personalizations they want their tenants to have and an agreement on the maintenance service. This is important because some housing associations already have handymen and maintenance personnel in place, these should be educated for using the CIK kitchen system. The housing associations can also choose to make use of the service by keukencollectief assemblers, in this case they will have a subscription. A condition of het keukencollectief would always be that in any case maintenance-service is always available for the tenant.

Keuken-credit system

A currency that is part of the system is called the Keuken-credit (KCr). The KCr is used to work around the tight regulations that are bound to social housing real estate (de woningwet). The kitchen manufacturer stated that it is very important to create a partnership with the housing associations. It works as follows: The HA can buy a certain amount of Keuken-credits from the Keukencollectief that can be used to give to their tenants for different reasons. A housing association can give certain tenants the personalization they need, stimulate certain actions or to prevent certain behavior among the tenants. The tenants can swap their credits for rewards. For example: a dishwasher for a year, an extra module, a style change, a good quality pan-set or a food package. A wide range of choices, for every type of tenant something interesting and because choice freedom is important for the tenants (as user research pointed out). The housing associations and KC can also use the Keuken-credit to stimulate certain behavior to make the circular system work better (based on the behavior altering techniques by Niedderer described in section 6.2). It can be used for preventing disadvantageous behavior or to give a positive stimulus to actions needed for the circular system to work. For example: to stimulate a tenant to pick the DIY way to repair something instead of ordering a mechanic. Also undesired behavior could be discouraged, like throwing away parts in the normal trash instead of returning or throwing away/keeping sample packages instead of returning these. But, for this currency to work, the tenant needs to desire the credit and its benefits, so a frequent interaction with the system is needed. This will be discussed in section 15.3.

upgrades

The upgrades can be acquired by two possibilities:

- At first, individual tenants are able to lease appliances and upgrades from the Keukencollectief. The financial structure enables them to have appliances and parts they otherwise could not afford. Most of the social housing tenants have a very low income and not much to spend on extras. But this is also a group with a lot of elderly and physical or mentally impaired people. Good quality and convenient appliances are much needed. Also, by offering very energy efficient good-quality appliances impact could be made. Otherwise, this user-group would probably purchase low-quality , inefficient, budget appliances and materials because of their limited income. But, a question remains whether it is responsible to offer financial contracts to individual social housing tenants. This is worth looking into. Social housing exists for a reason, and KC should not be needed to be acting as a debt-collector instead of an intermediary.
- Secondly, the tenant has gathered enough Keuken-credits to implement a certain upgrade. Some upgrades are subscription based (extra modules, or style packages for a certain amount of time) while others are a purchase (pots, pans, food packages).

benefits for the partners

All stakeholders need to be aligned for this system to work. To align the partners, their interests need to be heard and taken into account. This was analyzed in chapter 5 (stakeholder analysis) and the session with the kitchen manufacturer. Next to their desires of kitchen quality, environmental benefits etc. They all desire that the system is financially appealing. It should be viable for them. For the parters this system could provide some serious financial benefits: For the manufacturers it could mean having more control over their product and material while having a steady, reliable revenue. The housing associations have to put in minimal effort in the system, save money on maintenance and possibly have a higher tenant satisfaction level. Especially the Keuken-credits could be financially beneficial for the housing association. “If the HA would spend half the amount of money from maintenance on rewarding tenants because they did DIY repairs, they would save serious money.” (Bribus, personal communication, 9 March 2019) For all partners it means having competitive advantage on the longer term because it is future proof for a society that is possibly going from linear to a more circular economy.

But the most important condition for this system to work might be on the front-side of the design. The tenant. To create business there have to be interactions. Are there enough interactions to make the system viable? In chapter 14 this was researched and concluded that for this system to work, upgrades and appliances need to be part of it. When enough traffic and interaction is created the tenant can be motivated with the use of Keuken-credits. The system needs to implemented on a large scale, with options to grow. Not only bringing the ‘hardware’ (standard kitchen parts) but also the ‘software’ (appliances and more) into the service model. To make the system work and to make use of the big positive environmental impact potential that appliances offer. The next section, 15.3 is about these interactions.

15.3 the interaction with KC

People don't like to change, changes often bring complexities so with every change some resistance should be expected. The user research in this project indicated that people have difficulties with hassle in a system, and need motivation to partake. This project should give the example that circular models are also possible for this target group. To overcome this resistance the system should be desirable for the tenants. This section explains how the keukencollectief engages the tenants.

the product

CIK brings a lot of benefits for the tenant compared to the normal system, but they need to be convinced. The biggest benefit of CIK would be that the tenants have a better product over a longer time and have to option to fully fit it to their personal needs and wishes.

what is exactly the kitchen?

The tenant receives a basic kitchen when moving into a residence. If the kitchen is older than 10 years, a free fresh-up package can be ordered via JouwCIK. As a standard the basic kitchen would be a docking station with a white basic kitchen with 2 high cupboards, 3 lower cabinets, a induction cooking plate, a sink, a built-in separation unit and an extraction hood. The basic kitchen is illustrated in appendix 15. Starting with this the tenant can personalize and upgrade as explained on the previous page. Also the housing associations can decide to expand/upgrade the basic kitchen for their tenants, this can also be arranged via the platform. All possibilities for upgrades are illustrated in appendix 16.

The induction cooking-plate, the extractor hood and separation bin currently aren't included in the basic kitchen, but really should be part of it. The extractor hood and induction cooking plate can enhance durability of the kitchen itself and creates a lot healthier environment, while gas cooking without an extractor hood is very bad for the cooks health. (TNO, 2018) The separation bin is a measure to help people creating more impact, something that can force a change, make impact and save money for the tenant on longer term (Milieucentraal, 2019). With the user values in mind of cleanliness. The free 'fresh-up-package' opportunity for resident-mutations after living duration longer than 10 years is a good opportunity to engage the tenants. This could be very beneficial for their engagement since tenants value the cleanliness of their kitchen very highly. When a tenant changes, there is the possible desire to make it yours, what could give changes to do a 'fresh-up', a style and rubber change to create a clean kitchen.

interaction

But for this product-system to work, the tenant needs to take on a bit more responsibility. This responsibility requires engagement. Through user research it appeared that a tenant can only be engaged in a new system when excellent service provided and makes it easier for tenants to cooperate. This excellent service is taken into the service side next to the elements that are described in section 15.1: a personal approach, simple, clear and transparent communication, and accessible help or information when needed.

the channels

The interaction mainly takes place via a digital platform called 'jouwCIK'. This is a web-based application with connected to the database. This is an adaptable and future proof platform that can be connected to all the partners for efficient information exchange. The kitchen is linked to the tenants online profile, within the application the tenant can log and do changes or arrange things for his/her kitchen. The application is designed while being suited to the tenants wishes with opportunities to expand. The interface within the application will be showed in detail at the end of this section.

As appeared in the tenants values from user research, the tenants valued having a way out when constrained, also mentally. The keukencoach is an element of the service that helps people in making choices, or arranging things when the tenant has a hard time with the digital platform. The keukencoach can be called or chatted with, and can help with questions about CIK in every stage.

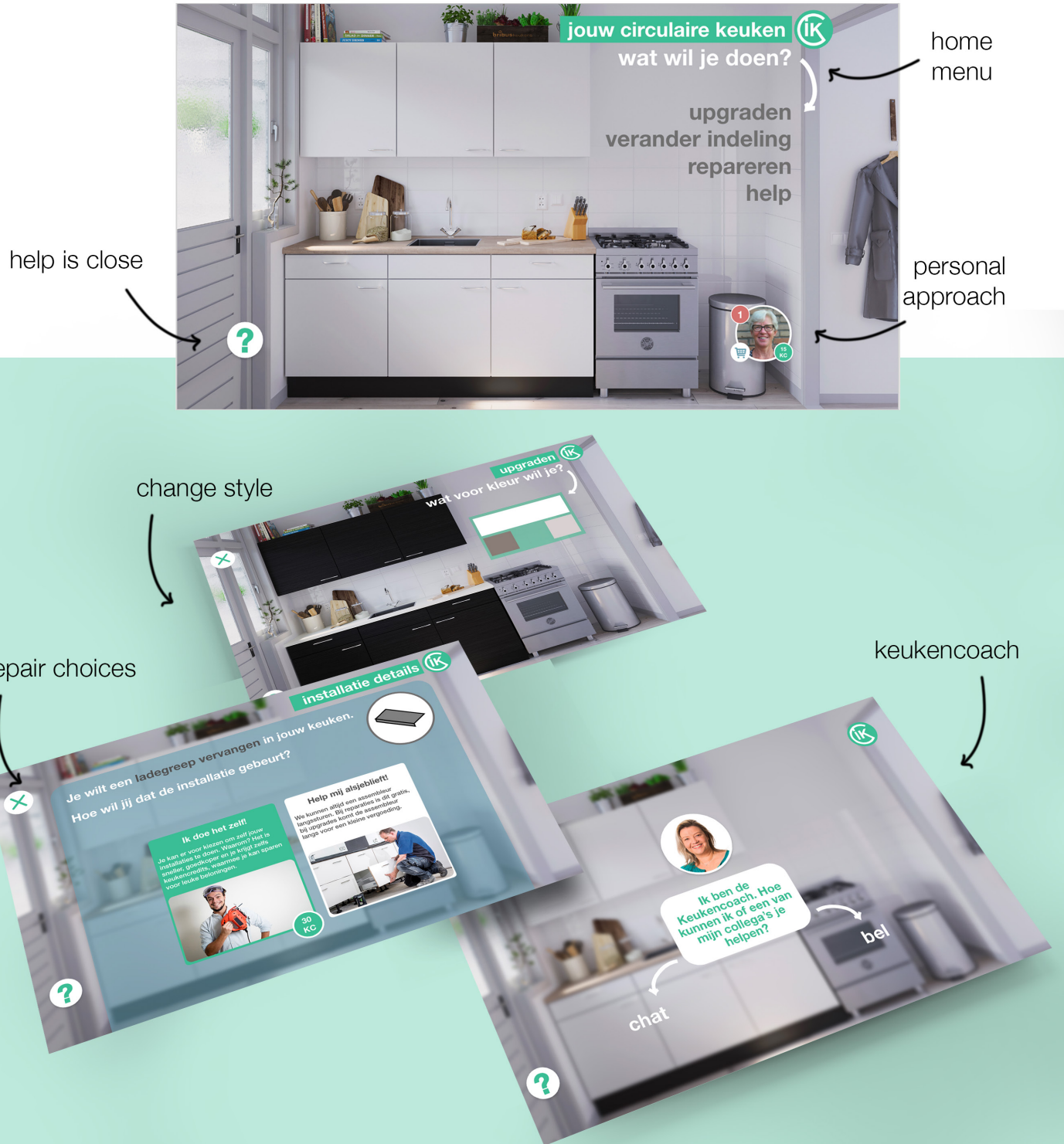
encouragement and rewarding

Within all interactions the tenant will be encouraged for more sustainable and efficient choices. This will be things like DIY repairs, picking up a order at a local postNL point or encouragement of more efficient appliances. DIY repairs is specifically important because it makes that the incredible potential for benefits. (section 4.3) It has a good LCA score and could also stimulate product attachment that could increase the life-cycle duration of parts. Making the ‘right’ choice is rewarded with the use of the Keuken-credits as discussed in section 15.2.

the interface

Figure 58 shows the screens from the digital platform ‘JouwCIK’. Appendix 17 shows examples of all other screens from the digital platform. As mentioned previously, there is a personal approach and a clear and simple layout with overview. The tenant can roam freely in this environment and can fantasize to expand their kitchen. By making the encouraged (more sustainable) choices, rewards can be earned and ordered via this platform. Extra information and help is accessible and can be found in every phase and screen.

figure 58. some interface screens from the digital platform ‘jouwCIK’



15.4 the back end of the service

The back-end of the service will also be guided by the keukencollectief. This is mainly a computer-system streamlines all background processes and the exchange of information between partners. Not all information should/can be open for all partners, KC supervises these information exchanges and optimizes them.

product database

As mentioned in section 14.4, for this system to work a PLM (product life-cycle management) database and software needs to be designed and implemented among the partners. This PLM database is specifically important for the manufacturers and logistics, this is hooked into the computer system. This part is mainly focused on the products and looping them back. It has the following tasks: The damage needs to be determined and classified, logistics need to be arranged and recovery process information are collected. For this to work every part needs separate identification.

service database

For the service-side, a lot of information is gathered and is used to optimize the service. For the personal approach to work, for the usability of the platform and the easiness of the system this is very important. This database is mainly and exchange of information between the housing associations and the Keukencollectief. This is connected to the other data to know which tenant has which parts in their kitchen, and where.

optimization

Gathering the data of the materials, parts and their use is very helpful in optimizing the product and system. This be used in optimizing the kitchen in the future, or to make new decisions for the service. To benefit from new insights by data analysis, it is important that the computer system, the service design and the kitchen are adaptable and open for changes.

part identification

To benefit from all material and part data, every part needs to be able to be identified individually. This can be done in a variety of ways; QR codes, NFC-chips, label scribing etc. From a tenant's perspective it is important that this does not come in the way of their kitchen aesthetics and that it is simple and used without a lot of hassle. This is why the interface design is based on a find and click action. This is a visual and simple action to find the right part on the tenants end. This enables the tenant to see the changes that he/she makes to their kitchen. To make sure that the tenant has selected the part that he/she talks about, a control step could be built in. For example: the tenant selects the part visually, the system asks: "is this part labeled with Upperdoor153?" (Figure 59). The tenant replies 'yes'. and the part is ordered. This label should be visible on the outside, be easy to read by people and by machines. For example by lasering the label on the part. For laminated parts it is important that it is on the laminate and on the part beneath it.

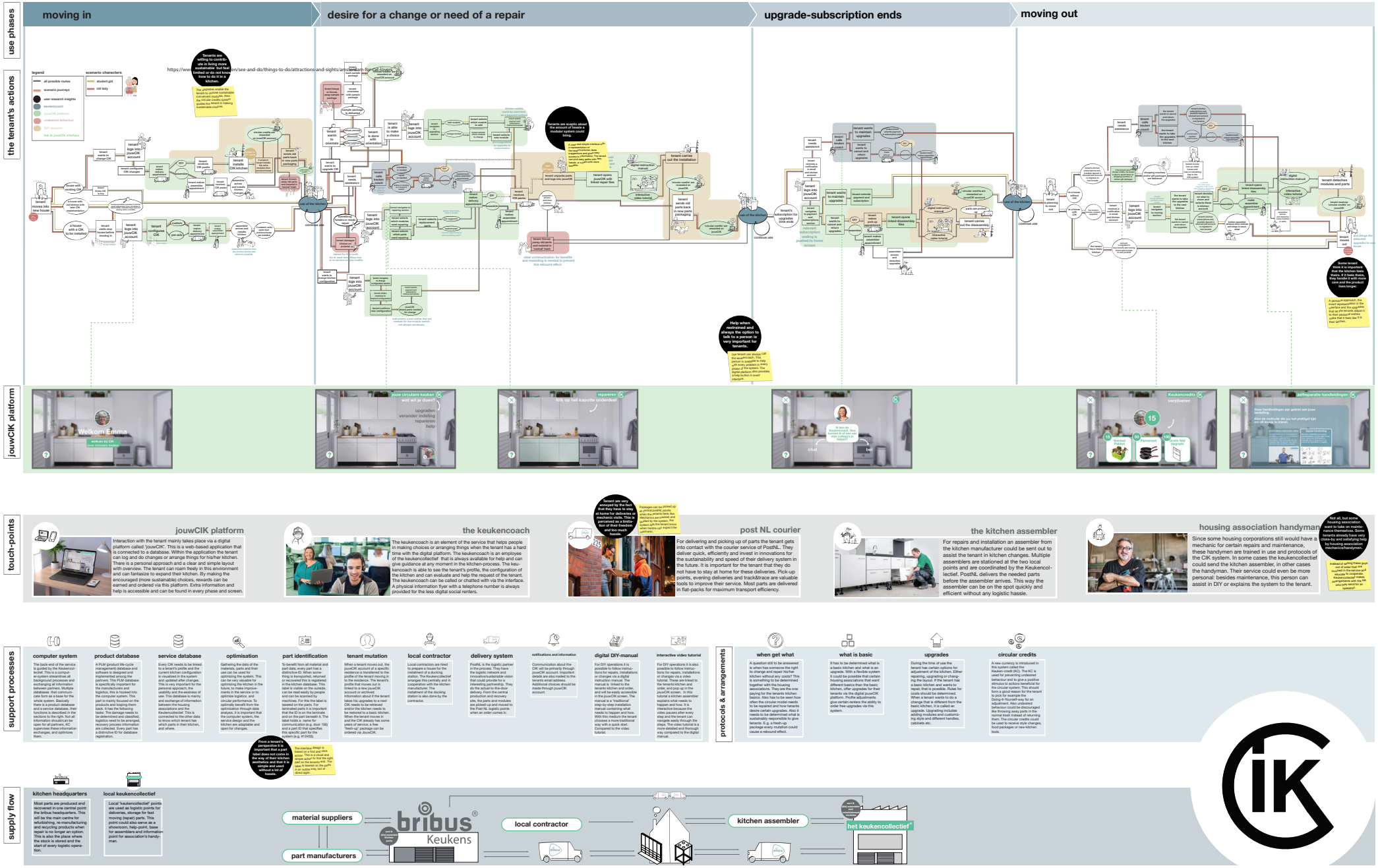
15.5 service blueprint

For an easy and integral medium for communication of the design to the stakeholders, a service blueprint is created during this project.

This contains all information about the service in a clear and hierarchic way. This blueprint is a visual representation of the design and also gives a detailed view on how the tenants journey looks through the service. This was created and iterated throughout the project. A miniature version is shown in Figure 60. The complete , full-size blueprint is available for download as a separate A0 file to the report.

figure 59. part identification example

figure 60. service blueprint



conclusion

These last chapters evaluate the final design and the conclude the project as a whole. This followed by a discussion and recommendations for further development of the product-service design.

16 | evaluation

In this section, an user test is discussed that is conducted to evaluate shortly how the end-user, the tenant responds to the design. After this, design C will be evaluated on the criteria that were set during this project.

16.1 user evaluation

Within a system with multiple stakeholders it is important to evaluate a design from multiple viewpoints. One of the most important initial goals was to use an user-centered approach, this is why the last evaluation is done with the tenant. The interface and the front-end is tested with two totally different social housing tenants for a small evaluation. A project-plan was created for this session to plan what was to be achieved during the session. A summary is displayed in this chapter, the additional parts of the project-plan are shown in appendix 18.

aim

The aim for this session is to shortly evaluate the front-end of the service design. The interview starts with a scenario in which the tenant got the (CIK) kitchen just built in, but wants to change something. Afterwards, the user evaluates the digital platform.

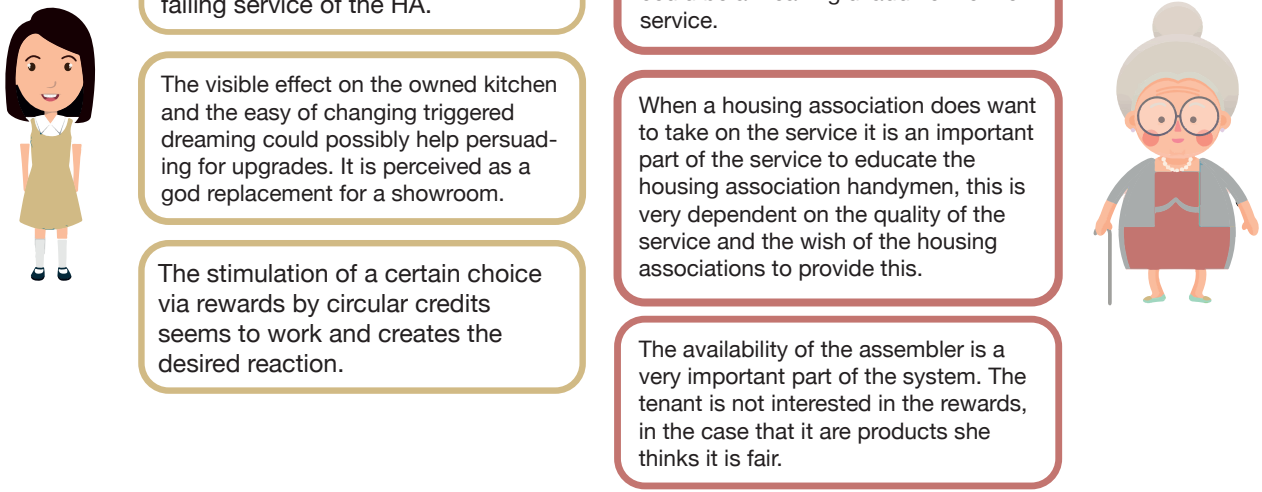
participants

For this short user evaluation two earlier participants were interviewed. There is chosen for two totally different age categories, life styles and tenant types. Tenant J is a young lady, a student living in social housing in a large city. While using the tenant-type framework described in section 8.5, she can be classified as a ‘homey kitchen user’. Tenant G is an elderly lady that is living in senior-social housing in a small city. She can be classified as a ‘independent kitchen user’. For this test her caretaker was also involved, she is the one that always takes care of the things that are ‘too difficult’.

results

The results of this session are the content of the interview and the output of a questionnaire with the user. The interview parts are translated into insights. The most interesting of these insights are shown in Figure 61. The output of the questionnaire are shown in appendix 18 and are also used in the next section to evaluate the criteria.

figure 61.most important insights based the interview during user evaluation



conclusion

As expected there seems to be a lot of differences in the way the tenant is going to interact with the system. In this case the student had no problem with the digital platform and claimed to be engaged and motivated. She was happy with it because the current system was failing her. The elderly lady had some problems with the application and was happy with the fact that she could also call in the same way as she used to solve these things. Her housing association is providing good service and act fast. But when her caretaker started to use the application in her name the elderly lady liked the overview, the amount of information the system gave and that it shows the effect on her kitchen. Also she stated that it seems very simple and thinks that other people would use this system very easily. Something that should be taken into consideration is the fact that the student thought the offer was very great and she had freedom of choice, but the elderly and her caretaker thought it was quite limited. What could be better was the amount of information and stimulation the system gave on changing behavior and means to use the kitchen more sustainable.

takeaways

I believe that the scenario in the blueprint predicted the behavior of both quite accurate. The differences between the two tenant's life phases and tenant types are confirmed and the system currently offers good path's for both target groups. The younger participant is as expected, more prone to DIY, getting help of others and can be seduced by the benefits of the kitchen-credit. But the elderly lady is quite unsure about the application, she says that calling is her way of solving these kinds of issues. But when she receive a little help from family or a caretaker they respond very positively to the application and is interested in the possibilities. The test also confirmed that het Keukencollectief should really try to implement the handymen of some HA in their service and training them in CIK's features, since some are already doing a really good job.

For further development of the system other types of tenants need to be tested, other life phases and other family formations. I think the new generation of elderly will be a lot more digitally skilled, so the application is the way to go. Either way, providing information packages in a non-digital way for the elderly tenants and acknowledging the caretaker is a good idea. But for the near future it will be interesting to see how elderly can be helped in using the digital platform. Maybe by looking for ways to include the caretaker easier by for example giving benefits to this person instead of the resident.

16.2 criteria evaluation

The design is evaluated based on the criteria that are set during the project. The last version of the criteria are the requirements as stated in problem definition C in chapter 13.

demands

While taking the demands in consideration, it can determined that in Design C almost all demands are met. The compact time-frame of the project did not allow satisfying all the demands. The demands that are not yet met in the design are the ability for tenants to take their own stuff into the system and the environmental impact of their choices within the system. For the goal of this project it can be concluded that these are more wishes and that they are not crucial for the design. But, the design can be adapted to meet these demands in further development, since they are currently not exactly represented in the design. This will be taken into recommendations for further development of the design. In advance better planning and prioritization should be done to overcome this.

wishes

In this section, design C is assessed based on incorporating the results of the questionnaire from the user evaluation (green) (appendix 18). Some wishes should be evaluated while using other methods with other stakeholders or users involved (blue). Also, some wishes are focused on being used for making design decisions while comparing alternatives to the design (gold). The wishes and the assessment are shown in Figure 62.

This approach was necessary within the time-frame of this project. In advance the design should be evaluated and tested with more stakeholders involved and compared with alternatives. The conclusion of this assessment and evaluation is handled in the next section, 16.3.

figure 62. assessment on wishes

--	-	o	+	++
W.5.2 - The design facilitates a circular product-service as best as possible.				
W.6.2 - The interests of all stakeholders should be taken into account as best possible.				
W.6.3 - The system causes the least problems for the tenants as possible compared to the 'conventional' kitchen.				
		W.6.4 - The system engages the tenant to cooperate as much as possible.		
W.6.5 - CIK should be as desirable, feasible and viable for all parties involved as possible.				
W. 6.6 - Housing associations should have as less work on the kitchen as possible.				
		W.7.9 - The system should address and made suitable to different tenant types as well as possible.		
W.7.10 - The design works as best possible for physically/ mentally disabled tenants.				
		W.7.11 - CIK motivates the tenants to partake as well as possible.		
			W.7.12 - CIK offers simple, clear and transparent communication as well as possible.	
		W.7.13 - The design should give the idea of freedom of choice as well as possible.		
			W.7.14 - The system takes on a personal approach as much as possible.	
		W.8.13 - The system works as easy and obvious as possible for the tenants.		
			W.8.15 - The platform offers appealing benefits for money as much as possible.	
			W.8.17 - The platform stimulates waste separation, efficient resource and appliance use as much as possible.	
			W.8.18 - CIK boosts confidence as much as possible.	
			W.8.19 There are as much as tools and information available via the system to change their behavior to become more sustainable as possible.	
W.8.20 - There is as much flexibility in the platform for implementing placing/taking of tenant owned items as possible.				

Legend

-- = bad
- = moderate
0 = sufficient
+ = good
++ = very good

green = assessment through user test
blue = assessment by other stakeholders
gold = assessment by comparing alternatives

16.3 evaluation conclusion

The specific goal of the project was to design a service that engages social housing tenants in using a circular kitchen system. So does the design fit the goal of the project, are the criteria met and is the design attractive?

I believe so yes. The engagement is wired through all aspects of the service design. There is engagement by facilitation of the improvements that new possibilities and benefits of this system bring. The digital platform and the system facilitate this and offers the tenant interesting benefits. It works for different tenant types by for example by providing a listening ear by the keukencoach that enables you to do adjustments to your kitchen. This touch-point is a place for the tenant to drop his/her frustrations and dreams and aims to give them a suitable solution. This is often not the case in the current system, and provides tremendous benefits for the tenant. There is also engagement by the circular vision and circular elements in the system. This design facilitates this and creates engagement by giving a sustainable and commercially attractive alternative. The kitchen feels innovative, personally and responsible for the tenant. It provides a good feeling by facilitating the tenant to contribute to this good cause.

The user-centered approach gave insights on how to do this and the design came through by keeping this in mind. Based on the user evaluation the design is perceived very positive and engaging. The criteria were met quite well and they provide interesting guidelines for further development of the project. The design provides attractive and appealing benefits for the stakeholders involved, the system seem to be understood by different tenants, it was perceived well and the interface gave the idea that the kitchen was theirs.

But since the project is complex, a lot of different stakeholders are included and the target group is very big, still a lot needs to be tested, developed and to be discussed with a lot more stakeholders and different tenants.

how meaningful is the design

Besides what the system offers for the tenants and the stakeholders, the system also offers new values for the Eco-system and society. Compared to the old kitchen system, it wilt be a lot more meaningful to the future of our world. CIK has the potential to help people and society on a lot of different levels, while improving the conventional kitchen system. It provides new values for the ecosystem and the society. In appendix 20 a framework was used to compare how meaningful this innovation is in relation to the old system. According to this method the new system design is meaningful and the old one isn't. In the new system there is innovation at the tenants home,in the industry and in society at economical. psychological, social and ecological level. Awesome.

17 | discussion

The assignment that started this graduation project was to investigate what tensions the circular kitchen might bring for social housing tenants and to come up with a design proposal.

This was done via an integral approach while considering all aspects of design: technology, business and people. This report describes an user-centered design process in multiple iterative cycles resulting in a design proposal for a service system to facilitate a circular kitchen for social housing in the Netherlands. The input of the evaluation of the design with the kitchen manufacturer resulted into the introduction of a new partner that drives the organization as a whole: Het Keukencollectief. An intermediary that connects all stakeholders and is the key to a successful and fertile business. This party aims to engage the tenant with a service that tackles possible conflicts that can arise between circular interests and the tenants. A lot of opportunities can be created in the business model around het Keukencollectief. This could bring a lot of advantages on all dimensions of sustainability: economically, socially and environmentally. The system offers a lot of new values as a whole and is a solid basis for a system that works towards a not-dying kitchen, a kitchen for life.

17.1 limitations

This project started with investigating what happens in the life of the tenant in the kitchen parallel to an analysis of the changes that a circular kitchen bring. The context of the problem was investigated while using literature studies and context-mapping with social housing tenants. There seems to be limited knowledge about the attitude that people have towards their kitchen and what they value around it. The context-mapping sessions provided a holistic view on the life of the user in the kitchen and pointed out findings in the behavior of the tenant. On the one hand it appeared that tenants differ in their perception of the kitchen. Their kitchen has an emotional or functional role and their activity in the kitchen are either individually or socially focused. These findings were placed in a framework where 4 tenant types were distinguished and are used to represent the different characters/types that appear among social housing tenants. On the other hand shared values were found among this research group. The things that appeared to be the most important factors within a kitchen and the system around it to maintain it were primarily: the fact that a kitchen should be clean, the freedom of choice, as little hassle as possible and secondary, motivation to partake, value for money, help when restrained structure and organization among tools and materials and space to work in a kitchen. Since the method of context-mapping is really focused on qualitative research, and the sample for this was relatively small, further research is needed to prove whether these values are representable for all social housing tenants, and also whether it can be true for a greater audience; tenants in general or even kitchen users (in the Netherlands).

The project proceeded and it appeared that the service of CIK needed development. A service design that upholds the freshly found insights on the tenant and prevents conflicts that can arise by involving the circular design in their life. A concept for a service was created that incorporated the findings. A major stakeholder, the kitchen manufacturer evaluated the concept and their interests and problems were taken into a new design iteration step. It appeared that the stakeholders involved were not all on the same level and if one becomes too dominant, it might not be leading to a very circular or even viable product-service system. This resulted in the introduction of a new partner that should drive the organization as a whole. The new-found Keukencollectief guards the interests of all stakeholders involved and makes it into a successful and fertile business proposal.

When aligning this project to the research of a similar case study by Sumter (2018), in which competencies for a designer were found to take into account were found for successful implementation of a circular design with an existing product. These abilities should be considered: Calculating environmental impact on a system level over multiple life cycles, planning and anticipating how the system will evolve and how to deal with future consequences, organizing and facilitating good stakeholder interaction and collaboration in carrying out a circular business model and having an integrated approach in which the development of products and services happens concurrently. All these parts were given some attention in this project, further research on the environmental impact on the system level is needed and the housing association interest need to be taken into further optimization of the design. Specifically on the service side. A lot is already happening behind the scenes and by other collaborators on the CIK-project, but these things need to be researched while adding the service side to the system as a whole.

In the end the design was tested and the final front-end design of the service was evaluated by conducting an user test with tenants. This gave the insights that the design was perceived positive and engaging and worked according to the vision on the design. But, not all tenant types are involved in the evaluation of the end-result and the sample group was realtively small. If the framework was applied on the participants, they represented 2 of the 4 tenant types. This together with the small sample make that the assessment of the final design in the evaluation relatively subjective. Also the application was mainly the front-end that was tested, while there are more aspects of the service important. In advance there could be a more methodical approach in the user test to see how the service scores with more participants, a wider spread and also including other aspects of the service.

17.2 recommendations

Overall, I found interesting and useful insights for the CIK project to continue with. But in such a complex system with a lot of interests and agenda's of different parties, I just hit the tip of the iceberg. A lot more need to be found out. This design project can function as a solid base for developing the Circular Kitchen. This adaptable service and product design offers interesting perspectives and opportunities for the future. In this section I elaborate on how I think CIK should move on and what I think is the right direction to go in the future.

shaping the keukencollectief

I think CIK should move on with the development of the Keukencollectief as an intermediary in the system that they are building. A partner, company should be found that wants to take on this job with the experience in the tasks that such an intermediary has, with access models product, service-systems and providing excellent service. They need to make this work with all the potential that this system offers. A possibility could also be to join forces with other product-service providing parties already out there. For examples the companies Bundles and Homie. These are commercial parties that act in the consumer market that provide domestic appliances with lease or pay-per use subscriptions. They buy appliances, bring these to the customer and provide service via the appliance manufacturers (Bundles, 2019) (Homie, 2019). They mainly act as intermediaries, tying all ends, like keukencollectief is also doing.

involve housing associations

Something I did not managed to include in my project is directly involving the housing associations in the developing the service. But this is very important, specially because there are a lot of differences between different housing associations. The idea of the Keukencollectief might convince them that this is the way to go, align them and move up the quality of service.

improve the front-end

The front end, the interface has its first prototype up and running and the tenants seem to like the way it works. But this should still be optimized and additional research should be done. More persuading elements can be added or optimized like environmental impact and the Keuken-credit system has a lot of potential. This could be really a way to change the industry, but also the way social housing tenants are behaving. Also something that should really be possible in the front-end is that the interface takes already owned items into account. This strengthens the personal approach and can improve the functionalities of the digital platform.

functional improvements

The adaptable, modular design of the product could be improved as well. From the users perspective an interesting development would be to increase modularity of the parts that are not modular yet. Like the counter-top, wall-sockets, water-pipes and electricity cables. The development that the Netherlands is moving off gas-cooking already works in this advantage, the gas-pipe restriction would be less. But if the mentioned parts would be also be more 'plug&play', this would offer even more personalization and room for upgrades in the kitchen. These would offer interesting opportunities and would make the system as a whole better.

opportunities to expand

During this project I also encountered some opportunities that CIK was already thinking about, but I want to point out that with the Keukencollectief in place, that these opportunities should really be explored.

expansion to private market

An interesting opportunity is to expand to the private market, specifically the consumer market and maybe on the long term the private rental market. The private rental market in the Netherlands would be a tough market to penetrate since the main interest of private housing owners is maximum return on investment. (Vastgoed Belang, 2019) Compared to the housing associations they value their societal responsibility, environmental benefits and the well-being of their tenants a lot less. This also became clear during the stakeholder concept evaluation, Bribus mentioned that clients from this market do not take their tenants wishes in consideration and make kitchen choices mainly based on their own interests. But the consumer market does appear to offer opportunities; similar product-service designs like Bundles and Homie that provide consumers with access based home appliances, show that the market is quite willing. They seem to gain market share in 2018 and more and more industry partners are showing interest in cooperation in such a business model.

expansion outside the kitchen

To make the system more profitable it might be interesting to include other parts of the home in the same system. These could be appliances like wash-machines, dryers but also repairs in other parts in the residence, the bathroom or other real estate parts that need recovery so now and then. Also I think that more (positive sustainable behavior influencing) convenience tools already need to be included in the standard kitchen. It creates awareness and force the kitchen user to think about altering their behavior to a more sustainable level. This means that also housing associations can take their stance and responsibility in the environmental discussion in this way, and help making impact for a large group of renters.

expand personalization

To create more traffic and interaction for the keukencollectief, the offer of CIK could also expand to things that are currently not possible in social housing or that are very hard to arrange for the tenants. These are upgrades like cooking islands, built-in bars that provide certain luxury to the tenants that

have money to spend on their kitchen, but could also be special modules for handicapped or old people. For example a wheelchair accessible counter-top, special grips or different cabinets. Within the social housing segment there are a lot of physical and mentally handicapped tenants. A standard kitchen does not cut it for them. Why not offering modules to improve their home to their needs in a good way?

international

This recipe for a product-service design might also work abroad. Every market has different manufacturers and tenants, but the system of the Keukencollectief could stay the same. Theoretically it could be rolled out in every country, but new connections should be made and interests of the stakeholders should be prioritized. With the right buttons pushed, Keukencollectif could spread its arms across Netherlands borders and establish a Kitchencollective, Küchenkollectiv or a Cocina Collectiva.

means to make impact

One stakeholder that is not yet discussed very thoroughly, but who can help in making this system work or give it a boost, is the government. In chapter 5, this is mapped as an indirect stakeholder with a lot of interests on a lot different levels. Their task in social housing market is mainly focused on monitoring that housing associations provide good housing for people with a low income while following the rules and regulations. (Rijksoverheid, 2015-b) But something the government currently struggles with are the European climate-agreements, where the Netherlands is improving, but should take radical measures. There seems to be a lot of resistance from industry, political parties and with civilians (Nu.nl, 2018).

This system could provide the means to help and to gain ground and work towards these climate-agreements. If the government would approve, subsidize and adapt regulations this system could gain a lot of ground. It is a direct tool to influence sustainable factors in the kitchen-use and industry. By rewarding the end-users and saving money with the housing associations it might even speed up the gas transition. For the housing associations it might even become a reason to work with them. If the tenants of these organization benefit significantly comparing to the ones with a conventional kitchen. The keukencollectief could make serious positive environmental impact compared to the conventional kitchen system and has the means to persuade stakeholders on all levels by introducing additional benefits by rethinking the system.

This was my graduation report.

Thanks for reading and keep in mind:
There is not (yet) a planet B.

Sincerely, Bas

no kitchen was harmed in the making of this report

glossary

Biological Cycle
Consumables in a circular economy are made from biological nutrients that are non-toxic and possibly even beneficial to the biosphere whence they are returned after being consumed (Ellen MacArthur Foundation & IDEO, 2017).

Biosphere
The global ecological system comprising all living beings and their interactions. It is the global sum of all ecosystems (Ellen MacArthur Foundation & IDEO, 2017).

Carbon Dioxide Equivalent
Carbon dioxide equivalent (CO_2eq) stands for a unit based on the global warming potential (GWP) of different greenhouse gases. The CO_2eq unit measures the environmental impact of one tonne of these greenhouse gases in comparison to the impact of one tonne of CO_2 (Climate Policy Info Hub, 2019).

Cascade
Cascading materials and components is making use of them for another purpose once they reach their end-of-use phase, thereby extracting value from stored energy and material coherence. Along the cascade material order declines as entropy increases (Ellen MacArthur Foundation & IDEO, 2017).

Circular business model
How an organisation creates, delivers and captures value in a circular economic system, whereby the business rationale is designed in such a way that it preserves product integrity to a maximum extent, minimizes leakage and resorts to the use of resources in the process of creating, delivering and capturing value only when the options for using presources have been exhausted, in order to achieve the most complete cycling of materials within the larger economic system possible (Den Hollander, 2018).

Circular Economy
An economic system that replaces the ‘end-of-life’ concept with reducing, alternatively reusing, recycling and recovering materials in production/ distribution and consumption processes. It operates at the micro level (products, companies, consumers), meso level (eco-industrial parks) and macro level (city, region, nation and beyond), with the aim to accomplish sustainable development, thus simultaneously creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations. It is enabled by novel business models and responsible consumers (Kirchherr et al., 2017).

Eco-costs
Eco-cost is a Life Cycle Analysis (LCA)-based indicator for environmental impact. It is based on “marginal prevention costs” e.g. costs required to bring back the environmental burden to a sustainable level, by either end of pipe measures or by system integrated solutions (Design-4-Sustainability, 2019).

Emotional durability
The ability of products to remain wanted by users over a long period of time (Den Hollander, 2018).

Flow
The flow of a non-renewable resource is the rate at which its finite stock (or known reserve) is depleted. The flow of a renewable resource is the rate it is used in (or degraded by) the economy; when its flow rate exceeds its regeneration rate the stock starts to degrade (Ellen MacArthur Foundation & IDEO, 2017).

Leakage
Products or their components/materials that flow from the circular economic system to the biosphere, and that cannot be recovered at the present time (Den Hollander, 2018).

Maintenance
The performance of inspection and/or servicing tasks at regular intervals, to retain a product’s functional capabilities and/or cosmetic condition (Den Hollander, 2018).

Physical durability	The ability of products to withstand wear, stress, and environmental degradation and remain able to fulfil all physical functions for which it was designed over a long period of time (Den Hollander, 2018).
Presource	Obsolete products awaiting recovery (Den Hollander, 2018).
Prevention	Measures taken before a substance, material or product has become waste (EC, 2008, p. L312/10).
Product lifetime	The duration of the period that starts at the moment a product is released for use after manufacture and ends at the moment a product becomes obsolete beyond recovery at product level (Den Hollander, 2018).
Product use cycle	The duration of the period that starts at the moment a product is released for use after manufacture or recovery and ends at the moment a product becomes obsolete (Den Hollander, 2018).
Re-context ualizing	Use of an obsolete product (or its constituent components), without any remedial action, in a different context than it was used in as it became obsolete (Den Hollander, 2018).
Re-manu-facturing	Industrial processes whereby a party disassembles obsolete products into components, to a level down to bring as many of those components as considered eligible after testing back to at least original equipment manufacturer original performance and recombines those components (generally originating from different used products) with as few as possible new parts, to manufacture new products of a similar type and specification, that result in a new product with a warranty that is identical to that of an equivalent product manufactured out of all new parts (Den Hollander, 2018).
Recovery	Any operation with the primary aim of reversing obsolescence. Note that this definition of recovery rather differs from the one presented in the European Waste Framework Hierarchy (Den Hollander, 2018).
Refurbishing/ re-conditioning	he process of returning an obsolete product to a satisfactory working and/ or cosmetic condition, that may be inferior to the original specification, by repairing, replacing or refinishing all major components that are markedly damaged, have failed, or that are on the point of failure, even where the customer has not reported or noticed faults in those components (Den Hollander, 2018).
Repair	The correction of specific faults in an obsolete product, bringing the product back to working condition, whereby any warranty on the repaired product generally is less than those of newly manufactured equivalents and may not cover the whole product, but only the component that has been replaced (Den Hollander, 2018).
Reuse	Any operation by which products or components that are not waste are used again for the same purpose for which they were conceived (EC, 2008, p. L312/10).
Stock	The stock of a non-renewable resource such as a metal ore or fossil fuel is finite outside geological time-frames. The stock of a renewable resource such as a forest or soil can be regenerated. In a circular economy stocks of both types are managed (Ellen MacArthur Foundation & IDEO, 2017).
Sustainable Development	Principle encompassing three aims which must be accomplished simultaneously: environmental quality, economic prosperity and social equity (Taylor, 2016).
System	A set of interacting components forming an intricate whole. The circular economy is particularly concerned with complex adaptive systems (such as the global economy and the biosphere) (Ellen MacArthur Foundation & IDEO, 2017).

Technical Cycle	Technical materials (nutrients), such as plastics, are not suitable to be safely returned to the biosphere and so are designed from the start to enter the technical cycle, consisting of loops of repairing, reusing, re-manufacturing, and recycling (Ellen MacArthur Foundation & IDEO, 2017).
Waste Hierarchy	Priorization/ranking the ‘R’s’ strategies from CE (Kirchherr et al., 2017).
Hardware	A term in this project used for referring to standard kitchen parts. Included are the cabinets, counter-top, docking station, water-tap etc.
Software	A term in this project used for referring to kitchen appliances. Fridge, cooking plate, extractor hood etc.
Waste	Any substance or object which the holder discards or intends or is required to discard (EC, 2008, p. L312/9).

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A KITCHEN FOR LIFE

appendices

appendix 2. technical details

the product side

As mentioned in design starting point (section 4.2) the kitchen consists of a docking station with different modules.

The layout of a separate module is visualized in Figure 63. The module is based on a frame, with a variable infill and a removable front finish. These are some product features that are not yet discussed in ‘design starting point’:

kitchen configuration

- The modules can be placed in different size-configurations. Adjustment of this configuration has the benefit that it can be used by different tenants over longer periods of time. The module size is the same but the flexibility is offered by changing the height and lay-out of the modules. The docking station contains connector-holes with 5cm spacing in vertical and horizontal direction. And vertically, 3 set-ups are possible. Under the frame a ‘foot’ is placed that matches the adjusted height to fit the module.
- The sizes of the modules and the hole flexibility bring the advantage of relatively limited unusable space between parts, walls and the ceiling. A maximum of 5 cm spare space could arise.

module infill

As shown in design starting point the modules contain a so-called module infill. The module infill can be configured in different ways. In a basic kitchen all bottom cabinets will have multiple drawers, and the hanging drawers just a door. But there is a possibility for upgrades, it could also be an appliance or a different kind of cabinet.

style package

The style package includes all style adjustable parts in the kitchen. At first this will be the module front and side covers. An easy changeable style package offers the tenant the opportunity to get a fresh look or go with the current kitchen fashion.

material and appliances

These are some material features that are not yet discussed in ‘design starting point’:

- During the phase of building prototype 1 (early 2019) most parts are made from wood. The frame, plates and fronts are made out of formaldehyde-free multiplex. This is a variant on the widely used multiplex at the moment, but without the hazardous formaldehyde glue (Figure 64). Most multiplex parts have a HPL coating (High Pressure Laminate) that is pretty durable and easy to clean. At the moment the HPL is glued on the parts but this will change in the near future. Ideally the HPL layers are glued with an adhesive which is easily removable. This way the HPL can be separated easily and parts can be used again. For the first design this is not the case yet.
- The kitchen counter is made from thicker multiplex. In the future it could be possible that it is offered in RVS, ceramic or other variants (Figure 65).
- Parts like the screws, water tap, handles are made from durable RVS.
- A rubber strip connects that is milled into the parts of the modules closes off the gaps between the module and the wall plates on the docking station.

ATAG delivers the electrical devices in the kitchen. This could be an oven, induction cooking plate, extractor hood and refrigerator. The basic kitchen will come with an extractor hood. Good extraction in the kitchen is underestimated and seems to be crucial in reducing potential damage on lung, heart and blood-vessels according to TNO. (TNO, 2018)

figure 63. module build-up

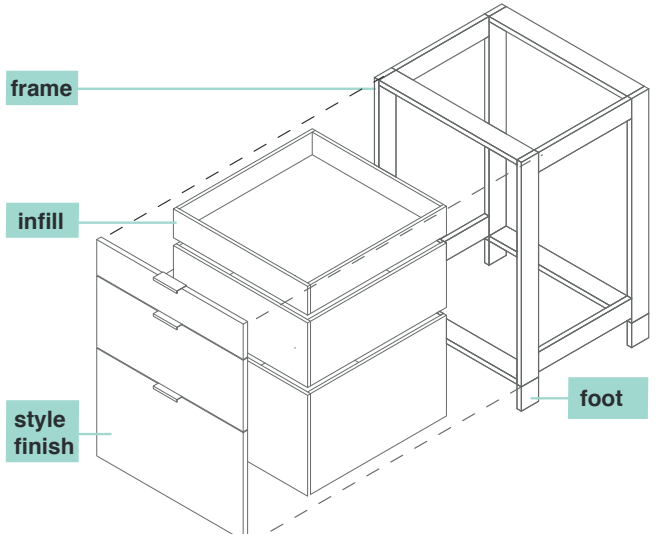
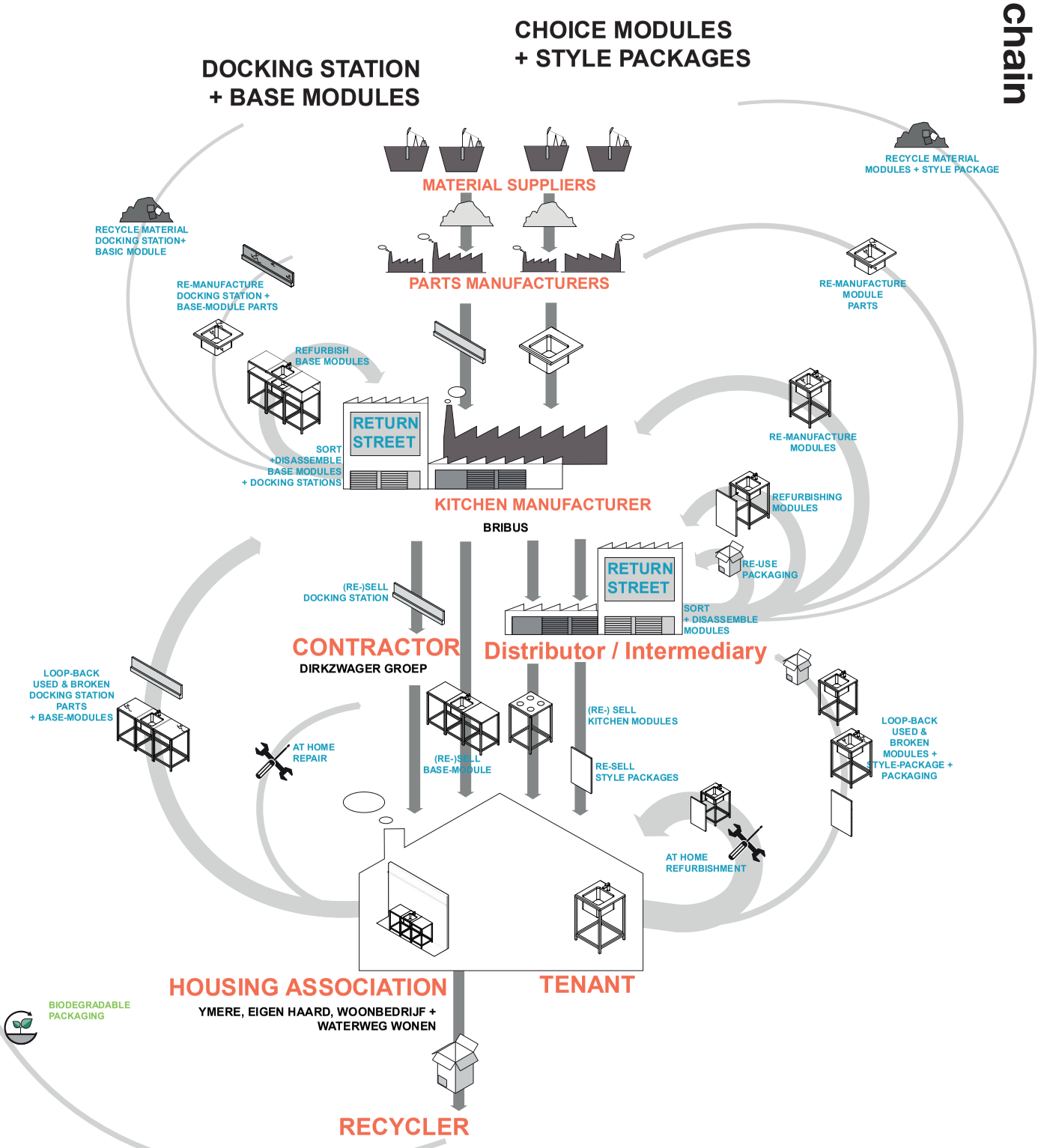


figure 64. formaldehyde-free multiplex

figure 65. HPL


DOCKING STATION
+ BASE MODULES
CHOICE MODULES
+ STYLE PACKAGES
MATERIAL SUPPLIERS
RECYCLE MATERIAL
MODULES + STYLE PACKAGE
RECYCLE MATERIAL
DOCKING STATION+
BASIC MODULE
PARTS MANUFACTURERS
RE-MANUFACTURE
DOCKING STATION +
BASE-MODULE PARTS
RE-MANUFACTURE
MODULE
PARTS
REFURBISH
BASE MODULES
RETURN
STREET
SORT
+DISASSEMBLE
BASE MODULES
+ DOCKING STATIONS
RE-MANUFACTURE
MODULES
KITCHEN MANUFACTURER
BRIBUS
REFURBISHING
MODULES
RE-USE
PACKAGING
RETURN
STREET
(RE-)SELL
DOCKING STATION
SORT
+ DISASSEMBLE
MODULES
CONTRACTOR
DIRKZWAGER GROEP
Distributor / Intermediary
LOOP-BACK
USED & BROKEN
DOCKING STATION
PARTS
+ BASE-MODULES
AT HOME
REPAIR
(RE-)SELL
BASE-MODULE
(RE-) SELL
KITCHEN MODULES
RE-SELL
STYLE PACKAGES
LOOP-BACK
USED &
BROKEN
MODULES +
STYLE-PACKAGE +
PACKAGING
AT HOME
REFURBISHMENT
HOUSING ASSOCIATION
YMERE, EIGEN HAARD, WOONBEDRIJF +
WATERWEG WONEN
TENANT
BIODEGRADABLE
PACKAGING
RECYCLER

appendix 4. impact case study Amsterdam

This fragment is copied from a report for 'stimulus project circular components in the built environment.' More details about this calculations are not provided. (Van Stijn et al., 2017)

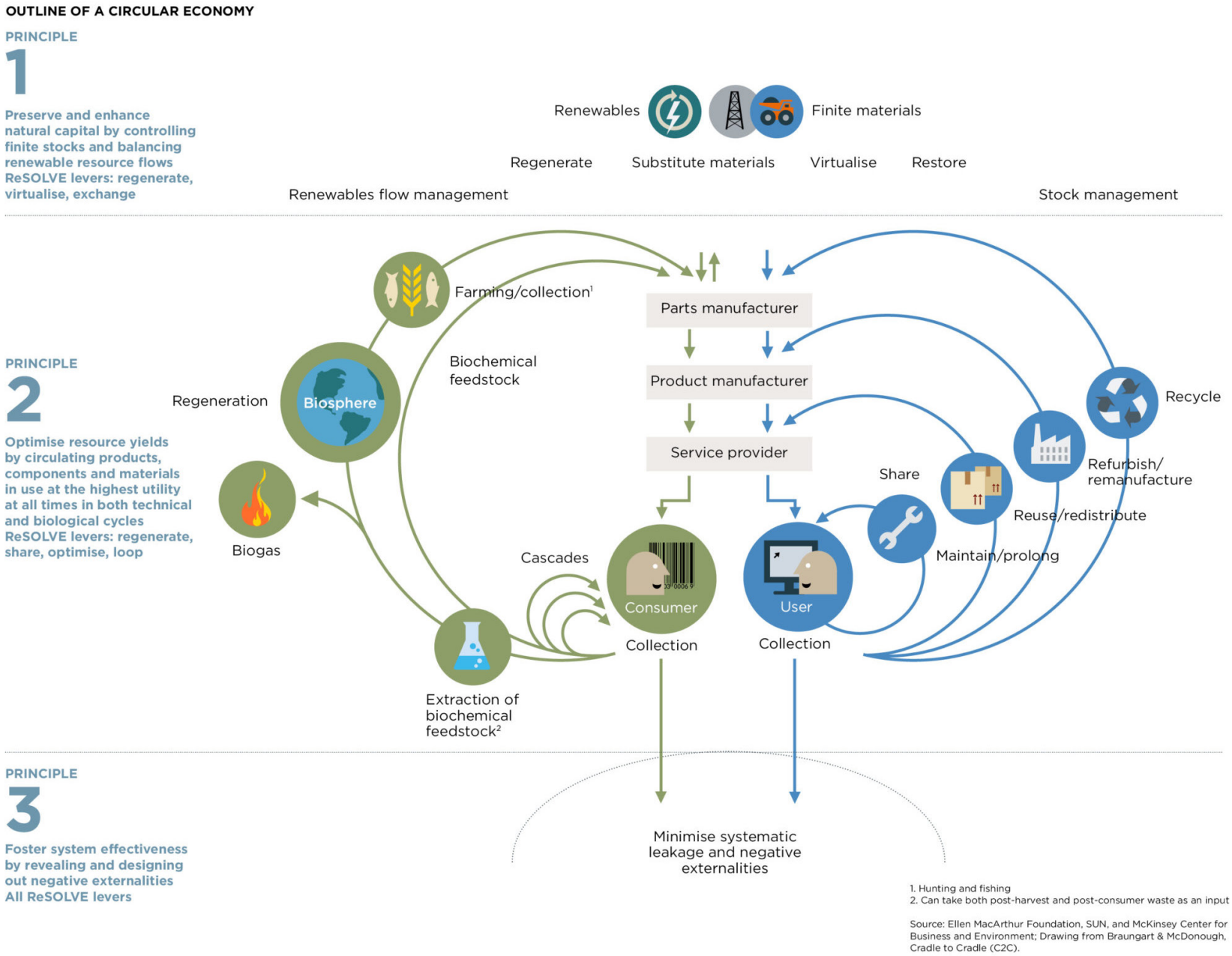
"2.6. Impact and benefits for the Metropolitan Region Amsterdam

From both developed circular components, the Circular Kitchen has been identified as having high-potential for to-market development on short term. Several potential impacts and benefits can be identified for the Metropolitan Region Amsterdam if the Circular Kitchen would be up-scaled to the market:

- Implementation of the Circular Kitchen will lead to a reduction of resource use, pollution and GHG- emissions. A business-as-usual kitchen results in 10,6 kg of waste per year per household. In the Amsterdam, social housing stock this contributes to 2,0 kilotons of waste each year. The Circular Kitchen could save up to about 10 kg of waste per kitchen/year and if implemented in the Amsterdam social housing stock could save 1,9 kilotons of waste in the sector each year – a reduction of 94%. Our LCA calculation indicates current kitchens (excluding appliances) lead to 9,7 kg CO2eq emissions per household per year. Adding the appliances (without the use related CO2) result in another 99,1 kg CO2 eq per year. A tentative calculation indicates emissions from the energy consumption in the use phase are minimally 200 kg CO2 eq. The Circular Kitchen could bring the CO2 eq emissions down to only 2,1 kg CO2 eq per kitchen (without appliances) per year, 49,5 kg for the appliances, and could save 53 kg CO2 eq from use related energy per year per household. A reduction of 78% on emissions related to the kitchen, 50% on those related to the appliances, and 26,5% on use related energy. If implemented in the social housing stock of the Amsterdam this could lead to the mitigation of 1,4 kilotons CO2 eq per year for the kitchens. By including circular and energy conserving appliances it is expected that this could lead to a savings of 9,4 kilotons CO2 eq per year for the appliances, and 10,1 kiloton of CO2 eq per year for the use related emissions.
- The Circular Kitchen gives Amsterdam's tenants, who currently have limited influence on their kitchen, a lot more choice and flexibility over the whole use period.
- The proposed business model would unburden the Amsterdam housing associations allowing them to focus their resources on their core tasks.
- By closing the loops in the proposed industrial models new job and service opportunities could be created in Amsterdam.
- The Circular Kitchen is easier to construct and deconstruct and thus gives an answer to the growing scarcity of (specialized) skilled workers and increased efficiency in the (de)construction process within the city."

appendix 5. butterfly model

(Ellen MacArthur Foundation, 2019)



appendix 6. sensitizing booklet

A diary-workbook is created and sent to the participants a week before the interview sessions. The toolkit is sent by the (physical) mail and the participants are asked to fill in an exercise each day. The total toolkit consists of the workbook with stickers pasted into. Topics addressed in the workbook are the general behavior around the house, how they see their kitchen and questions about kitchen habits, how often, what, when, how.


werkboek van .....

Ik en
mijn Keuken

Introductie 3

Hallo!

Volgende week kom ik bij u op bezoek om met u te praten over keukens.

Dit werkboekje is bedoeld om u in een creatieve stemming te brengen voor het gesprek van volgende week. In deze 'sessie' zijn wij erg benieuwd naar uw persoonlijke ervaringen in en met de keuken.

Dit werkboekje is een soort dagboek met kleine opdrachten verspreid over 5 dagen. Ik wil u graag vragen de opdrachten per dag van de week in te vullen. Het duurt niet meer dan een paar minuten per dag. De dag van de week staat rechtsboven op elke pagina aangegeven. Mocht dit niet lukken dan is het niet erg als u opdrachten op een andere dag maakt. Het is de bedoeling dat u begint met de oefeningen op maandag 10 december.

Er zijn geen goede of slechte antwoorden in dit boekje, alleen uw antwoorden. Beantwoord de vragen zoals u wilt. Uw antwoorden hoeven niet dat te zijn van een ontwerper, maar dat van een persoon met ervaring in een keuken. Dit werkboekje bevat ook wat stickers die u gaan helpen bij de oefeningen.

Graag zou ik uw werkboekje meenemen om in te zien na de sessie. Mocht u het willen dan kan ik hem altijd aan u teruggeven.

Groet,
Bas de Rooij

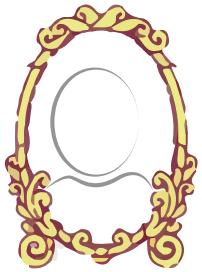
Introductie 5

even voorstellen

Ik ben Bas de Rooij, een 25-jarige student aan de Technische Universiteit in Delft. Ik doe de master die gericht op producten ontwikkeling vanuit de gebruiker. Verder houd ik van sporten en kijk ik graag naar films.

Naam	Bas
Woonplaats	Amsterdam
Leeftijd	25
Dit eet ik het vaakst	Aardappelen met groente en vlees
Dit eet ik het liefst	Ravioli met salie en boter

Maandag



Hoe zou u de deze dingen over u zelf beantwoorden?

Naam	
Woonplaats	
Leeftijd	
Dit eet ik het vaakst	
Dit eet ik het liefst	

Maandag 7

de inrichting van mijn huis

Hoe belangrijk vindt u het om een fijne inrichting van uw huis te hebben en kunt u uitleggen waarom?

Op welke drie onderdelen van de inrichting van uw huis bent u het meest trots en waarom?

1

2

3

Dinsdag 8

dit is mijn keuken

Maak een tekening van uw keuken. Teken en (be)schrijf hoe uw keuken er uit ziet. (u mag het boekje draaien)

Dinsdag 9

dit is wat ik belangrijk vind bij mijn keuken

Omcirkel de termen die u belangrijk vindt. U mag ook nieuwe termen erbij schrijven.

schoon

goede apparatuur

praktisch

iets wat bij mij past

mooi

design

lekkere geur

zo klein mogelijk

duurzaamheid

Woensdag 10

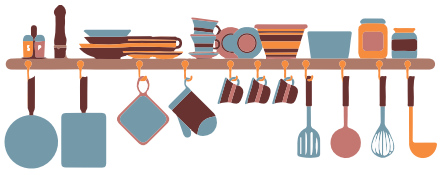
mijn keuken-activiteiten

Welke activiteiten doet u allemaal in de keuken? Bijvoorbeeld afwassen, eten aan het aanrecht, boodschappen inruimen, afval sorteren, kleding vouwen, telefoneren tijdens koken etc.

Het meeste tijd besteed ik aan

Het leukste vind ik

Het minst leuk vind ik



Woensdag 11

mijn kookproces

Beschrijf het proces als u uw favoriete gerecht gaat maken in de keuken. Beschrijf stapsgewijs wat u doet in de keuken. U mag schrijven en tekenen.

Is het proces wel eens bij u veranderd? Hoe en waarom?

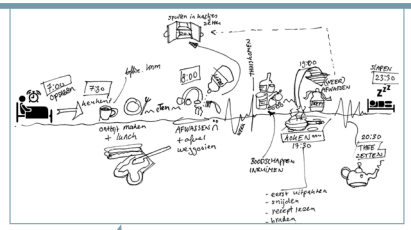
Donderdag 12

een dag in mijn keuken

Teken de momenten in de onderstaande tijdlijn wanneer u iets doet in de keuken op een doorsnee-dag. Op de rechterpagina staat een voorbeeld.

begin hier

ochtend



voorbeeld

avond

Vrijdag 14

hoe voel ik mij in de keuken

Kies vier stickers en plak deze bij bepaalde momenten op de vorige pagina (de tijdlijn).

Teken hieronder de emotie-sticker na en leg uit waarom u zich zo voelt.

Vrijdag 15

hoe zie ik mijzelf in de keuken

Zoek twee plaatjes waarmee u uzelf associeert als u in de keuken bezig bent. Dit mag een kranten/tijdschrift knipsel zijn, een tekening of iets wat u uitprint.

Heel erg bedankt voor het delen van uw ervaringen!

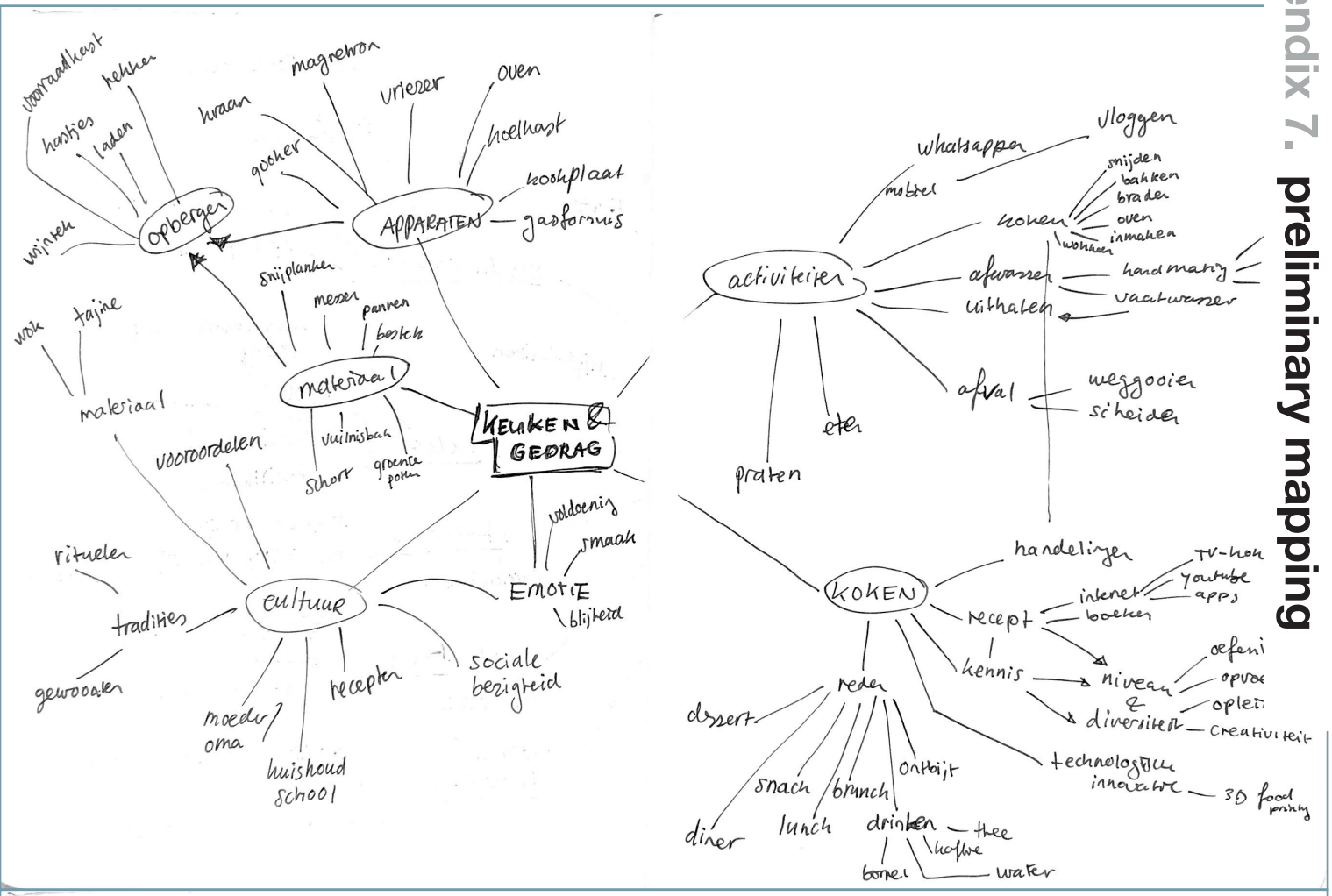
Mocht u vragen hebben over dit werkboekje of de verwerking van de resultaten dan hoor ik het graag.

Tot volgende week bij ons gesprek over uw keuken!

Groet, Bas

Bas de Rooij
T +31651360870
E B.R.N.deRooij@student.tudelft.nl

TU Delft


KEUKEN & GEDRAG
APPARATEN
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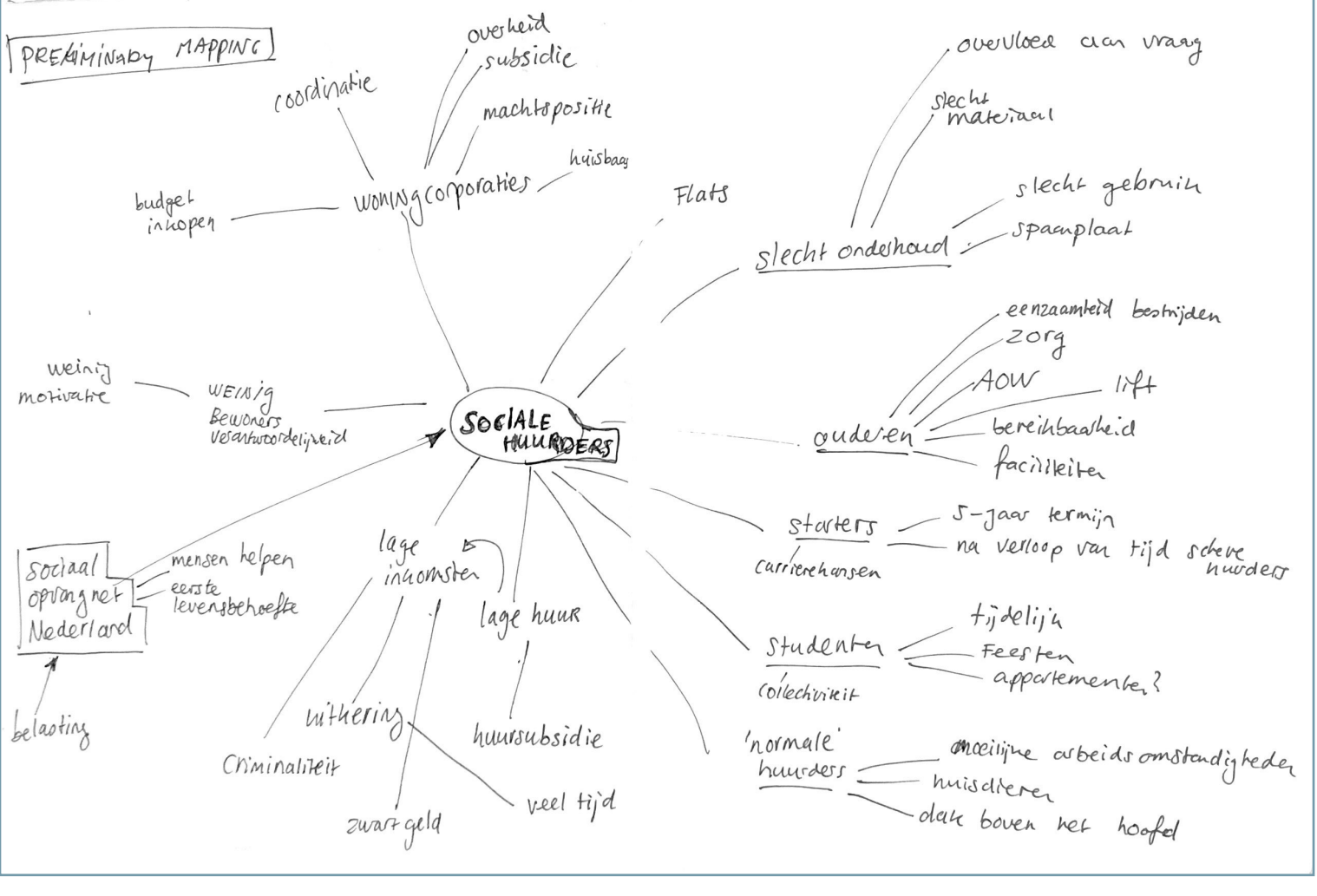
PRELIMINARY MAPPING
SOCIALE HUURDERS
woningcorporaties
overheid
subsidie
machtspositie
huisbaas
coördinatie
budget inkopen
Flats
slecht onderhoud
overvloed aan vraag
slecht materiaal
slecht gebruik
spaanplaat
ouderen
eenzaamheid bestrijden
zorg
AOW
lift
bereikbaarheid
faciliteiten
starters
5-jaar termijn
na verloop van tijd scheve huurders
carrièrekansen
studenten
tijdelijk
Feesten
appartementen?
collectiviteit
'normale' huurders
moeilijke arbeidsomstandigheden
huisdieren
dak boven het hoofd
lage inkomsten
lage huur
huursubsidie
uithering
Criminaliteit
zwart geld
veel tijd
sociaal opvangnet Nederland
mensen helpen
eerste levensbehoefte
belasting
weinig motivatie
WEINIG Bewoners Verantwoordelijkheid

appendix 8. workplan generative sessions

Workplan

Checklist

Charge
- Video camera battery
- Iphone X (for pictures)
- Iphone 5 (for audio recording)
- Iphone 4 (backup)
- USB charge-hub 1 & 2

Print
- Release form (vrijwaringsformulier)
- Workplan – (checklist & script)
- Collage matrix past
- Collage matrix future

Preparation Checklist
- Bring release form
- Bring workplan (script/ checklist)
- Bring video camera + tripod + charger
- Bring iphone X
- Bring iphone 5
- Bring Iphone 4
- Bring charging hub (2x)
- Bring charger phone, charger laptop, charger
- Bring pens, markers, scissors, tape, post-its, gluestift, adhesive tape
- Bring treats (sweets & chocolate) (keep in mind: allergies)
- Bring collage-past toolkit
- Bring collage-future toolkit
- Bring A3 paper (in cocon)
- Bring umbrella
- Put session script, release form and toolkits in grey session folder
- Bring session administration (pink folder)

Toolkits

Collage-past toolkit
- A3 met poppetje in het midden and cirkels
- Plaatjes en woorden papiertjes

Collage-future toolkit
- A3 met poppetje in het midden and cirkels
- Plaatjes en woorden papiertjes

Workplan V2
Generative Session – A Kitchen for Life

Script

Opmerkingen
- PUMP ENERGY! Breng het concept enthousiast
- Vermijd tot laatste fase de woorden duurzaamheid en circulariteit
- Bedenk grote thema's om te bespreken en bouw hier een beetje omheen tijdens het interview. Probeer niet per see vraag voor vraag af te werken.
- Maak veel foto's tussendoor!
- Let op wat je en hoe je wat vraagt.
- Stel om de 20 minuten een wekker voor camera

Onderdeel	Actie & vragen	Methode/tool
Introductie		
5 min.	Kennis maken	
	Mag ik filmen, fotograferen en opnemen? ○ *Wilt u het opname-vrijwaringsformulier tekenen?* ○ *Hoe lang heeft u speling in de tijd?*	**Overhandig vrijwaringsformulier** (*achteloos)
	Werkplek klaarzetten	**Zet camera neer en aan, leg telefoon neer met voice-recorder aan.**
	Bent u klaar met tekenen?	**Innemen vrijwaringsformulier**
(5m)	Uitleggen voortgang en inhoud van de sessie: ○ *Het doel* ○ *Experts zijn van hun **eigen ervaringen*** ○ *Waarom deze vorm in plaats van 'serieus' interview.* ○ *Niets is te gek en denk hardop*	
Opwarming		
5 min. (10m)	Mindmap oefening *U krijgt een A3 vel voor u op tafel en een marker. In het midden staat 'keuken' probeer zo veel mogelijk dingen te bedenken die met 'keuken' te maken hebben.*	**Leg A0 vel op tafel met in het midden 'keuken'.**
Nu		
5 min. (15m)	Behandelen sensitizing booklet. ○ Bedank voor het invullen ○ *Ik stel u wat korte vragen over een paar dingen maar later analyseer ik het boekje nauwkeurig.* ○ *Wat heeft u ingevuld en waarom?*	**Bedank, bekijk en stel vragen over het werkboekje.**

Workplan V2
Generative Session – A Kitchen for Life

10 min. (25m)	Rondleiding *Verhaal: Ik ben opgegroeid in Hong Kong en ik heb thuis geen keuken. Ik ben gewend buiten deur te eten. Zou u mij willen rondleiden in uw keuken?* ○ ***Wat vindt u prettig en wat vindt u niet prettig aan uw keuken?*** ○ *Wat doet u zoal in de keuken?* ○ *Hoe vaak doet u bepaalde dingen?* ○ *Doet u dit alleen of samen met iemand?* ○ *Hoe lang doet u deze dingen in de keuken?* ○ *Hoe zag uw keuken eruit toen u in deze woning kwam?*	**Neem camera en statief en film rondleiding**
	LET OP VIDEO CAMERA (DRUKKEN FILMEN)	
Verleden		
5 min (30m)	Collage over keuken *Plaats de plaatjes en woorden rondom uzelf wat u vroeger en nu belangrijk vindt in het huishouden/keuken en wat u minder belangrijk vindt. U mag ook andere mensen in de collage tekenen.* 	***Laat men de trigger cards en words op de nu/vroeger matrix plaatsen.***
10 min (40m)	*Waarom heeft u de dingen gekozen die te zien zijn in de collage?* ○ ***Hoe ziet u dat terug in uw huidige keuken?*** ○ ***Hoe zagen uw vorige keukens eruit?*** ○ *Hoe belangrijk vindt u dat de keuken van u voelt?* ○ ***Wat is er nodig om de keuken van u te laten voelen?***	**Bespreken waarom/wat in de collage is gekozen**
	LET OP VIDEO CAMERA (DRUKKEN FILMEN)	
5 min. (45m)	**PAUZE**	**PAUZE**

Toekomst		
20 min.	**Verhaal:** *We gaan naar de toekomst, naar 2023. De wereld om u heen verandert en u loopt over een aantal jaar door een winkelcentrum. U loopt tijdens een dagje winkelen toevallig door een winkelcentrum langs een keukenwinkel en u blijkt de 1000e voorbijganger te zijn. U wint 10.000 euro aan waarde om een keuken te laten installeren. Hoe zou dit er dan uit zien? (evt. veranderen in verhaal dat woningcorporatie belt)*	
	<u>Droomkeuken simulatie en toekomst-collage</u> 1. *Fantaseren over droomkeuken (lopen keuken)* 2. *Probeer nu de collage oefening op dezelfde manier te doen. Maar dan in 2023 met de nieuwe keuken in uw achterhoofd. Wat vindt u belangrijk?* 	**Laat participant dromen en fantaseren. Hierna nieuwe matrix met oude triggerset aanrijken** ***Eventueel plattegrond mee-tekenen met droomkeuken op ruitjespapier***
(65m)	○ *Stel u mag alleen één onderdeel vervangen in de keuken. Wat zou u dan aanpakken en waarom?*	
	LET OP VIDEO CAMERA (DRUKKEN FILMEN)	
Testen Design A		
15 min.	<u>Pitch CIK-Ontwerp</u> *CIK heeft een ontwerp bedacht waarvan wij denken dat het een goed idee is. Maar we we zijn benieuwd wat u ervan vindt.* *CIK is een duurzame, solide optie met allerlei voordelen voor de huurder qua persoonlijke inbreng, flexibiliteit en onderhoud.*	**Leg voordelen uit aan de hand van Design A tekeningen**
	○ *Wat vindt u van dit concept?* ○ *Zou u graag iets veranderd zien?* ○ *Als er een app/website-onderdeel ('catalogus') zou zijn, hoe zou dat volgens u het beste werken/eruit zien?* ○ *Heeft u behoefte aan een showroom?* ○ *Zou u er geld voor over hebben extra modules of stijlpakketten te leasen?*	

Workplan V2
Generative Session – A Kitchen for Life

	Hoe zou u gemotiveerd worden meer zelf te doen in vervangen/repareren etc.?	
(80m)	○ *Hoe belangrijk vind u het milieu?* ○ *Hoe ziet u dat terug in uw huishouden?* ○ *Wat weet u van circulariteit?* ○ *Hoe ziet u circulariteit in de keuken voor u?*	**Noem pro's cons milieu in dit design**
	LET OP VIDEO CAMERA (DRUKKEN FILMEN)	
Conclusie		
3 min.	*Heeft u vragen?*	
	Zou u mee willen werken in eventuele volgende vragen/sessie? Waarschijnlijk 1 keer in februari/maart.	
(83m)		**Afscheid nemen**

Zo snel mogelijk doen na interview

- Geluidsopname air droppen naar Iphone X en uploaden google-drive
- Beeldmateriaal op computer zetten
- SD-kaart omwisselen/opschonen
- Camera Accu opladen
- Toolkits weer op orde brengen
- Nieuwe papieren in grijze map

appendix 9. analysis process report

The analysis of the gathered data is done while using the method described in (Sanders & Stappers, 2012) called 'analysis on the wall'. This global approach of the method is illustrated in Figure 66. All data, on different levels of interpretation, are included in the process and used to create a theory, a bigger picture and new insights.

preparing for analysis

After the sessions the data is prepared. The raw data gathered in the research consists of Interview transcripts, sensitizing workbooks, collages made during the session, pictures of the generative sessions. (Figure 67)

1. The data is prepared for efficient and effective use; the audio recordings are transcribed; pictures of the collages and the sessions are printed and the room needs to be hung with big posters or foam-boards. Pens, markers, post-its and recording devices are needed.
2. All interesting quotes are marked in the transcripts. The most important quotes (about 80 in total) are printed provided with an interpretation of the researcher's words. (On small 'statement cards') (Figure 68)
3. Help from other researchers in this phase of context-mapping is very useful. For this research a fellow-student with professional context-mapping experience cooperated.

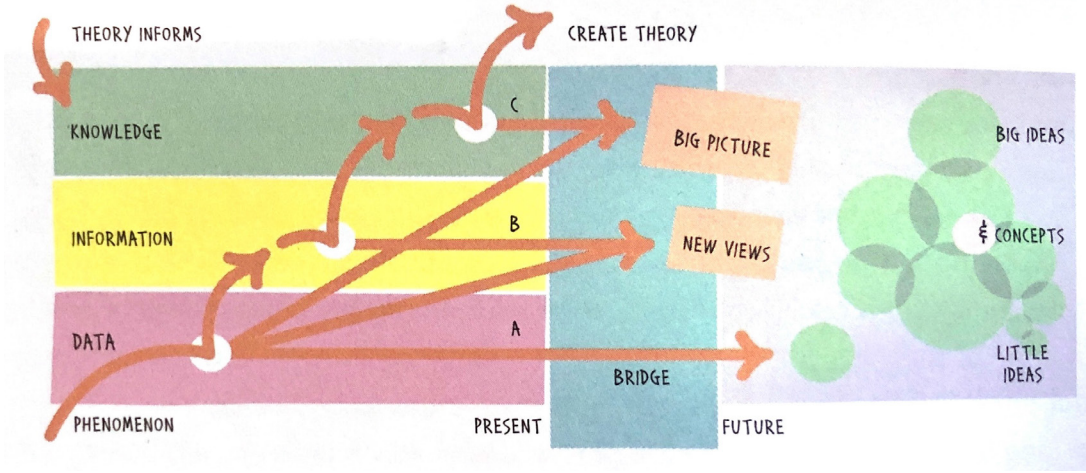

figure 66. Sanders & Stappers model for analysis and conceptualization space

figure 68. a statement card

color-bar	
paraphrase	**By bringing own appliances and stuff into a kitchen, the kitchen starts feeling like it is yours.**
quote	P 1 No. 5
	"Ja, de keuken voelt van mij. Ik denk omdat er bijna, alleen het blok stond er. We moesten zelf de vloer leggen. We moesten zelf een koelkast kopen en neerzetten en het gasstel dus. Toen we hier binnenkwamen was het gewoon helemaal wit-grijs beton. En een keukenblok en nu is het een huis of zoiets en heb je alles zelf binnen gebracht. "
notes	

figure 67. all data is gathered after the sessions

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doing work

The analysis sessions took four days. Beforehand two days were planned but reporting the results took more time than thought. This will be taken into the reflection.

Phase 1 Video recording devices are placed and turned on and the lead researcher briefs the other what is to be achieved during the workshop. He introduced the project, defined the goals and framed the time and activities. The first perceptions/idea of the researchers were discussed briefly. The researchers discussed and shared their feelings about possible categorization. Then they went over all the data. The researchers started with clustering the statement cards. Themes were created and links were illustrated. If extra clusters/categories/themes were needed, they were added. For extra illustration of the themes the images from the trigger-set used in the generative sessions were placed. This resulted in a rough first interpretation of the main themes (Figure 69&70).

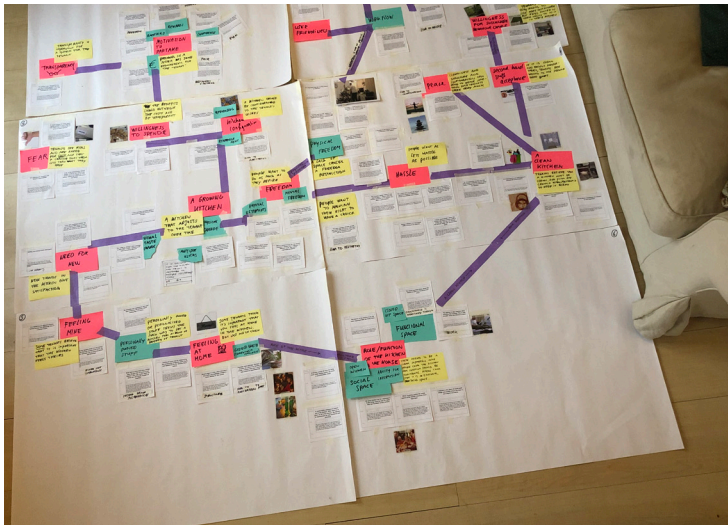
Phase 2 In phase 2 the established themes and corresponding quotes were evaluated and recategorized. More and new links were found and illustrated and short interpretations of the themes were added to the wall. This resulted in a more detailed and extensive wall analysis (Figure 71).

Phase 3 This was the moment when everything came together. Elaborate stories about the established themes are constructed and an integral visual summary in the form of a diagram or model was created. This process is described in the next section.

figure 69. help from other researchers is useful during clustering

figure 70. clustering result phase 1

figure 71. clustering result phase 2



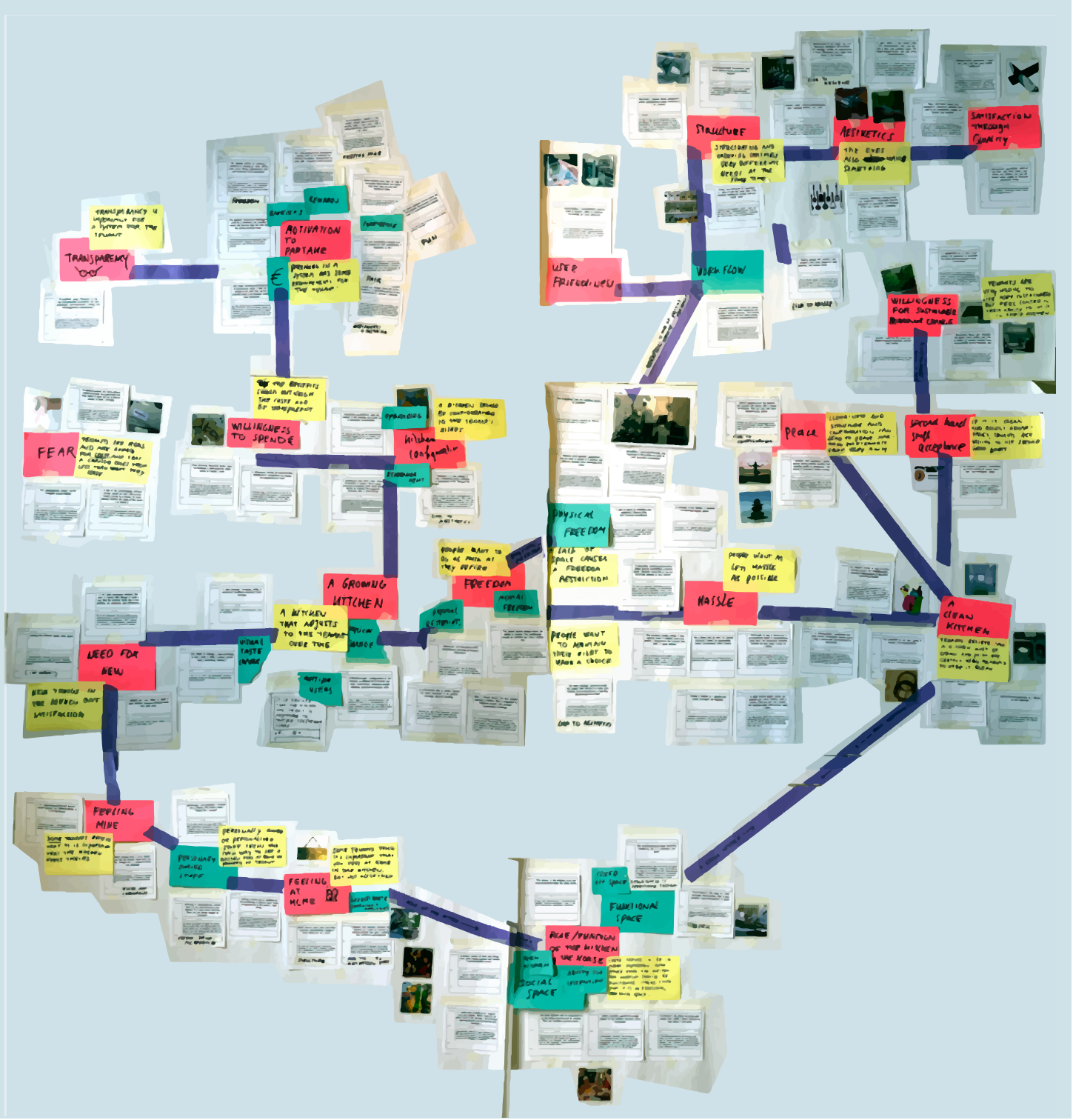


figure 72. clustering poster phase 2

pattern-finding

During the ‘Analysis on the wall’ a fundamental insight was gathered that confirmed an idea that arose during the sessions: There is a clear distinction between tenants that want a closed kitchen and the ones that dream of an open kitchen. After diving deeper in the reason behind this, it appeared that the tenants differed very much in their general idea of the kitchen. In Figure 72 it is illustrated by the theme ‘role/function of the kitchen in the house’. While placing the statements cards in this theme, there was a more functional/ practical camp and on the opposite side tenants valued the ambiance and looks in the kitchen. The feeling it gave them and a social aspect was also something they valued dearly.

This insight triggered the pattern-finding process. This is shown in Figure 73.

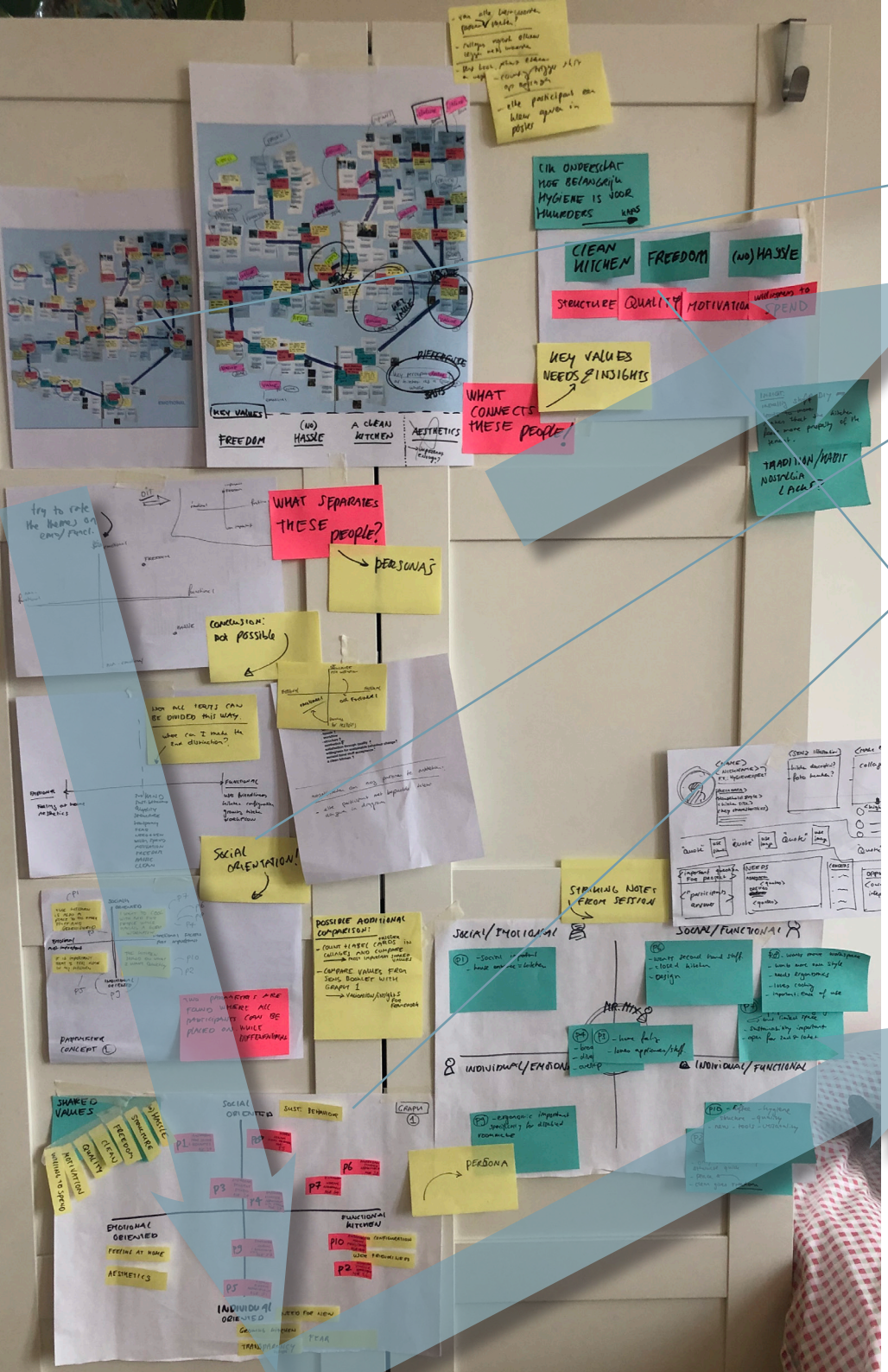


figure 73. pattern-finding process

what separates these people?

When looking more closely to the defined themes, and trying to fit all the insights into a pattern, it became clear that also functional tenants had social desires, but wanted a closed kitchen because of different reasons. Then a new insight was gained: the tenants that thought the kitchen should be functional differed from the more 'emotional' tenants. Social vs individual was added as a new parameter. This graph shows that this way there is a wide spread over the graph and while summarizing, different characters can be defined that will be processed into personas. Some themes could be appointed to the axis, and were the values of the people who scored high on the corresponding axis. This model is used to build personas. Every section of the diagram is taken into a persona. The mid-section (around the origin) is the fifth persona. These are shown in the main report.

"And now you can add the table to the kitchen. Then you can put some stuff on it, then the kitchen gets bigger and then you can chat while you are cooking." – P3

"Actually, I only go into the kitchen if I have to cook something, doing dishes or grab something. If it was a bit cozier, that would be chill but I think it is far more important that it is functional, clean and structured." - P2

what connects these people?

The themes that could not be placed in the pattern corresponded to an initial idea during the 'analysis on the wall': these were the key values that connected all the tenants! 'a Clean Kitchen', '(no) Hassle' and 'Freedom' appeared as key values. During the pattern finding process they seem to be valued by almost all participants (in different ways) and a lot of other themes were linked to these key values. Besides these major themes the factors 'structure', 'quality', 'motivation' and 'willingness to spend' were also seen as secondary values that all the tenants valued in their kitchen in some way. In the next parts these themes will be explained. In the main report the terminology is iterated an defined again for better communication.

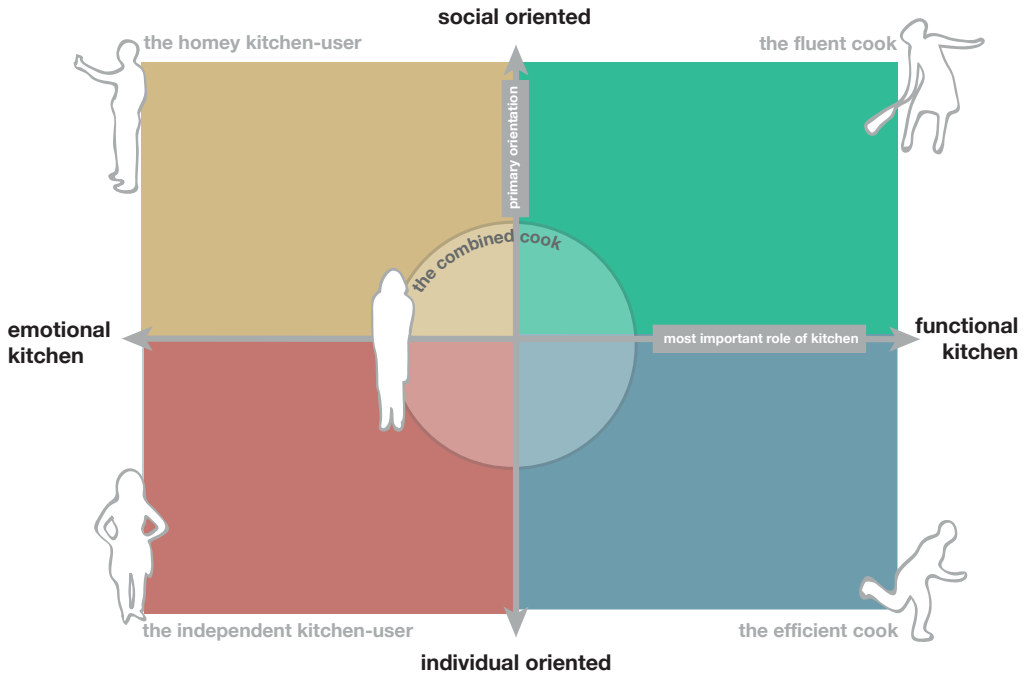
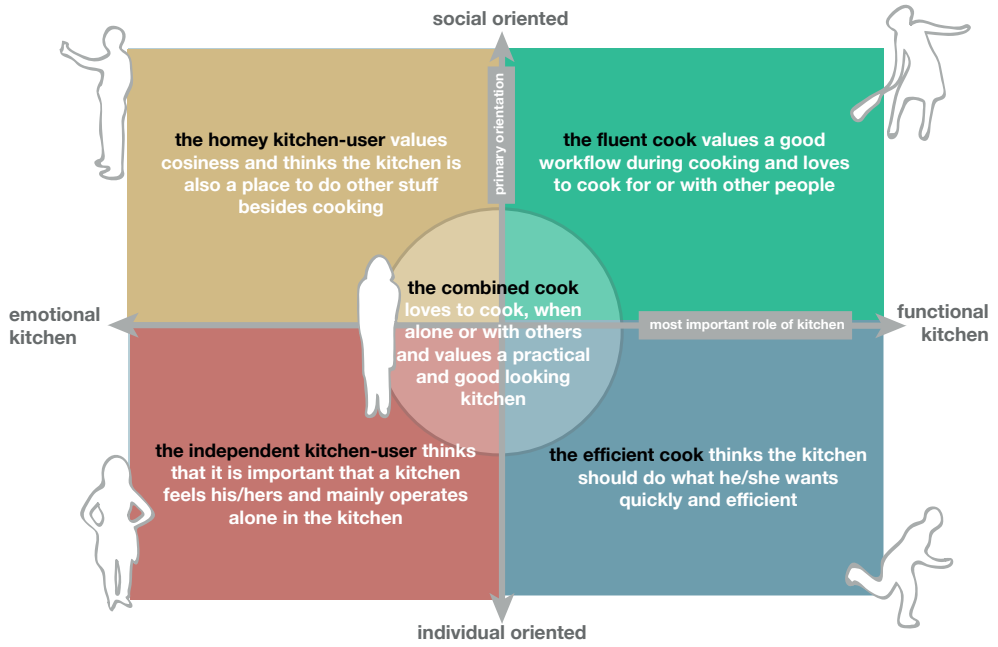


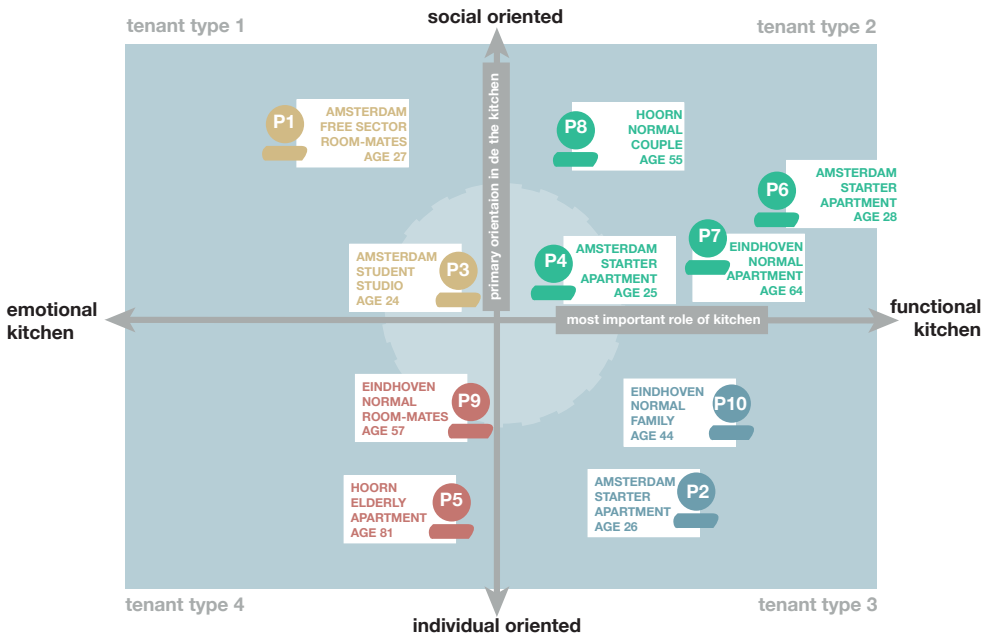
figure 74. integral visual summary that show tenant types

figure 75. integral visual summary that show tenant types



To bring structure to the theme-clusters and links, an integral visual summary was created to illustrate the differences between the tenants (Figure 74&75). The method from Sanders & Stappers was used in combination with some inspiration for building frameworks from VIP (Hekkert & Van Dijk, 2011). The method described by Sanders & Stappers was quite limited in handles and guidance for exploring patterns. Together it provided patterns with valuable insights as described in chapter 8: 'user research'.

figure 76. integral visual summary that place the participants within the tenant types



theme stories

These elaborate stories are the description of the themes that were found during clustering phase 2. They include quotes, interpretation and overall theme interpretation and conclusion. Note that they are evaluated and refined during use of these themes.

freedom

'People want to do as much as they desire'

Not very surprising one of the most important things for the tenant. Something that is possibly very deep in our nature. The desire to do as we please. Despite all the choices a housing associating has to offer the tenants want to remain free. But in different sub-categories:

• Mental freedom: "Once again, I think a human should be able to choose for themselves. These appliances, and the ability to lease. You should keep the ability to buy these things yourself." – P9. Tenants want to maintain the right to choose.

• Physical restraints: Other tenant's think it stays important that even when they are physically disabled, or there is a chance this will be in the future, that the system facilitates them in doing what they want. "Doing repairs myself? No. Not that I do not want to do this, but because I can't do this physically. Sometimes I can, but I can't rely on this." – P7

• Physical freedom: A majority of the users struggles with space problems within the kitchen, they feel restricted by it and can cause negative experiences. "I am always the one doing the dishes. I don't like it because of the space. I don't mind doing it, but the space is a factor in this." – P4

To conclude; in further design and decision-making processes this should be taken in. If a new design could support physically disabled tenants, give room to choose and create physical freedom in the kitchen. This would be a big plus.

(no) Hassle

'people want as little hassle as possible'

Probably also not a very surprising issue, but the priority for no hassle does need to be taken into further developments. Tenants want complex systems to work easy for them, and to take as little effort as possible in every facet of a system. Example quotes are: "I don't mind a lease system for something, but when something is broken, someone needs to come by and fix it." - P10. Or about a possible repair: Yes, this seems very easy to do! If a cabinet for example is broken you quickly put something new in it. With my current kitchen I think this is not possible. Yes, this is a good system." – P8. If something is made easy tenants are willing to accept things they would not want in the first place, for example: "A booth for example. Where I go and then they say: He! You've got a anthracite kitchen right? I've got a spare second-hand door. You can take it!" – P7.

To conclude; making it people as easy and obvious as possible is also important for this system. This way the tenant will cooperate easier and in more ways.

a clean kitchen

'Tenants believe a kitchen must be clean and point out certain requirements to keep it clean' The last primary key value that almost all the participant shared is that they all think it is important that their kitchen is clean. They differ in the ways they see this executed in the kitchen design. "I am continuously annoyed by the gas stove! It is way too low and there are cracks in-between the parts. If you are cooking there is continuously falling food. That is annoying and also hard to clean. I can't reach with my arm, then my clothes get dirty and then I think: whatever!" – P8 Other tenants are willing to do concessions with primary requirement that it is clean: "Personally, I don't think stuff has to be new, as long as they are clean. That is important. A clean kitchen." – P4.

To conclude; as long stuff is easy to clean, appears clean or is easy to maintain clean, a key value of a lot of tenants would be represented.

second hand stuff acceptance

'if it is clean and brings advantages tenants are willing to use second hand parts'

Something that seems obvious; not all kitchens that someone gets is new. But not specifically in the eyes of the tenant. In the 'a clean kitchen' already discussed that a second hand part should be clean. And also illustrated by the quote: "If something is practical and cleaned up than it does not really matter if it is design, it is fine if it comes from Marktplaats (Dutch second hand web-shop)." – P2.

To conclude; if the system would use second hand parts in a way that they previously used new parts. It is possible to gain the tenant's cooperation. But the parts should be cleaned up.

need for new

'new things in the kitchen give satisfaction'

"It feels nice when you get something new." A phenomena that is not new in a consumption society. These things should be bent. This offers changes for the tenants willingness for this system. "If that would be a package, where you can tweak small things to give the feeling that I have a new house, that would be a good system."

Concluding: maybe chance to let the tenant tweak; give something that is not new, but new for them.

growing kitchen

'a kitchen that adjusts to the tenant over time is desired'

Tenants seem to be very interested in a kitchen that changes with them over time. Tenants are aware that their taste differs over time, they change physically and that not every user can use the same kitchen ergonomically. "Yes that would be awesome. After a while you are keen to have something different, right?" – P8.

Concluding: a flexible modular kitchen is probably a very good idea. Some tenants already seem to see the benefit of flexibility and might cooperate.

peace

A small theme that describes the insight that cleanliness and structure and configuration can lead to peace something some tenants value very much. "I think Inner peace is very important and that is also something my kitchen needs to emit. That's why I would be in favor of one peaceful wall with all the appliances built in." – P7

Concluding: The option for built-in appliances and minimal design is something that some tenants would value dearly.

motivation to partake

Is a theme that describes the requirements a system could or should have for the tenant to want to partake in it. Talking about these things provided different requirements: Rewarding, Barriers, confidence and cost. Tenants make known that rewards for doing things they first did not have to do might work. For example for doing (DIY) repairs themselves. "I think a financial incentive always works. Or

a gift! Something that adds to your kitchen perhaps. Or a point-collection system, that you can do something big after a while!" - P1. So rewarding is something tenants see as a good way to motivate. On the opposite side people always see barriers for doing something. Some barriers for people could also work in the favor of the system. "I hate to wait for a mechanic. You have to stay at home, if you work then you do not feel like doing so. If it is easy you can do it quickly!" - P4 This barrier for people for current systems could be put as a good reason to cooperate in the new concept. Confidence is also something that could stimulate participation: "If it is easy, I could do it! I am not very technically skilled but if I look at this I would think: I can do it." – P1. **kitchen configuration**'a kitchen should be configurated to the tenant's wishes' Something that also is linked to the theme 'freedom'. People are very keen to some choices, but investing in extra kitchen adjustments is only desired when a kitchen is completely to the liking of the tenant. "It depends on what they ask of me. I would only be in favor of cooperating if the kitchen is exactly like I wish it to be." – P9 This theme is also very closely linked to the **willingness to spend** 'the benefits should outweigh the costs, and should be transparent' Something that is probably obvious, but stay important: Cost is a very important consideration for the tenant when thinking about lease plans instead of buying an appliance themselves. "It depends what is the price, if we buy new stuff, the lease plan has to be more beneficial than that it will cost at once. I am certainly open for it." – P8. A lot is depends on the price the tenant pays. Cost is related to motivation to partake (a theme discussed later). "Possible lease-costs must be included in the service-costs instead of the rent. Then tenants will cooperate. The moment that it becomes part of the rent it wouldn't work. Because raising the rent will not include service costs." – P7 Next to price, **transparancy** is also named as an important consideration. Transparency in communication is important for the system to work for the tenant. "The polluter pays, that seems logical. And if I do something I get something extra, if I don't do it, I won't. But again, this needs to be clearly communicated, and should be handled consequently." – P10

Concluding: With a new system, new ways to motivate the users in the system need to be found. When pressing the right buttons also the tenant will cooperate in making it a success. In future design and decision making these requirements need to be considered: Cost need to be appealing and beneficial, people need some choices in personalizing kitchen configuration, barriers for staying at home could work in advantage, rewarding is a could way to stimulate DIY and if the system is easy this need to be clearly communicated. This can help people get confident in doing what is needed to cooperate and transparency in this could be stimulate tenants in more ways.

fear

A theme that strokes with the requirements of a system and the advantages of creating confidence with tenants. Tenants see risks and are afraid for costs and that a change gives them less than that they had. Some tenants seem to be very skeptical when thinking about a new system. Responsibility when things goes wrong, unexpected costs and disliking choices of others seems to be the biggest of them. "I would like a DIY reward system, but only if it does not go at the expense of basic services. A mechanic should be able to come, but that it is optional because you keep basic services. That would be fair." – P2

Concluding: people see risks and have will become uncertain with implementation of new services. This is linked to the theme transparency and might be overcome with easy and clear communication.

feeling at home

This theme describes that fact that some tenants think it is important that you feel at home in the kitchen. "I like smart ways to hang up stuff. The feeling of feeling at home. Yes, I think that is important." – P9 Tenants bring forward different ways to achieve this. Smart ways to order, a comfortable ambiance, the ability to personalize kitchen parts and the presence personally owned stuff. The last-named factor is also something that tenants find important for a different reason. "Yes, the kitchen feels mine, I think because we had to put in the floor, buy a fridge and a stove. There was only a kitchen counter, and now we have a house because we brought everything in ourselves." -P1 **feeling mine** Is a theme similar to feeling at home but is not the same. Other tenants think it is important that the kitchen feels theirs. If a kitchen feels their they are more willing to invest in it, and to handle it with care. Something that is not easily to get done in a rental house. "And then you could say: if you have the money, why don't you? But in a rental house you make different choices then in a owned-home. – P10

Concluding: a group of tenants think it is important that the kitchen feels theirs and some think it is important that they feel at home in the kitchen. In future design and decision making this should be considered: flexibility in the ability of placing/taking your own stuff would be a plus. Customizability is a good idea for this user-group and the option for structural parts might also a good idea.

structure

'structuring and ordering is desired for very different needs'

"Ordering is important, this way I can reach out to stuff much easier, give them the same place so you don't have to search. This saves time, and saves chaos. You can work on routine." – P7. This is one example of multiple participants that desired to have structure and ordering in their kitchen to gain a certain amount of workflow, working on routine. Workflow during actions in the kitchen not only is seen as something practical but it also provides satisfaction. Something very related is the other theme that is called **user friendliness** This gave a different solution to the same end: satisfaction through workflow, this theme describes that a tenant was willing to use new technology if the kitchen became better or more user friendly. Back to structure: Other tenants wanted the same order and structure for different reasons, aesthetic reasons. "But if you look movies or IKEA's magazine for example, those things show kitchens where all cooking material hangs, pots and pans are displayed, or a large range of tools. That just looks very nice, it is more about aesthetics than usability. – P3.

Concluding: Tenants desire a certain workflow while working in the kitchen. This can bring forward big amount of satisfaction. Structure, order and possibly technology in design and/or tools can provide this. Next to the benefit of workflow structure and order can also bring forward aesthetic satisfaction for the tenants who think this is important.

aesthetics

'the eyes also want something'

Some tenant's think it is important that their kitchen looks good. For example: A kitchen open to the rest of the house should be decorated with effort to stroke with the houses design, and if adjustments are made tenants do not want

color differences because of aesthetic reasons. “I would not put fancy things in my kitchen. Prettier stuff and better quality I would, but not more stuff.” – P2. This also shows that the theme quality could be a part of aesthetics. Wanting quality over quantity.

quality

Is a theme that shows this desire for quality for different reasons (like structure). Next to quality for aesthetic reasons there is also the tenants that want quality for practical reasons: “Yes, important is that it is practical and clean. And also, good quality appliances. Things should work properly. I already have a blender and a kitchen machine” – P8 This tenant invested in quality appliances. Other tenants see the benefits of 2nd hand material for better quality: “I always want 2nd hand stuff. You might spend the same amount of money, but in second hand stuff you will get better quality.” – P6.

Concluding: Aesthetics and quality are things also tenants in social housing think is important. Something that is hard, but should be kept in mind in future decision making. For different reasons and some are interconnected. But what it does is creating satisfaction. And satisfaction could create cooperation. With for example providing tenants with the willingness to want something 2nd hand.

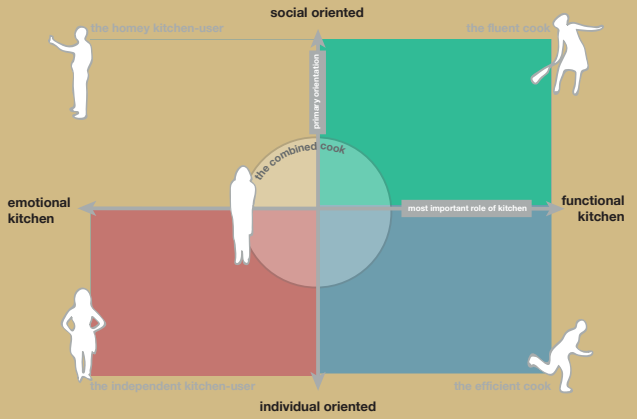
willingness for sustainable behaviour change

Tenants are willing to live more sustainable but feel limited in their ability to do so in their kitchen. A sustainable way of living is perceived as important for personal health and future generations. The willingness exists but the right tools and knowledge seems to lack. Examples are: a waste grinder or the space and ability to separate waste in the kitchen. “I feel such a douche who says: sustainability is important, but at the same time I don’t act like I mean it. We only have one trashcan. But if the options are there, then it would be easier. Because Amsterdam is not really stimulating it.“ – P1

Concluding: with some tenants the willingness for sustainable behavior is there. While providing tools and information a lot could be accomplished, and necessary concessions in the kitchen because of these changes might be overcome relatively easy.

the homey kitchen-user

"The kitchen is also a place to do other stuff besides cooking and cosiness is very important."



cook **alone** — cook with **others**

cook **for myself** — cook **for others**

not a lot in kitchen — **a lot** in the kitchen

needs to **feel mine** — **not** need to **feel mine**

biggest needs & wishes

- **cosiness in the kitchen**
- **meeting spot for roommates and guests**
- **personal style in interior**
- **convenient appliances and tools**

biggest annoyance

"Space, otherwise you can't do a thing! Eventually everything relates to the space you have in your kitchen."

biggest wish

"I would buy a dishwasher."

opportunities

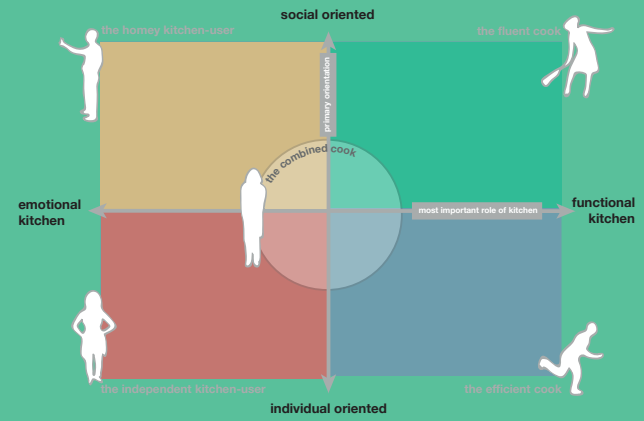
- **convenience upgrades**
- **configuration customizability**
- **style customizability**

pitfalls

- too much hassle
- delivery during working hours
- going somewhere to pick something

the fluent cook

“I love to cook with and for people while having a good work-flow.”



cook **alone**	cook with **others**
cook **for myself**	cook **for others**
not a lot in kitchen	**a lot** in the kitchen
needs to **feel mine**	**not** need to **feel mine**

biggest needs & wishes

- **plenty of working space**
- **structured storage space and materials**
- **easy to clean**
- **versatile appliances and tools**

biggest annoyance

“That my countertop does not close tight along the edges and has cracks inbetween. I despise if food falls into the cracks. UGH!”

biggest wish

“I want to extend the counter-top to have more working space. Space is the biggest problem.“

opportunities

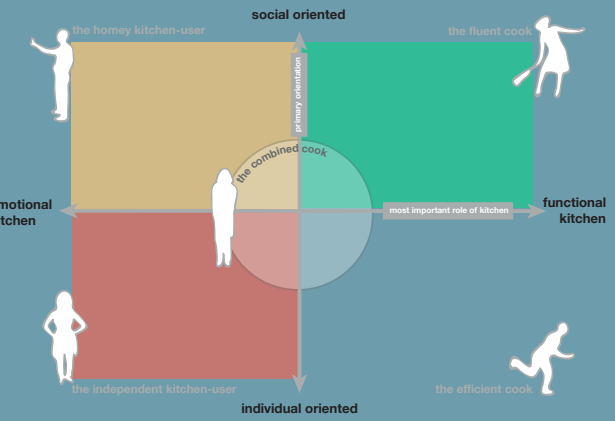
- sustainable convenience upgrades
- DIY option
- flexibility in configuration

pitfalls

- getting appliances that do not suit me
- getting a kitchen with a configuration that not suit me

the efficient cook

"The kitchen should do what I want quickly and efficient."



cook **alone** — cook with **others**

cook **for myself** — cook **for others**

not a lot in kitchen — **a lot** in the kitchen

needs to **feel mine** — **not** need to **feel mine**

biggest needs & wishes

- **quick and efficient appliances**
- **hygienic and clean kitchen**
- **structured ingredients and tools**
- **minimal and spacious kitchen design**

biggest annoyance

"A messy kitchen. There is a lot of things I want to do and that I am doing. So I need the kitchen to be clean so that I don't get more triggers."

biggest wish

"Quooker, the boiler takes too long. It will be practical because I drink a lot of coffee, need warm water often. That makes it easier and quicker."

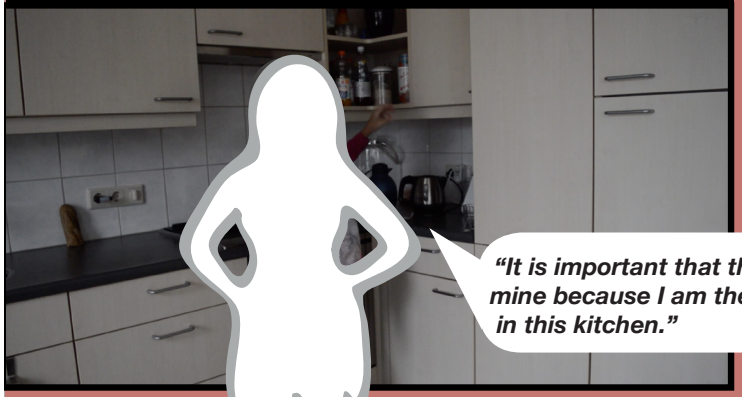
opportunities

- personalized kitchen configuration
- **DIY speed**
- built-in appliances

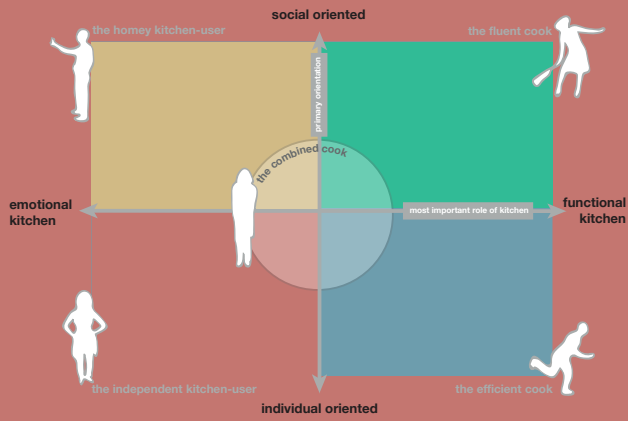
pitfalls

- lack of hygiene
- something that takes too much time
- delivery or picking up during working hours

the independent kitchen-user



"It is important that the kitchen feels mine because I am the one that cooks in this kitchen."



cook **alone** — cook with **others**

cook **for myself** — cook **for others**

not a lot in kitchen — **a lot** in the kitchen

needs to **feel mine** — **not** need to **feel mine**

biggest needs & wishes

- a kitchen that is easy to keep clean
- quality & durable appliances
- a cosy kitchen
- ergonomic working height
- a kitchen that suits me

biggest annoyance

"A dirty kitchen. A kitchen has to be clean. Where food is, it has to be clean. Also I don't like open spaces where dirt can go in."

biggest wish

"I would buy a very nice oven."

opportunities

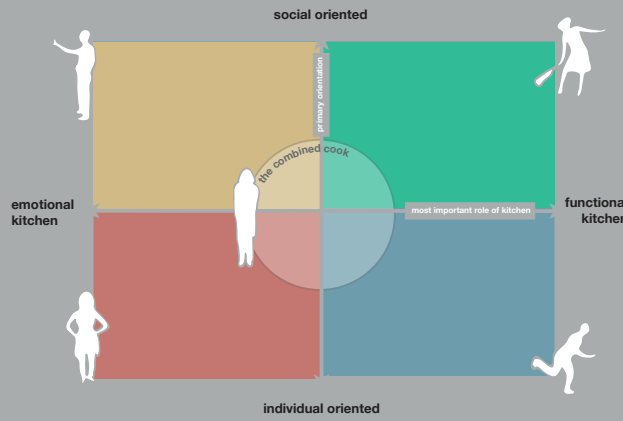
- quality appliance upgrades
- style customization
- ergonomic customization

pitfalls

- unexpected costs
- doing technical stuff myself
- unclear responsibility
- dirty parts and color-difference

the combined cook

"I love to cook, when I am alone but also when I have guests. A practical and good looking kitchen is important."



cook **alone** — cook with **others**

cook **for myself** — cook **for others**

not a lot in kitchen — **a lot** in the kitchen

needs to **feel mine** — **not** need to **feel mine**

biggest needs & wishes

- ability to cook and chat
- quality and complete set of appliances and tools
- a cosy kitchen that feels his/hers
- easy to clean and to tidy

biggest annoyance

"Money. I care about quality of things but most of the time I just buy the cheapest alternative. I would change it if I had money."

biggest wish

"I want a new induction cooking plate that cooks comfortable. I expect that it cooks more fluently."

opportunities

- rewards through DIY
- overall customizability
- upgrade options

pitfalls

- all the parts of the kitchen are new
- that it does'nt give a home-feeling
- that it doesn't feel mine

appendix 11. diverging results

a service platorm for the B2C side

f.e. interactive web-environment with back-end suggestions incl reward system

tool for hygiene-optimization

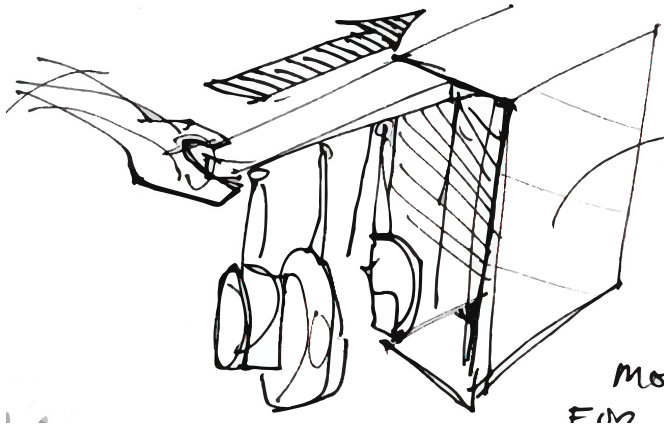
f.e. a tool for cleaning cracks in the kitchen

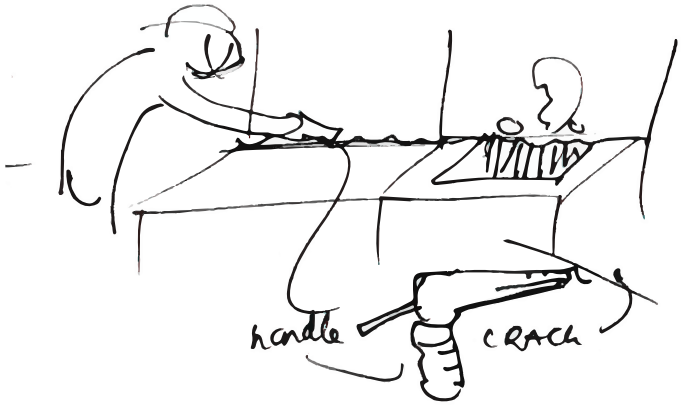
module for structuring and order in kitchen materials

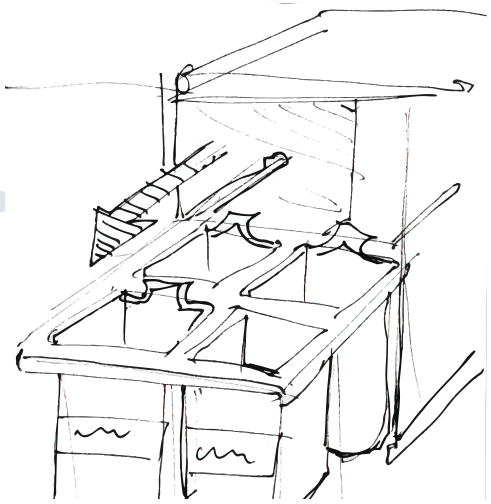
f.e. a module for structuring kitchen tools

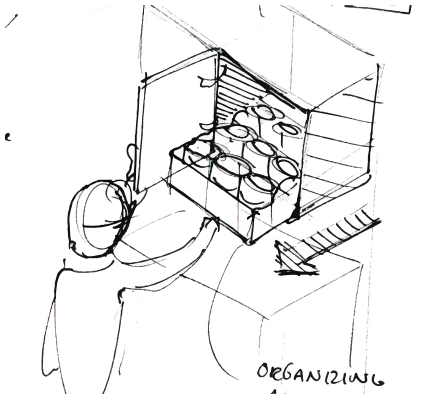
module that supports sustainable behavior

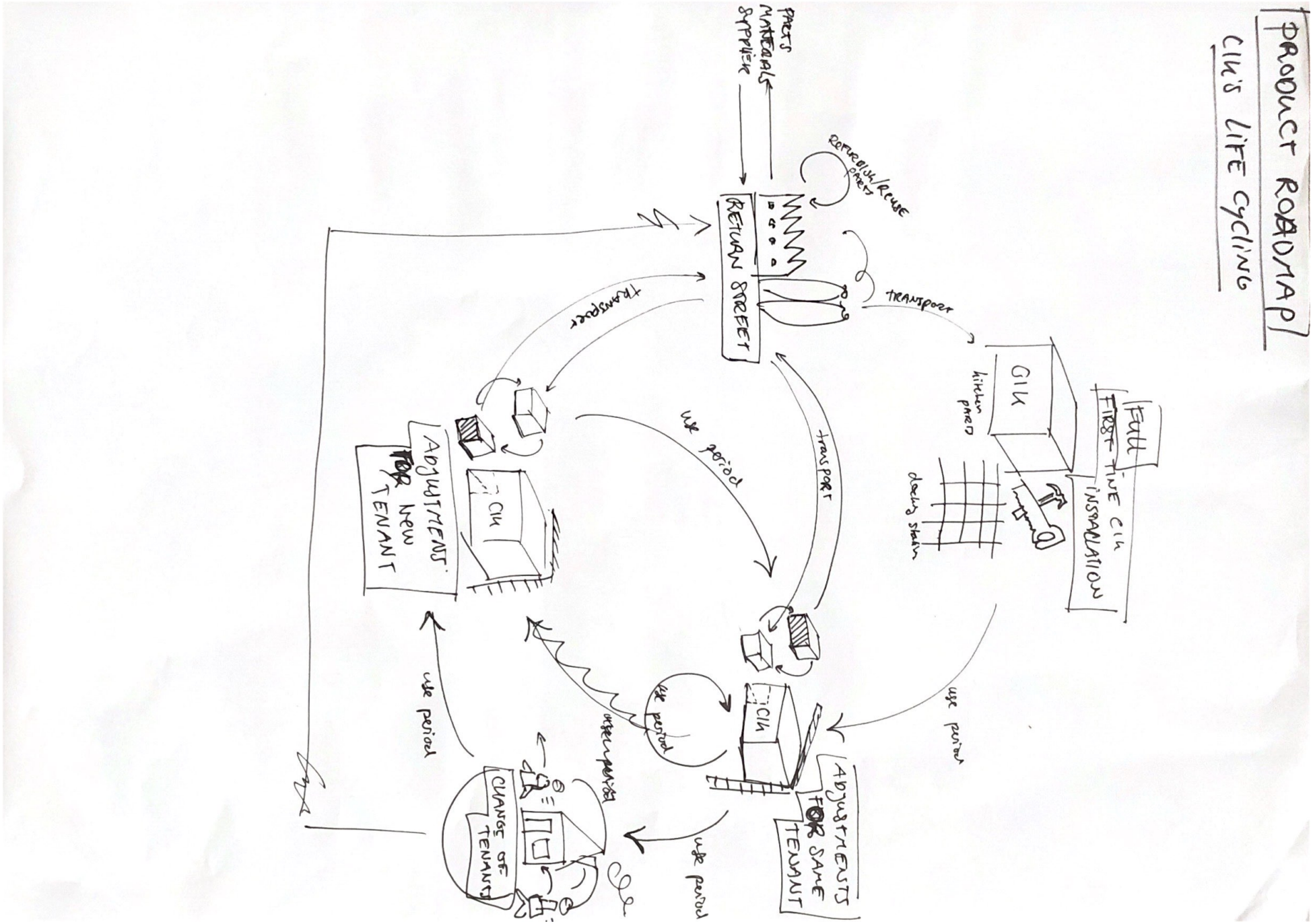
f.e. a module for reusable container system or separation

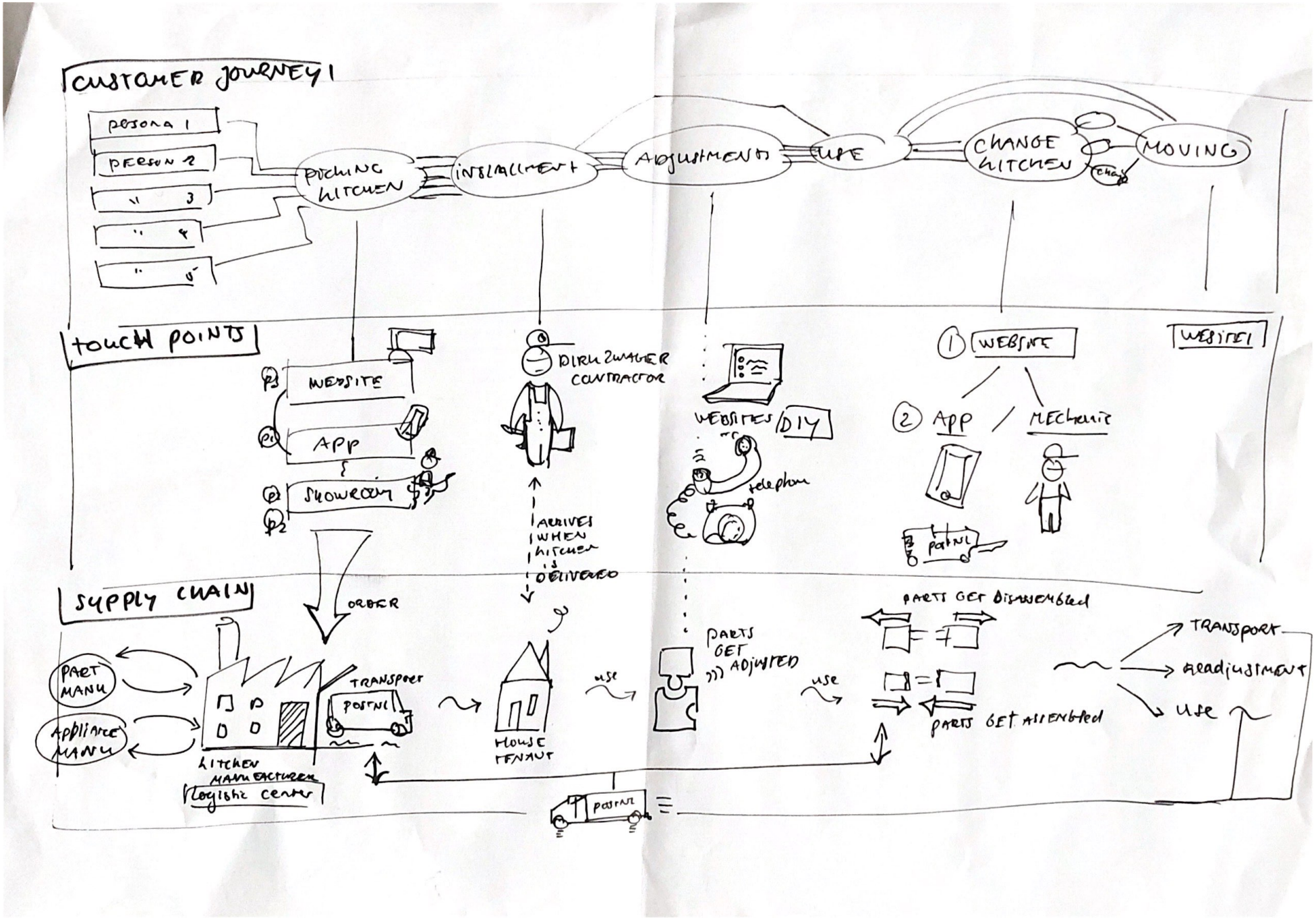


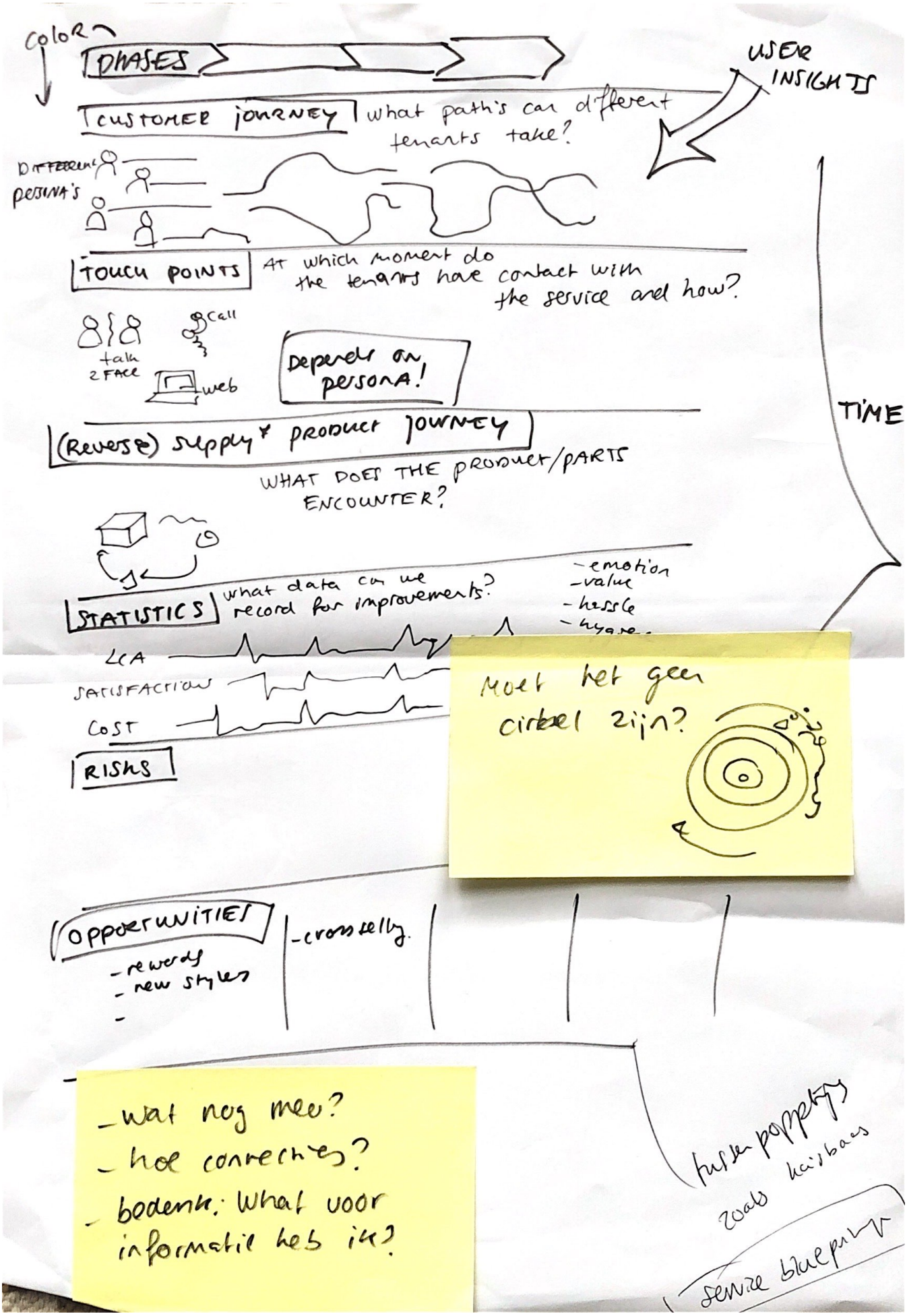







PRODUCT ROADMAP
CIU'S LIFE CYCLING
FIRST TIME CIU INSTALLATION
CIU
kitchen panel
closing stain
use period
TRANSPORT
RETAIL STREET
TRANSPORT
use period
ADJUSTMENTS FOR SAME TENANT
use period
CIU
use period
CHANGE OF TENANT
use period
CIU
ADJUSTMENTS FOR NEW TENANT
TRANSPORT
RETAIL STREET
PARTS MATERIALS SUPPLIER
RETURN/REUSE PARTS


CUSTOMER JOURNEY
PERSONA 1
PERSON 2
" 3
" 4
" 5
PICKING KITCHEN
INSTALLMENT
ADJUSTMENTS
USE
CHANGE KITCHEN
MOVING
TOUCH POINTS
WEBSITE
APP
SHOWROOM
DIRK ZWAGER CONTRACTOR
ARRIVES WHEN KITCHEN IS DELIVERED
WEBSITES DIY
telephon
1 WEBSITE
2 APP / MECHANIC
WEBSITE!
SUPPLY CHAIN
ORDER
PART MANU
APPLIANCE MANU
KITCHEN MANUFACTURER
logistic center
TRANSPORT
POSTNL
HOUSE TENANT
use
PARTS GET ADJUSTED
PARTS GET DISASSEMBLED
PARTS GET ASSEMBLED
TRANSPORT
READJUSTMENT
USE


color
PHASES
USER INSIGHTS
CUSTOMER JOURNEY
What path's can different tenants take?
DIFFERENT PERSONA'S
TOUCH POINTS
At which moment do the tenants have contact with the service and how?
talk 2 FACE
call
web
Depends on persona!
TIME
(Reverse) supply & product journey
WHAT DOES THE PRODUCT/PARTS ENCOUNTER?
STATISTICS
what data can we record for improvements?
- emotion
- value
- hassle
LCA
SATISFACTION
COST
RISKS
Moet het geen cirkel zijn?
OPPORTUNITIES
- rewards
- new styles
- cross selling
- wat nog mee?
- hoe connecties?
- bedenk: What voor informatie heb ik?
future proofing
roads
hairbags
service blueprint

appendix 13. concept evaluation session project plan

project plan

method
For this meeting the method for ‘product concept evaluation’ is used described by Van Boeijen et al. (2013). The method describes a step-by-step approach to set up a meeting and a plan when a concept or multiple concepts are evaluated by certain stakeholders with in this case the goal of evaluation and optimization. The sub-approach within this method is that of a ‘pictographic approach’: where the concept will be discussed based on a visual representation. Whereas in this session will be the service blueprint. The only limitation of the selected method is that it is not clearly described how the concept evaluation is related to optimization through participatory design. So that the stakeholders can optimize the concept by designing, or participating in design.

audience
The audience during the session are the company CEO and the manager operations (MO) from Bribus. Both are already very closely involved with the circular kitchen and helpt building the first prototype. This means that I can immediately start with explaining my personal process instead of the product itself and that I can dive into dept quite quickly. Since Bribus is relatively innovative and the company already has some service-systems running, they are very interested I See the service from CIK.

environment
The meeting will take place in the CEO’s office at Bribus Keukens headquarters in Dinxperlo. A secretary confirmed that in this office space a projector-screen is present.

objectives
1. Introduce Bribus to research results and ‘the tenant’ (persona’s and user context)
2. Present design B (service blueprint design until now)
3. Gain insights about Bribus vision on the design and what to adjust
4. Design new concept for the service model

workplan & script
The exact practicalities and approach during the session is displayed in confidential appendix 13.

results

The results of this session are a list of action points on what to adjust in the remainder of the project. What is possible within the time-frame and what not?

- After evaluating the concept with the stakeholder:
- Write session report/reflection
- What should I add, detail or refine in design B design C.
- What could be opportunities and what to take into consideration?
- A report of the process of the day containing conclusions should be sent to the respondents of the session.
- Tweaking the design

appendix 14. session workplan & script

Workplan

Checklist

Charge

- Iphone X (for pictures)
- Iphone 5 (for audio recording)
- USB charge-hub 1 & 2
- Laptop

Print

- Workplan – (checklist & script)
- Service blueprint design B

Preparation Checklist

- Bring workplan/checklist
- Bring iphone X
- Bring iphone 5
- Bring charging hub (2x)
- Bring charger phone, charger laptop
- Bring pens, markers, scissors, tape, post-its, gluestift, adhesive tape
- Bring PowerPoint remote controller
- Bring extra AAA battery
- Bring service blueprint design B
- Bring A0 & A3 paper
- Bring umbrella
- Put workplan in grey session folder

Script

	Doel	Wat te doen	Vragen
5 min (5m)	**Kennis maken**		*Vindt u het goed als ik dit gesprek opneem? En af en toe wat foto's maak?*
5 min (10m)	**Ruimte voorbereiden**	○ Leg creatieve spullen op toegankelijke plek ○ Zet presentatie aan en sluit afstandsbediening aan ○ Zet opneem-telefoon op tripod en zet aan	
10 min (20m)	**Introduceer publiek in project en proces tot blueprint**	**Presenteer** ○ Presentatie voortgang project	
10 min (30m)	**Presenteer service blueprint**	**Presenteer print service blueprint** en bespreek dit. Noteer en teken op het vel.	
15 min (45m)	**Vergaar inzichten van Bribus visie over het ontwerp en wat aan te passen en te verfijnen.**		○ *Wat denken jullie van het ontwerp?* ○ *Waar zouden de eerste verbeterpunten liggen?* ○ *Is dit systeem haalbaar?* ○ *In hoeverre sluit dit aan op Bribus extra?* ○ *Wat gaat er nu goed en wat niet goed?* ○ *Wat zijn sleutelmomenten voor dit systeem?* ○ *Wanneer gaan dingen mis?* ○ *Wat vindt Bribus van keukencollectief?* ○ *Wat gaat de rol van Bribus hier zijn?* ○ *Hoe zien zij de samenwerkingsconstructie voor zich?* ○ *Hoe ziet de **back-end** eruit?* ○ *Zien jullie dat data-systeem werken?*

			○ *Gaat dit logistieke systeem werken met voorraden en gebruikte onderdelen?* ○ *Hoe ziet Bribus de basiskeuken?* ○ *Hoe flexibel moet de basiskeuken zijn voor woningcorporaties?* ○ *In hoeverre is tweedehands spullen roulatie mogelijk en gewild binnen dit systeem?*
30 min (75m)	**Teken besproken onderdelen voor nieuwe service model**	Neem A0/A3 papier en teken samen hoe dingen eruit zouden moeten zien.	
40 min (115m)	**Ruimte invulling vrij voor Joost en Wim**	Luister en spreek	*Zijn er nog dingen die jullie willen bespreken?*
5 min (120m)	**Einde sessie**	Bespreek verwachtingen van resultaten en verdere communicatie	

** kan zijn dat dit niet meer nodig is (bijv. al gebeurd)

appendix 15. LCA calculation mechanic vs DIY

A Fast-track LCA is done to compare the environmental impact between sending a mechanic to a house for a module installation or a installation by the tenant themselves while using a post-NL courier for transport.

Case:

- A tenant lives in Nieuwegein and wants to install/replace a full module upper cabinet.
- The product that should be transported is a cabinet-module in a flatpack. With packaging dimensions 70 cm x 42 cm x 15 cm. With a weight of 13 kg. Based on an IKEA upper-cabinet. (IKEA, 2019)
- DIY route: The part is sent from a central production point, currently in Dinxperlo to a postNL point in Ulft with a small transporter van, half-loaded (Figure 77). From there it is sent with a large transporter van, fully loaded (Figure 78) to the destination.
- Mechanic route: The mechanic is based in Amsterdam. The product is shipped from Dinxperlo to Amsterdam with a large 24t truck, half-loaded. The mechanic takes it from Amsterdam to the destination with a small transporter van, half-loaded (Figure 77).
- Parameters are distance, dimensions/weight of product.

Assumptions

- A very variable parameter is probably in the number of packages that is in the vans during transport. In this case we assume the loadings stated in the case.
- The system-boundary lies here in the transport of this specific part. It is assumed that in both cases the use, production and end-ofl-ife impact is the same.
- The weight is used in the calculations is used since it is relatively heavy for the volume that it has.

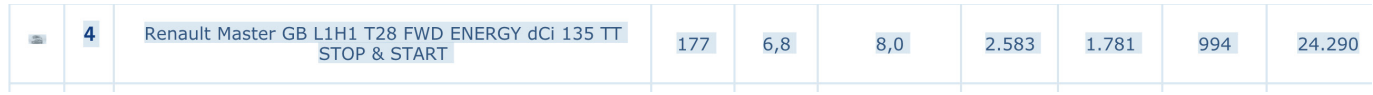
Conclusion

Sending a mechanic to a house for a reparation causes almost 4 times the CO2 emission caused by transport compared to a repair by the tenant themselves.

figure 77. small transport van, source: https://www.anwb.nl/auto/besparen/top-10-zuinige-autos/top-10-zuinige-bestelautos-overzicht

3	Renault Kangoo Express dCi 75 ENERGY STOP & START	110	4,2	3,0	2.502	1.255	695	13.540

figure 78. large transport van, source: https://www.anwb.nl/auto/besparen/top-10-zuinige-autos/top-10-zuinige-bestelautos-overzicht



4	Renault Master GB L1H1 T28 FWD ENERGY dCi 135 TT STOP & START	177	6,8	8,0	2.583	1.781	994	24.290

figure 79. LCA mechanic

Transportfase							
onderdeel	route	kg	km	lading-multi	transport volgens database (vermeld bron)	CO2 [kg/kg*km]	Carbon transport/ onderdeel [kg]
module kast boven	Dinxperlo - Amsterdam	13	*159*	2	vrachtwagen + trailer 24 ton (halfvol) (IDEMAT app)	0,000085	0,35139
	Amsterdam - Nieuwegein	13	51	2	bestelbus klein (halfvol) bron: ANWB	0,000069	0,091494

figure 80. LCA DIY

Transportfase							
onderdeel	route	kg	km	lading-mult	transport volgens database (vermeld bron)	CO2 [kg/kg*km]	Carbon transport/ onderdeel [kg]
module kast boven	Dinxperlo - Ulft	13	*10*	2	bestelbus klein (halfvol) Renault Kangoo Express bron: ANWB	0,000069	0,01794
	Ulft - Nieuwegein	13	103	1	bestelbus groot (vol) Renault Master GB bron: ANWB	0,000078	0,104442

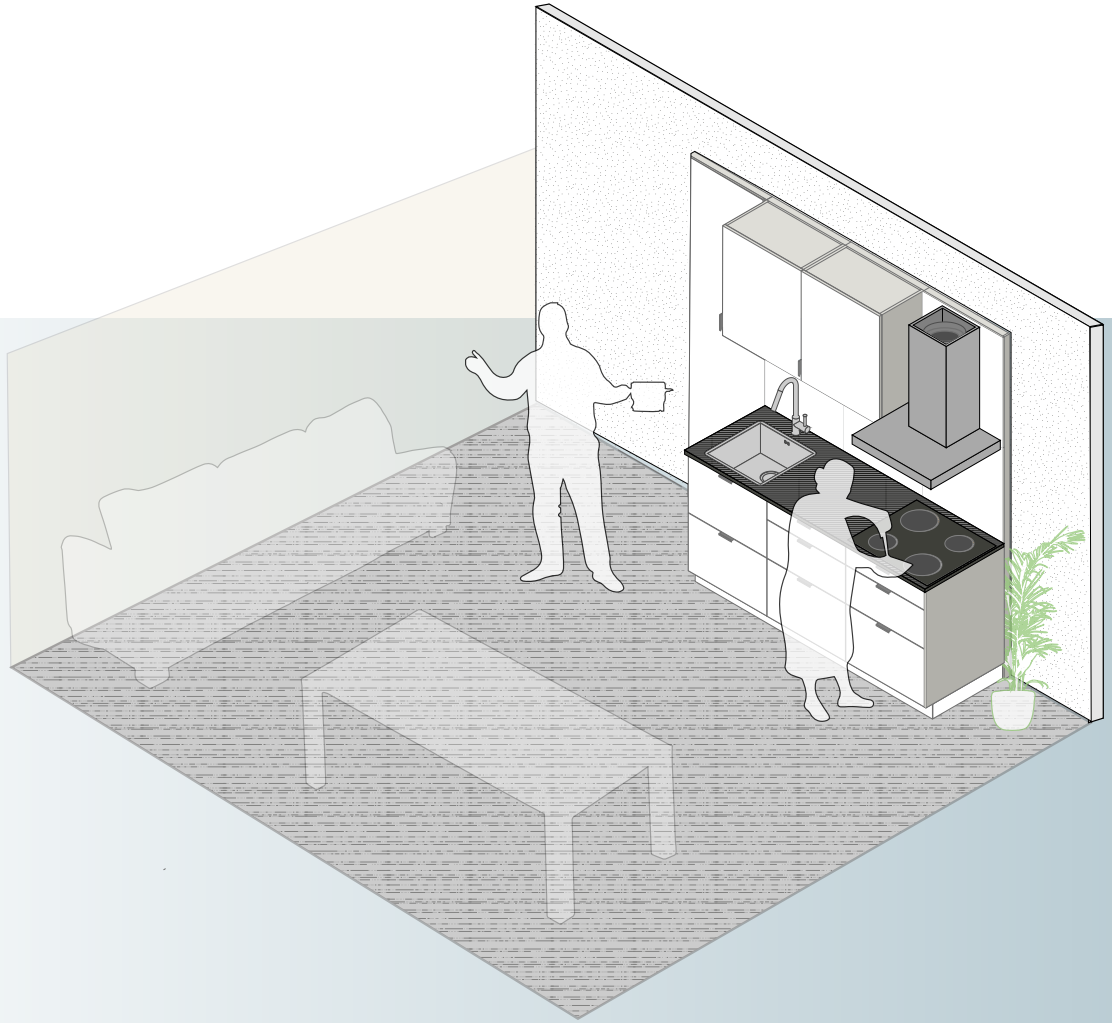
figure 81. LCA result

	Mechanic	DIY	
Productionphase			
Transportphase	0,442884	0,122382	
Usephase			
End-of-life scenario			
Total	0,442884	0,122382	kgCO2 per module per replacement
multiplication factor	3,618865519		

appendix 16. basic kitchen C

your circular kitchen
the basic kitchen

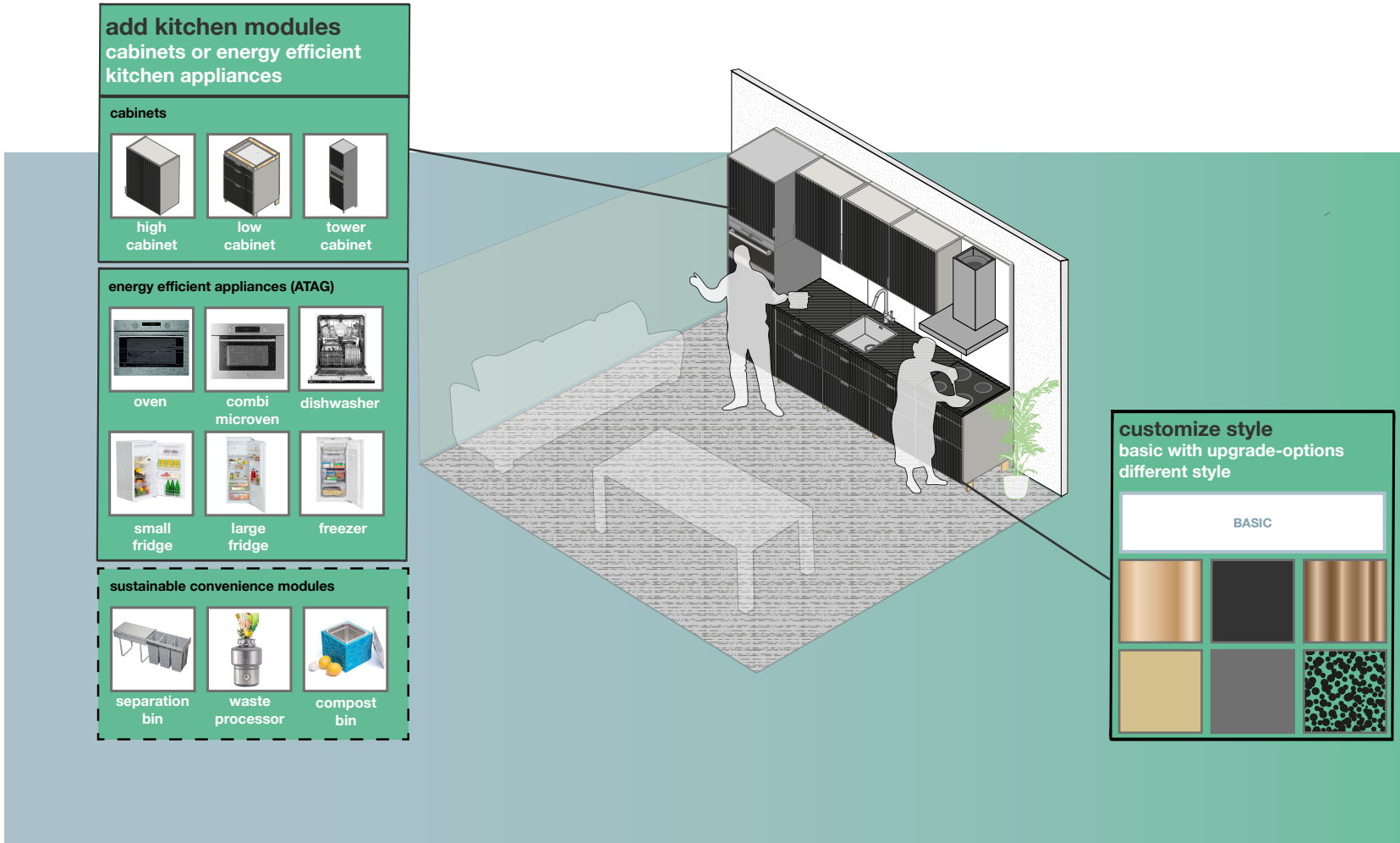
design C



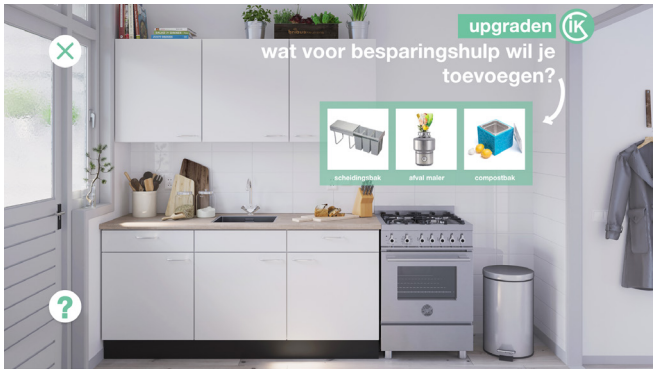
appendix 17. kitchen upgrades offer C

your circular kitchen
upgrading possibilities

design C



appendix 18. interface designs


upgraden
wat voor besparingshulp wil je toevoegen?
scheidingsbak
afval maler
compostbak


upgraden
wat voor kastje wil je toevoegen?
hoog kastje
laag kastje
torenkast

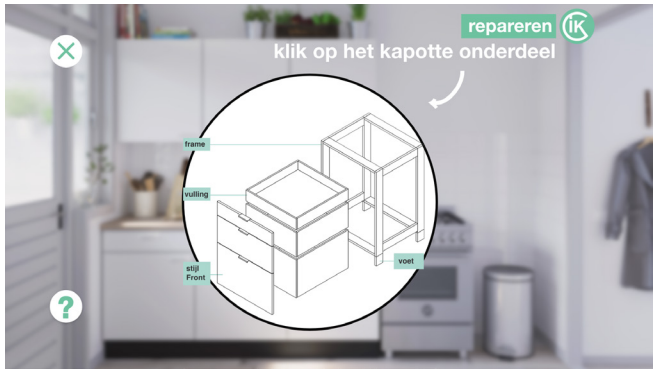

upgraden
wat voor kleur wil je?

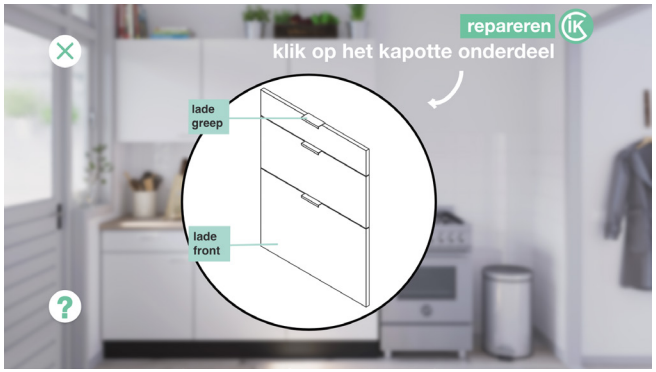

upgraden
wat voor kleur wil je?

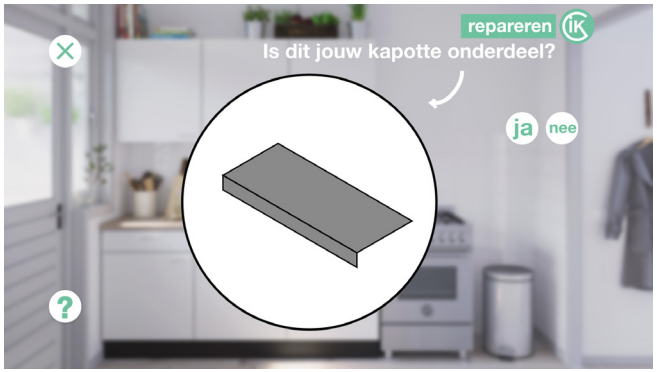

upgraden
wat voor apparaat wil je toevoegen?
vaatwasser
oven
magnetron
vrijkezr
koelkast


upgraden
waar wil je jouw nieuwe vaatwasser plaatsen?


upgraden
Ben je tevreden met deze plek?
ja
nee


repareren
klik op het kapotte onderdeel
frame
vulling
stijl Front
voet


repareren
klik op het kapotte onderdeel
lade greep
lade front


repareren
Is dit jouw kapotte onderdeel?
ja
nee


installatie details
Je wilt een bovenkastje verschuiven in jouw keuken.
Hoe wil jij dat de installatie gebeurt?
Ik doe het zelf!
Je kan er voor kiezen om zelf jouw installaties te doen. Waarom? Het is sneller, goedkoper en je krijgt zelfs keukencredits, waarmee je kan sparen voor leuke beloningen.
Help mij alsjeblieft!
We kunnen altijd een assembleur langssturen. Bij reparaties is dit gratis, bij upgrades komt de assembleur langs voor een kleine vergoeding.
30 KC


bezorg details
Goede keuze!
Jouw bestelling wordt zo snel mogelijk bezorgd. Volg jouw bestelling op postNL.nl
Je kan alvast een kijkje nemen hoe je de reparatie moet uitvoeren.
reparatie instructie
track & trace


installatie details
Je wilt een ladegreep vervangen in jouw keuken.
Hoe wil jij dat de installatie gebeurt?
Ik doe het zelf!
Je kan er voor kiezen om zelf jouw installaties te doen. Waarom? Het is sneller, goedkoper en je krijgt zelfs keukencredits, waarmee je kan sparen voor leuke beloningen.
Help mij alsjeblieft!
We kunnen altijd een assembleur langssturen. Bij reparaties is dit gratis, bij upgrades komt de assembleur langs voor een kleine vergoeding.
30 KC

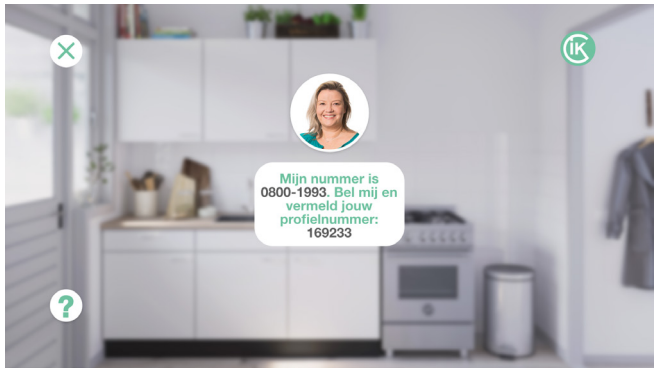

bezorg details
Mooi! Je gaat zelf een ladegreep vervangen in jouw keuken.
Hoe wil je dat het onderdeel wordt bezorgd?
30 KC
postNL ophaalpunt
5 KC
thuis afgeleverd

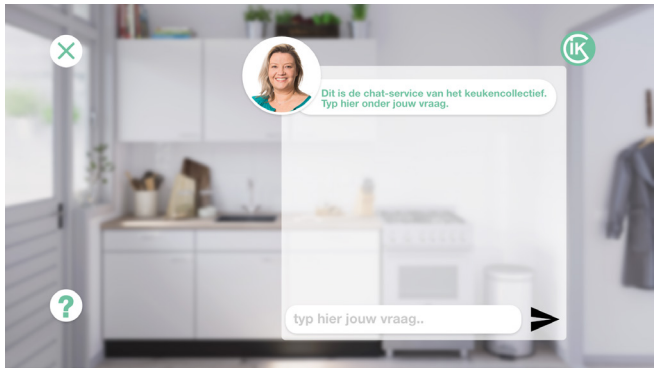

zelfreparatie handleidingen
Deze handleidingen zijn gelinkt aan jouw bestelling.
Kies de methode die jou het prettigst lijkt om dit klusje te klaren.
interactieve instructie video
digitale handleiding
Met deze handleiding doe je jouw werkzaamheden op jouw eigen tempo. Deze traditionele handleiding is makkelijk door te skippen en in te zoomen op onderdelen is mogelijk.


Keukencredits
15
verzilveren
Je hebt op dit moment 15 Keukencredits verzameld! Je kunt deze verzilveren voor handige beloningen.


Keukencredits
verzilveren
15
15
Voedsel Pakket
50
Pannenset
100
Gratis Stijl Upgrade


Ik ben de Keukencoach. Hoe kunnen ik of een van mijn collega's je helpen?
chat
bel


Mijn nummer is 0800-1993. Bel mij en vermeld jouw profielnummer: 169233


Dit is de chat-service van het keukencollectief. Typ hier onder jouw vraag.
typ hier jouw vraag..

appendix 19. project plan user evaluation

The aim and method are decribed in chapter 16. These are the remaining section of the project plan.

goal

The goal in this session is to get the tenant's opinion on the digital platform and create insights for further development for the platform and service as a whole.

method

The session was in the shape of an interview with the tenants. The interview started with some questions about the current service from the housing association and the protocol and the tenants actions when something needed replacement, repair or if they wanted something new. After this the service of the keukencollectief was explained and the tenant tried out the digital platform prototype as was presented in chapter 16.3. After the test with the digital platform the participant filled in a questionnaire with statements related to the criteria.

environment

The testing environment is in the living room of the tenant.

objectives

1. Introduce tenant to the scenario, that the current kitchen appears a CIK model, where a service is designed for
2. Get a general idea on what plays in the tenant's mind
3. Sketch use-scenario's, and get response/findings on the actions/desires.
    - What if a drawer a handle breaks?
    - What if you are tired of the color after one year?
    - What if the kitchen becomes dirty?
4. Test digital jouwCIK platform with tenant
5. Let the tenant fill in a questionnaire with criteria statements.

workplan & script

The workplan containing the script for the session is shown in appendix 19.

results

interview quotes and opinions

Per participant the results are noted in quotes and paraphrases from the interview. These are filtered in important and less important. Then these are interpreted and translated in useful insights.

participant J

Most important remarks and notes

- "This system feels all in one. It is nice and convenient, because you have the feeling that the system knows you and your kitchen."
- "When I call now, they don't know who I am and where I live. This feels more personal because you can always call or chat, and that is comfortable." She encountered issues with being connected to right person for the right job/issue. Het keukencollectief feels very clear, and is felt very comfortable to have one over seeable spokesperson with information available at one point, with information on paper instead calling someone and continuously referred to others.

---> The personal approach works and it seems like a solution to the current failing service of the HA.

- If the participant would get this system tomorrow, she would start exploring all the options, without getting one per see. She liked the non-committal browsing and dreaming of the opportunities. Probably her first action would be to replace all cupboard handles and repair her water tap.

--> The visible effect on the owned kitchen and the easy of changing triggered dreaming could possibly help persuading for upgrades.

- Was very interested in the rewards and keukencredits. But, if the mechanic was free, she would pick this option, but if the rewards were appealing enough, she would pick the DIY-approach. She would ask other persons to help if she would get the rewards.

--> The stimulation of a certain choice via rewards by Keuken-credits seems to work and creates the desired reaction.

Other useful remarks

- She was interested in DIY to gain the benefits of it. But, before choosing if DIY is a good idea, she wanted a short preview/difficulty impression for the DIY-repair.
-
- She was worried about un-intended behavior of others. How do you know if other tenants don't break their stuff on purpose to gain the benefits of the Keuken-credits?

participant G:

Notes and insights:

- In dit geval is de service van de woningcorporatie gewoon best goed. Mevrouw belt altijd het zelfde nummer en vaak wordt het binnen 5 dagen verholpen, spoed sneller. Ze onderhouden veel en ze komen vaak terug met andere bedrijven om onderhoud aan van alles te doen.
- The tenant could also call the 'huismeester'. But she does not know who he is. There used to be a 'huismeester' that was responsible for these things, but he is gone.
- This tenant says that there are not a lot of repairs and other stuff, there does not happen very much in the kitchen. The tenant confirms that you dont change much about the kitchen. "Als ie staat, dan staat ie, daar ken je jaren mee toe." Only if you want to change the kitchen. **-->In this case, interaction is not really needed, but if this was needed to run the system, expansion of the service to the rest of the house is interesting.**
- She hates her ugly extractor hood, but she has layed that thought away "dan moet je het maar niet om het mooie doen." Er is hier niet gauw iets kapot, en er is in dit geval 1 keuzemoment. Deze huurder wil niet het ene jaar groen en het andere jaar rood. Maar de huurder geeft aan. "Als het mijn eigen huis is dan zou ik wel vaker iets willen veranderen."
- Even now, G thinks that it is important that the fridge is hers. At first she would want to invest in a new fridge and waits on holiday money, but after thinking about it, she would consider a lease fridge if the price was interesting. It feels a bit unnatural because the fridge was always her property, but for 25 euro per month the tenants would be interested in a built-in fridge and oven.

--> Leasing appliances could be a very interesting offer when people have not many years to live (old people).

- This tenant gets a new kitchen every 20 years. She wants the standard, and picked it in a showroom. When she moved in she first did not want a new kitchen, when she had the right to it. She thought It was too much hassle, and she thought the kitchen was pretty nice. But eventually her family persuaded her to do it.

--> in this case in the future, a fresh-up package would be a very good solution with a tenant-mutation. This was perceived as a good idea.

Most Important insights:

- In cases where the tenant is older and less digital-skilled the caretaker is the one arranging things. "In General she arranges it herself, but when it is too hard the caretaker takes on the task." Now she has one number that the tenant calls. (they provided a too elaborate information package for this) A lot of instances do not recognize and support this. The caretaker sometimes needs to do illegal things to get stuff done.

--> Acknowledgement, access and authorization of the caretaker is very important for older tenants. A flyer with a direct number to reach the Keukencoach, or a information sheet for caretakers to help could be a meaningful addition to the service.

- This housing association does their service pretty well and the tenants are already pretty satisfied.

--> When a housing association does want to take on the service it is an important part of the service to educate the housing association handymen, this is very dependent on the quality of the service and the wish of the housing associations to provide this.

- er like the digital platform. They liked the fact that they can fantasize and install new things in their own kitchen. They also thought this was a lot easier then a showroom. The caretaker thinks it is important to see the product itself and wants to go to a showroom, but in this case the computer animation is a lot better than a catalogue from a kitchen manufacturer.

--> The own kitchen works very persuasive, and is perceived as a lot more handy. It lets the tenant dream about the possibilities, what the tenant thinks is interesting. This might stimulate sales. It is also a good replacement for a showroom for this tenant.

- About the circular rewards: "Het lijkt Blokkertje wel met zo'n pannenset." "we gaan niet zitten knoeien." This tenant would not ask other people to doe repairs or installations for her. "I am too shy for that and I will buy a pan-set myself." But they think that young people will do it theirselves. They think that this system with rewards is fair, but if the other people that can do the DIY would get money instead of products. That feels unfair. "Products feels less like money." "But I just want someone to do it right, someone that studies for it." And they think it is important, that when it fails, that they will return to correct it.

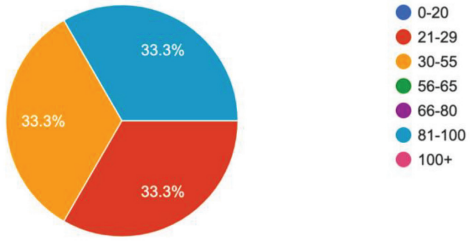
--> In this case the service of assembler is a very important part of the system. The tenant is not interested in the rewards, in the case that it are products she thinks it is fair.

results user questionnaire

The following graphs show the results of the questionnaire. The colors refer to the specific person answering the question. Blue is the old lady, red is the young student and orange is the old lady's caretaker.

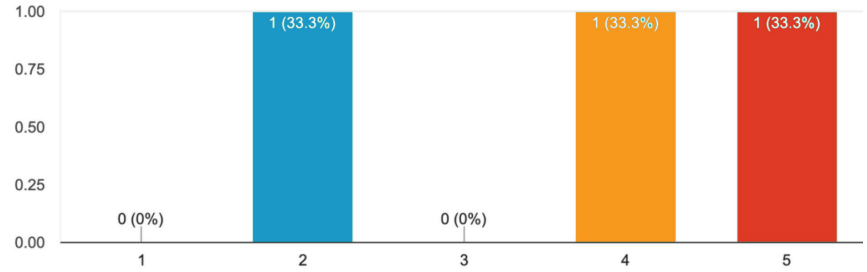
What is your age?

3 responses



I think that this system motivates me in partaking in the circular kitchen system.

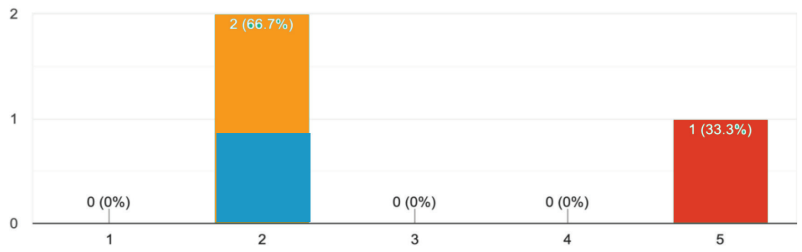
3 responses



fully disagree fully agree

I think that I would like to use this application frequently.

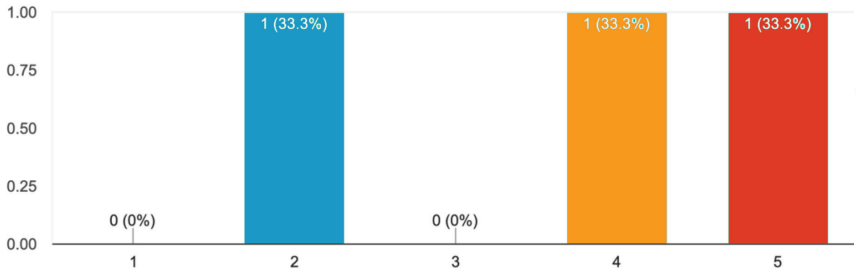
3 responses



fully disagree fully agree

I thought the application was easy to use

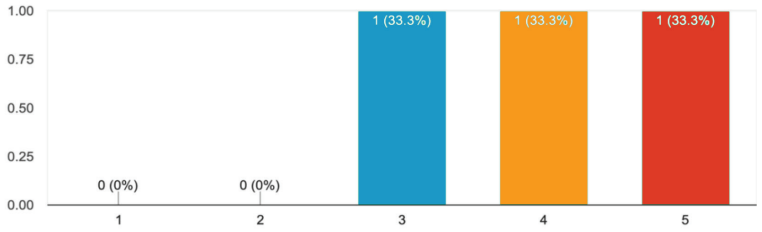
3 responses



fully disagree fully agree

I think that I am able to get help when I am stuck or I am not able to understand something.

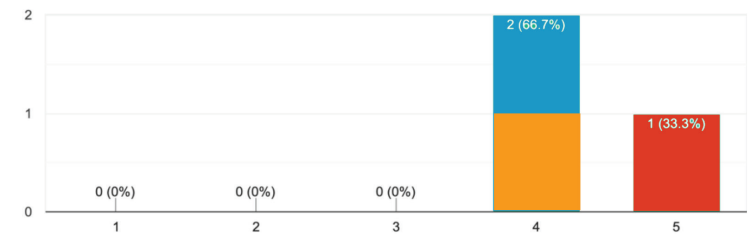
3 responses



fully disagree fully agree

I would imagine that most people would learn to use this application very quickly.

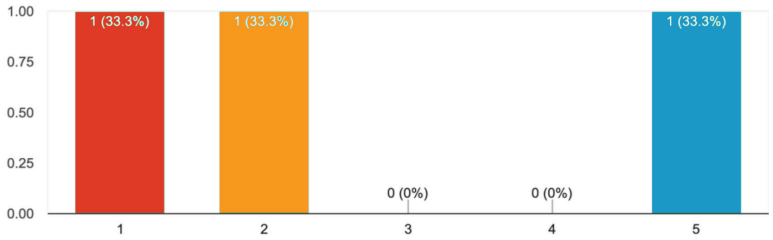
3 responses



fully disagree fully agree

I think that I would need the support of a technical person to be able to use this application.

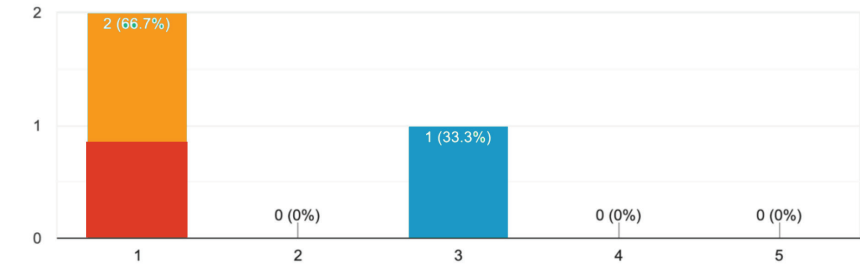
3 responses



fully disagree fully agree

I found the application very cumbersome (hinderlijk) to use.

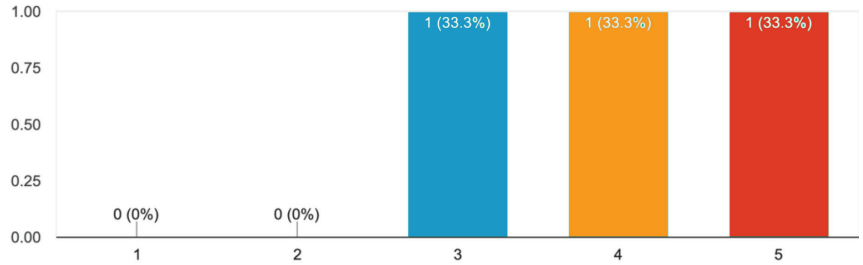
3 responses



fully disagree fully agree

I feel engaged in using the circular kitchen by using this application.

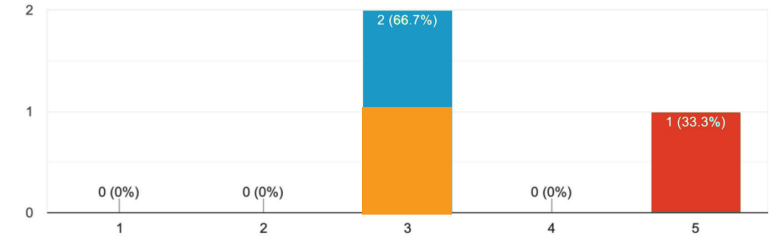
3 responses



fully disagree fully agree

It feels like the application suits how I look at my kitchen.

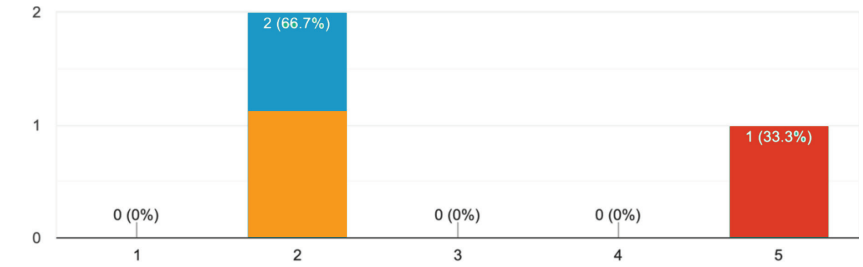
3 responses



fully disagree fully agree

I feel a freedom of choice while using the application.

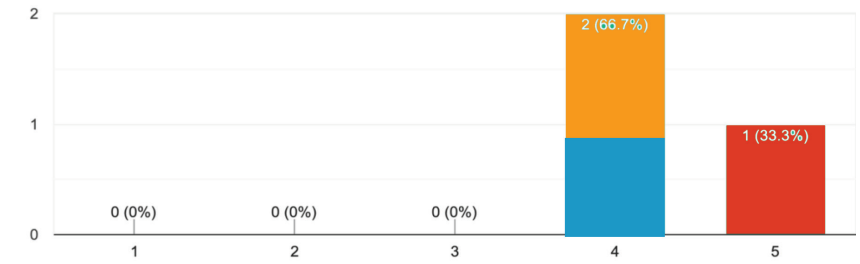
3 responses



fully disagree fully agree

The application communicates simple, clear and transparant.

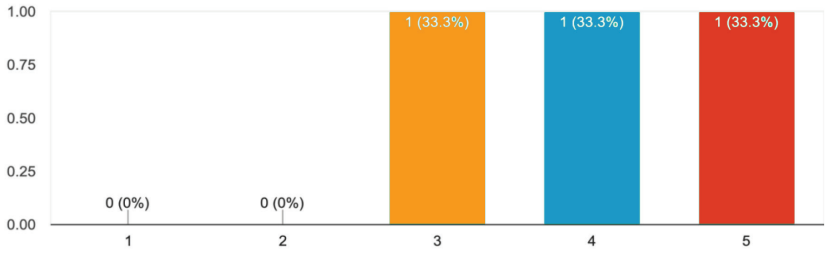
3 responses



fully disagree fully agree

The application approaches me in a personal way.

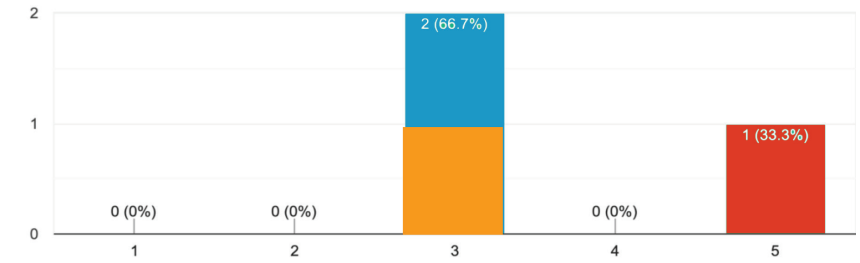
3 responses



fully disagree fully agree

The system offers appealing benefits for money.

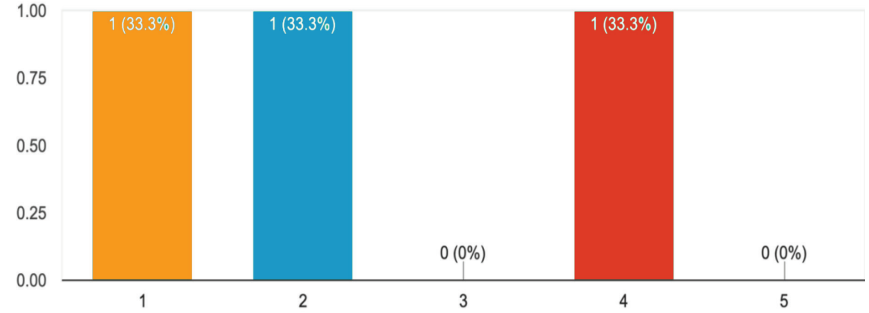
3 responses



fully disagree fully agree

The application stimulates waste separation, efficient resource and appliance use

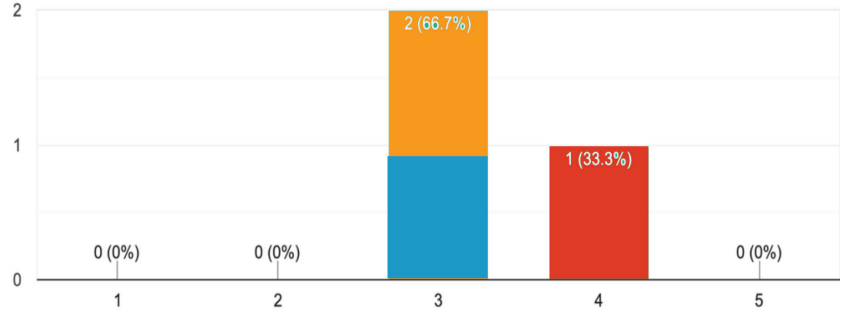
3 responses



fully disagree fully agree

There are a lot of tools and information available via the application to change my behavior to become more sustainable.

3 responses



fully disagree fully agree

appendix 20. workplan user evaluation

Workplan

Checklist

Charge

- Iphone X (for video recording)
- Iphone 5 (for audio recording)
- Laptop

Print

- Workplan – (checklist & script)
- Presentatie sheets CIK en keukencollectief

Preparation Checklist

- Bring workplan/checklist
- Bring iphone X
- Bring iphone 5
- Bring charging hub
- Bring charger phone, charger laptop
- Bring pen, marker, tape, post-its
- Bring computer mouse
- Bring laptop
- Put workplan in grey session folder
- sheets CIK en keukencollectief

Script

	Doel	Wat te doen	Vragen
5 min (5m)	**Introduceren**		*Vindt u het goed als ik dit gesprek opneem?*
5 min (10m)	**Ruimte voorbereiden**	○ Zet laptop op tafel ○ Leg opname telefoon op tafel ○ Zet opneem-telefoon op tri-pod en zet aan	
5 (15m)			Wat zou u nu doen als… ○ Een handvat afbreekt ○ Als u de kleur niet meer mooi vindt. ○ Als de keuken vies wordt? ○ Als u een extra apparaat erbij kan huren? Hoe ziet u dit graag anders?
10 min (25m)	**Introduceer tot scenario**	Leg principe van keuken uit met tekeningen van CIK ©	Schets scenario: *Er is een nieuw soort keuken. Het is heel makkelijk uit te breiden, te repareren en te veranderen. Het is sneller, goedkoper op lange termijn ook nog eens veel duurzamer en goed voor het milieu. Alles is te regelen via een aanspreekpunt: het keukencollectief. Zij hebben een webapp waarmee jij jouw keuken kan onderhouden. Stel u voor dat uw huidige keuken blijkt dit nieuwe model. (CIK)*
15 min (40m)	Test digital platform (met mantelzorger)	• Geef laptop met jouwCIK aan • Klik record scherm en geluid aan!	○ Wat gaat er in uw hoofd om? ○ Zou u dit gebruiken? ○ Vind u dit handig? ○ Snapt u het? ○ Wat is niet zo goed? ○ Wat kan er beter? ○ Ondervind u problemen? ○ Hoe zou u anders dit oplossen? ○ Wat denkt u dat het keukencollectief is? ○ Wat zou u nog meer van het systeem willen?
5min		Enquête op laptop	Enquête laten invullen

(45m)			
10 min (55m)	Los gesprek voor inzichten	Luister en spreek	
5 min (60m)	Einde sessie	Sluit het af	

appendix 21. meaningfulness evaluation

How meaningful will the CIK-system be compared to the conventional kitchen system with the Keukencollectief incorporated in the design?

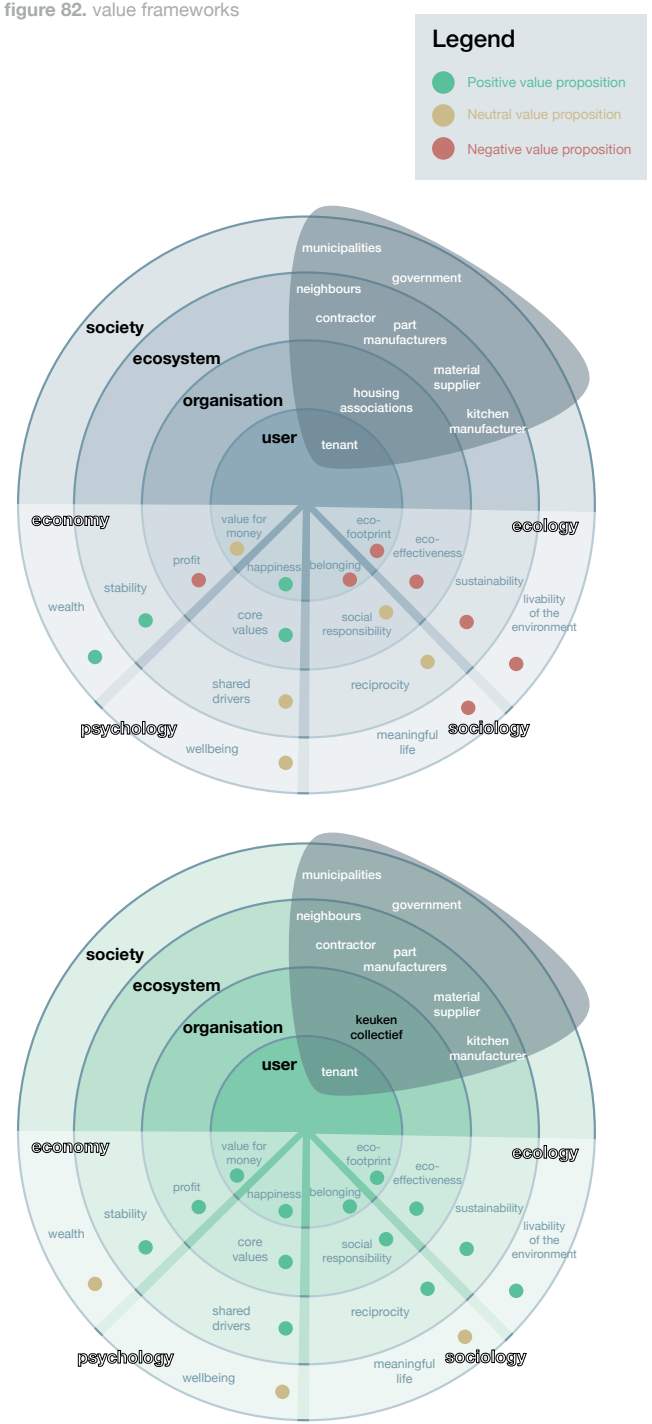
method

For this to compare, the 'value framework' method is used as described in by Design United (2013). It is a tool for sharing value to multiple stakeholders of meaningful innovations. The framework combines the value-perspectives from each social science: economics, psychology, socially and ecology. The design is considered meaningful if it addresses the four levels from all four perspectives. The values are assessed while using the method (Design United, 2013). First the conventional score is made up, later the one for the current design is created. Both frameworks is shown in Figure 82.

conclusion

According to this method the new system design is meaningful and the old one isn't. The shortcomings of the initial system can be defined as value gaps/opportunities and are already solved in the system. On a lot of levels the system has different values, when compared to the conventional social housing kitchen system, the lineair system. It has a lot of different outcomes. In the new design there is innovation in the product, in the way people perceive and use kitchens, possibilities for industry to improve, personalization and above all, the positive environmental impact. The key values that the design from this project brings are the following: Enabling the user to benefit from the system via communication platform, the system enables a circular approach, with a product that lives longer and produces less environmental impact, It changes the kitchen-industry and provides appealing economical benefits for the stakeholders in the system, the system is accessible for a large group of tenants with different back-grounds and life-phases, it is personal and approachable and is suited for different types of tenants.

figure 82. value frameworks



master thesis
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May 2019