

# Circular economy in relation to manufacturing companies producing kitchens - a method for realizing the theory in practice

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## Abstract

Climate change is a pressing agenda around the globe. In order to cope with the changing climate and the depletion of resources many industries must change their ways. This research pursued an angle of analyzing the possibility of using circular economy in manufacturing businesses - more specifically the kitchen industry. Connections to the automotive industry were made and especially the way in which they use product service systems to expand their market a part of which leasing is a key method of financing a purchase. In connection to a business case revolving around Kvik A/S a new business model was created; bringing new ideas to the industry such as leasing and trade-in system in order to acquire and retain customers.

Keywords: Circular Economy, Manufacturing, Business Model, Kitchen Industry, Product service system, Recycle loop

## Introduction

The issue of climate change is on many worldwide agendas. Climate change is regarded as a global challenge (Solomon, 2008) in need of action. The European Union (EU) has waste management as one of their primary goals. The EU has created a waste hierarchy to convey its' priority order: prevention, reuse, recycling, energy recovery and least preferred, disposal (European Union Council, 1999). The waste hierarchy's vision is to divert waste from landfills into energy recovery (Lausset et al., 2017) due to the depletion of non-renewable resources. The un-reflected usage of resources is driven by that consumption has for long been considered a sign of wealth (European Union, 2015). In order to move into a more sustainable use of resources the current linearity of product lifecycles must be challenged (Ritzén and Sandström, 2017).

One way of opposing the linear lifecycle is the concept of circular economy (CE). In its simplicity CE suggests refraining from disposal of material through closing the loop of materials within the product lifecycle (Ritzén and Sandström, 2017) in order to reduce resource usage and thereby decreasing energy demand. Unlike traditional recycling CE emphasizes product, component and material reuse, remanufacturing, refurbishment and repair (Korhonen, Honkasalo and Seppälä, 2017) while also supporting renewable energy sources throughout the product value chain. In CE economic growth is no longer achieved by producing more goods, but by keeping them available for a longer time (Amui et al., 2017).

## Manufacturing

Manufacturing is the process that converts raw material into finished goods meeting the expectation or specifications of the receiving customer. This is often done by a man and machine setup, which is then scaled to the desired size for the manufacturer. Large companies have multiple divisions of manufacturing setups (BusinessDictionary, 2017). The manufacturing paradigm goes back two centuries and is vital for a nation's economy. The vitality can be attributed to the creation of the high paying jobs the manufacturing industry creates. Thus, creating lasting wealth to the citizens of the nation (Hu, 2013). Manufacturing has undergone paradigm changes since its dawn. Until now there have been four paradigms within manufacturing. The first paradigm is the Craftsman paradigm. The craftsman manufactures the product to the customers' direct wishes at a high price and low speed (Hu, 2013). The second paradigm is mass production, because of moving assembly lines it became possible to manufacture goods in a high speed and at a lower cost. The United States was first at implementing this new way of manufacturing (Duguay, Landry and Pasin, 1997). The implementation of the moving assembly line by Henry Ford is considered a cornerstone in the implementation of mass production (Hu, 2013) letting the production line set the pace for the workers (Duguay, Landry and Pasin, 1997). The two presented paradigms represents the choice the manufacturer needs to make; either customization or mass production in focus (Duray, 2002). The third paradigm is the lean era: the production is optimized with the aim of minimizing waste along the production process while maximizing value for the customer. The lean paradigm is often associated with the Japanese automotive industry (Hu, 2013). The fourth and newest paradigm is known as mass customization. The goal of mass customization as a strategy, can be defined as: the use of flexible structures in the organization and the processes to enable manufacturing of customized products, which satisfies the customer at the same low cost as would be the case if the product was produced in a mass production setting (Hart, 1995). The four paradigms are shown in Figure 1.

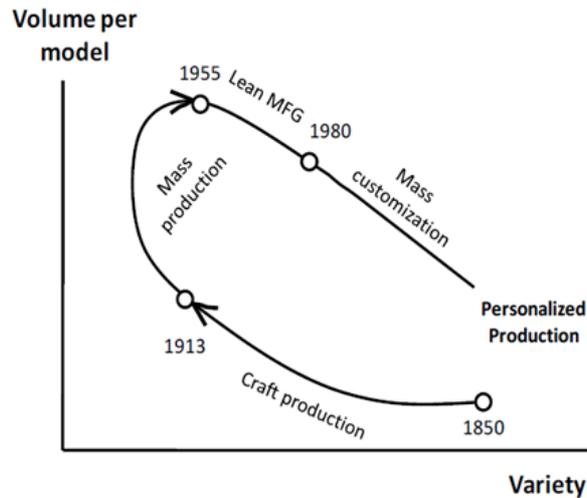


Figure 1: The four paradigms in manufacturing. Presented as volume and variety combined with the historical timeline.  
Source: (Hart, 1995)

Manufacturing of kitchen furniture has changed over the last forty years, in the earlier days a kitchen was a crafted product built by craftsmen to fit the room it was designed for. Then came mass production and took production to larger factories, this tendency allowed for lower production cost, simultaneously getting rid of a lot of the customization. Studies show that mass customization can be achieved by putting modules together in an order that fits the user's requirements (Duray, 2002).

### CE and Manufacturing

Capitalism ushered the industrial revolution applying fossil fuels to the production industry and simultaneously introducing new mechanical inventions (Mathews, 2011). However it also brought what Polanyi called a “counter movement” (Polanyi, 2014) which among other factors includes the destruction of nature (Mathews, 2011). Therefore, the future of capitalism must take into account the mutual relationship between economic growth and the sustainability of resources (García-Olivares and Solé, 2015). In the book *Natural Capitalism* the transitioning from the manufacturing paradigm to a new type of production, where producers are not selling a product but a service is discussed. The customer does not own the product and does not have to pay for the raw material since these belong to the manufacturing company (Hawken, Lovins and Lovins, 2000).

Product Service systems (PSS) is a part of an environmental driven research which argues that mankind will face disaster, unless there is found a way to unlink economic growth from environmental pressure. The authors understood that a focus on final customer needs instead of focusing on the product fulfilling these needs, would give a larger degree of freedom in the design of a need fulfillment system (Tukker and Tischner, 2006). PSS could lead the way for companies to develop value propositions - thereby increasing their revenues, while decreasing the consumption of resources. One of the more frequently discussed approaches to change the current linearity within the product lifecycle, is CE (Ritzén and Sandström, 2017). Companies transitioning towards PSS and CE must change their business model (BM) towards service as a commodity instead of a physical product. Prolongment of product life will thereby be a driving incentive for the company, including ensuring proper material utilization (Tukker, 2015).

Furniture companies are struggling to increase and even maintain their market share (Zadnik Stirn, Gornik Bučar and Hrovatin, 2016). Consumers are more demanding than earlier which also makes the buying process more difficult. A number of factors influence the customer's buying behavior, however most important are: motivation, social and environmental demands and the company's marketing strategy (Zadnik Stirn, Gornik Bučar and Hrovatin, 2016). In keeping with this knowledge some manufacturing companies are moving towards Extended Producer Responsibility (EPR) as a way of minimizing the need for new raw materials and component parts (Bennett and Graedel, 2000). With EPR product ownership is becoming less common while product leasing is increasing. EPR therefore motivates manufacturers to take back their product when consumers normally discard them and then manage them at their own expense (Intlekofer, Bras and Ferguson, 2010). Many have argued that leasing is a “greener” form of business transactions than selling due to the fact that by maintaining ownership of the product the company is forced to increase the product lifetime and put in a strategy for reusing discarded products (Intlekofer, Bras and Ferguson, 2010).

Leasing is as mentioned a growing strategy in the manufacturing business, however it is not seen in the kitchen industry as of yet. This research project therefore aims toward analyzing if a leasing strategy in the kitchen industry is possible, using Kvik A/S as a business case.

## Research Design

The primary focus of this study is to understand circular economy and manufacturing as a theory. These two areas of theory are then combined with the aid of existing within the field. The aim is to understand how circular economy can be a part of manufacturing in the future. Therefore, a case study is performed to understand how the case company relates to the idea of circular economy. The case study will be performed as semi structured interviews with different people within the case company. The people for the interviews will be chosen via the snowball method (Saunders et al., 2015).

The layout of the study consists of two desk research performed in parallel. The studies are performed by searching for literature in known databases. The literature found is then analyzed using qualitative reasoning to find consensus within the different articles. The knowledge is then condensed into short narratives about the two areas, this is done to build up an understanding of the different realms.

The second part of the study is combining the two theory realms using literature. This is done to understand the link existing between them within the literature of manufacturing and what drivers are present to further enhance the reaction between the areas of theory. Thus, making sure that this research contributes to the knowledge base regarding grounding the two theory realms onto mutual ground. To tailor this research towards the kitchen industry a search for the two theories within kitchen manufacturing is conducted and described in the last section of part two. The gaps found will act as points of interest for the third part.

Third part consists of a literature study and a cases study. The desk researched literature study is done on the topics of non-correlating gaps uncovered in the combination done in the second part. While the case study is a deductive testing of the theory found in the literature including a calculation of the potential amount of product saved by the method. Therefore, the two are done partially sequential.

The intended outcome is a recommendation on how the case business could implement CE into their BM. This could be applied for other businesses within the same industry. Figure 2 shows the methods converted into a flow diagram for the intended research.

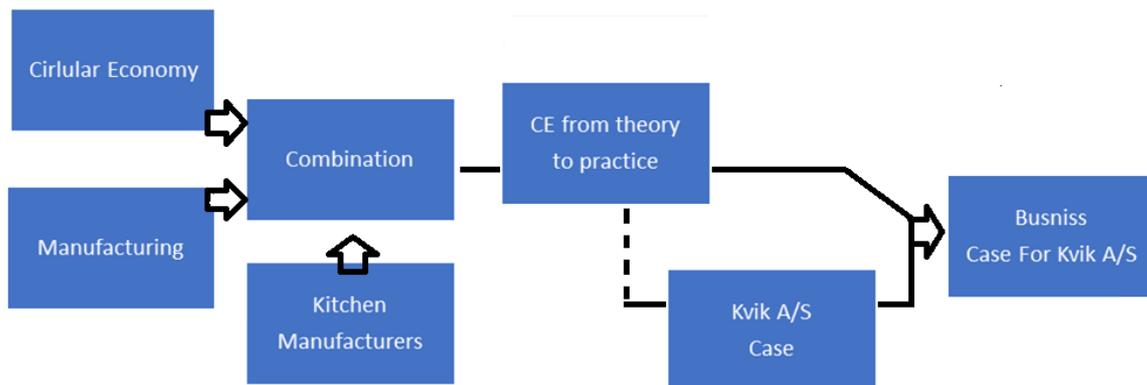


Figure 2: Flow diagram of the research design

### CE from theory to practice

One of the main problems with implementing CE is the need for closed loops when talking about artificial materials, since the natural metabolism of the earth cannot digest the materials. But an indefinite cycling of resources is almost impossible because of material degradation and the imperfect reclamation systems combined with the material separation processes (Haanstra, Toxopeus and van Gerrevink, 2017). A revised model for waste management within the society is needed since the practice now only partially lets the material go back to the company. Thus, a need for companies to handle recycling through take-back systems (Singh and Ordoñez, 2016). This will eliminate the possibility for the perfect circular lifecycle since it leaves no room for leaks (Haanstra, Toxopeus and van Gerrevink, 2017) Compared to the global scale only 11% of collected waste is categorized as recovery of materials another 19% is categorized as energy recovery, (Incineration) (Singh and Ordoñez, 2016) the steps towards CE will have to be small changes.

The first major change that must be undertaken is to change the mindset within the company from a product development and sales focus to be a service provisioning company, with a focus on provision of functionality through services. This requires a new business model to be formed (Sousa-Zomer et al., 2017). With a stronger reach in the network of the company to implement the necessary changes.

Shifting towards PSS will provide a basis for a company to better contribute to CE in general (Sousa-Zomer et al., 2017). The customers need to accept the change and they will have to embrace the PSS way of solving their product demands for the implementation of CE to persevere. Some studies indicate that for certain product demands the customers are willing to

trade in product for a service (Haanstra, Toxopeus and van Gerrevink, 2017) which has been seen in the automotive industry.

### Leasing

Leasing has been around for many years, however mostly known from the automotive industry. Automobile leasing as a consumer strategy, has increased in popularity; in 1990 approx. 8% of all American cars were leased while at the end of the century that number had increased to around 33% (Trocchia and Beatty, 2003). Households usually choose to lease due to a lower initial cost. Leasing an automobile rather than purchasing and financing, can lower both the down payments and the monthly cost, because the leasing expenditure only covers the vehicles depreciation over the term of the lease rather than the total car (Aizcorbe and Starr-McCluer, 1997). In general leasing and financing make consumption possible in situations that might not be possible otherwise. According to findings made by Trocchia and Beatty there are four major motives to leasing vs. buy decisions in the automotive industry. It is found that consumers opting to lease will possess a higher desire for gratification due to the fact that they can achieve more with less when leasing (Trocchia and Beatty, 2003) which also helps project a more favorable image of themselves.

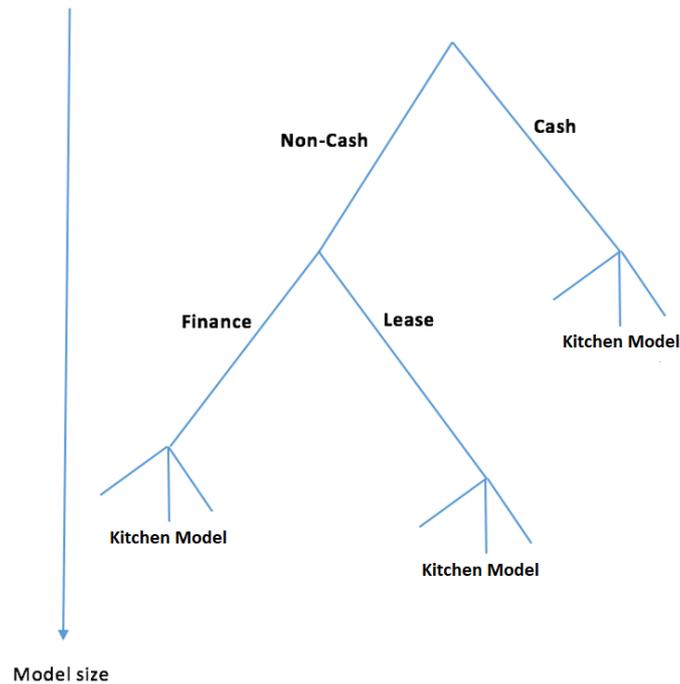


Figure 2: Customers vehicle choice dependent on financing type. Modified from (Mannering, Winston and Starkley, 2002)

Figure 3 depicts that households choosing to finance or lease their automobile spend more money / choose an upgraded model than what they would have done otherwise. Seen from a company perspective trade-ins and leasing help achieve two basic goals (Lu and Xu, 2015):

The two strategies can help incentivize consumers to upgrade to products featuring new technology or replace old with new. Since trade-ins and off-leased products are returned to the company, they can gain better control over reuse and secondary market usage. Thereby gaining profit and engaging in sustainable production.

All in all, gaining competitive advantage through increasing customer satisfaction by providing more flexible solutions and being environmentally friendly (Lu and Xu, 2015). Leasing and trade-in strategies have become increasingly successful in the automotive industry which begs the question if the same success can be created in the kitchen industry.

The two industries have some similarities, as an example: large purchase sizes, product is usually used for many years and the product is a central item in a home. Therefore the gratification desire can be viewed as similar in the kitchen industry as in the automobile industry which in turn also influences the consumer image created by the product.

Next step in this research project is to combine the information gathered in above sections, towards a BM. A BM is the plan for a successful operating business, identifying sources of revenue, customer basis and cost structures. According to Ausrød, Sinha and Widding designing a BM is the act of weaving interdependent activities together to gain a lucrative business (Ausrød, Sinha and Widding, 2017).

### **Business model containing CE in Kitchen manufacturing**

To be able to make a new business model that can handle the challenges connected with CE it is important to take the following key points into consideration.

- Getting the organization ready for CE
- Recycling loop for materials
- Design for x
- PSS
- Persuading the customer

### **The right organization for CE**

CE in the organization means that the whole company thinks within the realm of circular reuse of material. This means that the whole supply chain needs to be tailored to fit the theory. Therefore, it is necessary that a complete loop is created so all activities limiting the possible reuse of material is re-invented towards a more sustainable method. To enable this kind of feedback loops within the company requires an organizational structure where all employees feel confident in contributing knowledge to improving the process.

### **Recycling loop**

Getting the materials back to the company is an important task, which can be divided into two different categories. First, how to incorporate the old products into the new supply chain as raw material. And second how to reclaim the products from after the new business model, this can be done by service technicians visiting customers to replace parts.

### **Design for X**

The theory of design for x needs to be incorporated in order to create a well-functioning loop. New parts must incorporate the old interfaces used in prior produced parts in order to ensure reusing of discarded products. If the compatibility is not incorporated the recycle loop is broken and the CE is not complete.

### **The PSS for kitchens**

The product functions of a normal kitchen shall be replaced with a service that can satisfy the customer. In order for successful PSS the customer should not care if he buys a service solution or a physical product from the company. For this to work the PSS shall contain all the same aspects of buying a physical kitchen. Customers in general are more demanding when it comes to buying products than earlier. Which influences the PSS, due to the fact that customers need to perceive that they gain more from buying a PSS kitchen rather than a physical kitchen.

### **Persuading the customer**

From the automotive industry it is known that customers are likely to favor the cheapest solution with highest perceived value. Meaning that the customers gets a feeling of higher value from the service solution compared to the price they pay. Also, the service solution creates the feeling of being an easier task to undertake for the customer.

### **Financial**

The overall financial differences in the new BM can be divided into two categories, the first of them being the knowledge about the customers tending to buy larger/ more when they lease since the initial cost is lower. Also the monthly cost of ownership is lower due to the customers only paying for the depreciation over the term of the lease. Second the cost structure of the company needs to incorporate that the products are not sold therefore the company still owns the raw material. Which entails a rise in capital binding within the company.

In the last couple of sections, the BM parts have been presented. In the next section the theory will be converted into a BM. Starting with is a short introduction to the case company. This company have a functioning as is BM this will be used as an steppingstone to tailor a new BM using the theory.

### **Kvik**

Kvik A/S is a kitchen manufacturer with 140+ stores around Europe and Asia. The HQ is situated in Vildbjerg, Denmark which is also their production site. In Vildbjerg they produce most of the wood products used in their kitchens. They import cabinet doors and fronts from Italy through four external suppliers. "Accessories" such as handles, cutlery trays etc. are imported from china. All imported products are shipped to Vildbjerg wherefrom all orders are shipped to local stores.

Kvik is very customer oriented - they promote themselves on being Danish design for an affordable cost and spend many resources ensuring customer acquisition through marketing and new product launches. Their slogan is "everyone has the right to a cool kitchen", embedding both the cost and design strategy.

The research group has combined the reviewed theory with Kviks business and created a new BM for Kvik in order to visualize the possibilities of incorporating CE, see figure 4.

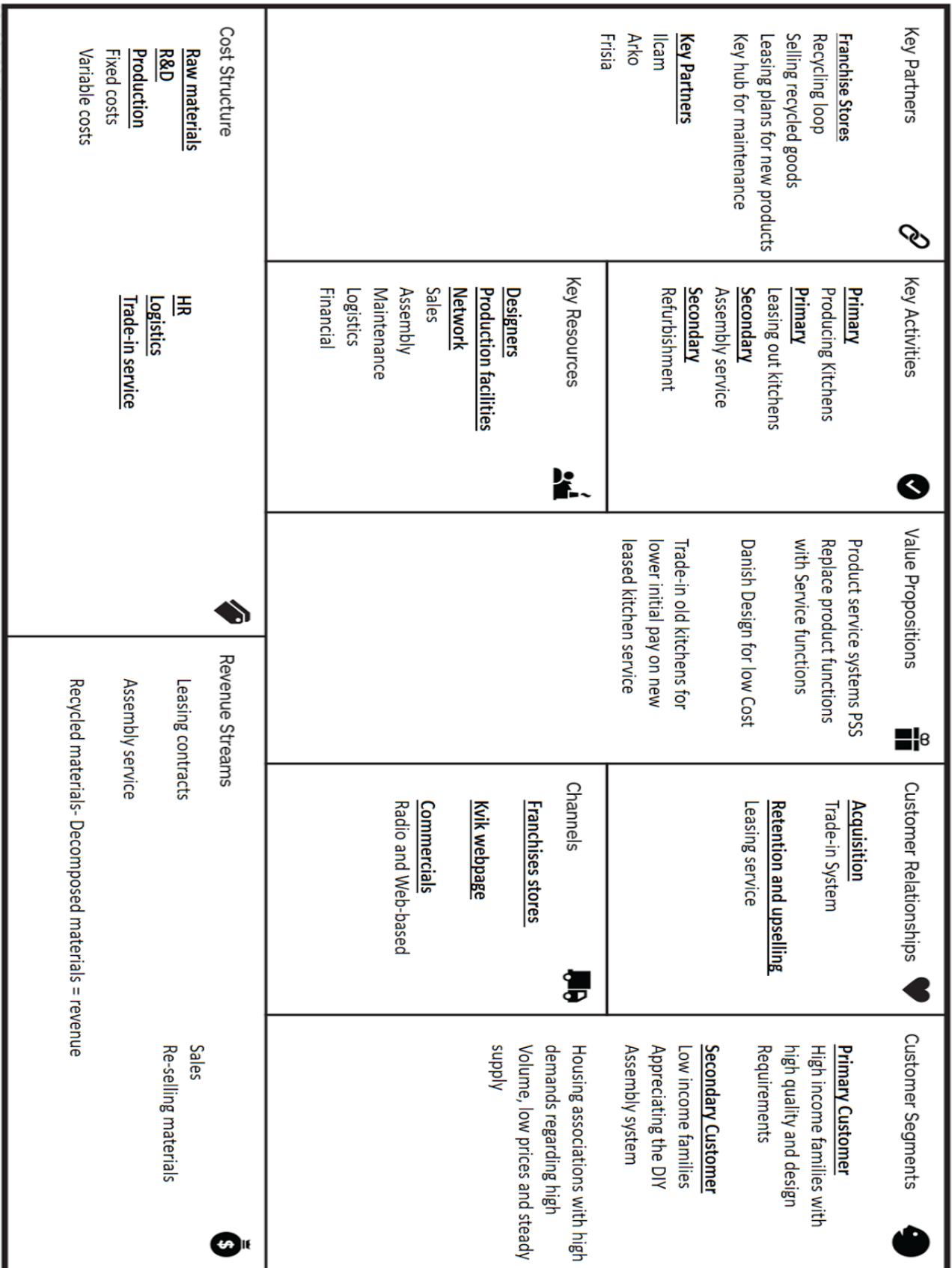


Figure 3: Business Model for leasing kitchen strategy within Kvik

From the business model shown above it can be seen that implementing CE can to some level coexist with the current way of doing business. This means that the implementation can happen in small incremental steps that will enable the organization to cope with the changes. One example could be the recycle loop that with incremental implementation can be scaled over time to cope with the recycling of materials instead of having to cope with the total amount of the whole

business from the beginning. The business model is partially going to incorporate the CE as shown in figure 5 from the perspective of Kvik A/S.

**Recycle loop**

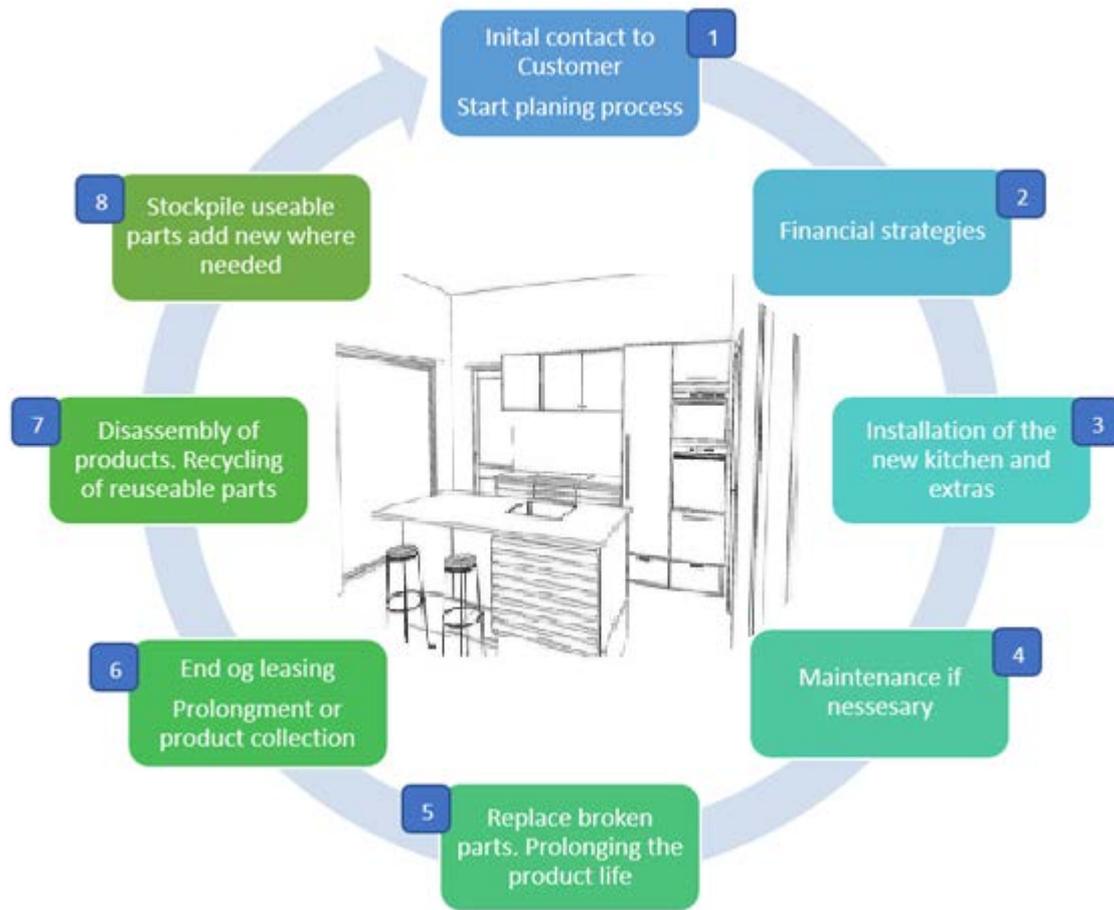


Figure 4 The proposed recycle loop for the new bm.

**Step 1**

A potential customer enters a Kvik store and a relationship is started with a salesperson in the store. The initial thoughts of the customer is presented and the sales person reacts on the information first by showing the customer different showrooms and next by sitting down with the customer and drawing a kitchen. In the drawing phase the customer chooses which products they want in their kitchen.

**The trade-in solution**

The Trade-in offer, is designed to make customers switch from their normal preferred kitchen provider to Kvik by offering them a base price for their old kitchen, also kitchens that do not fit the Kvik product platform. In a case where the product platforms match, the cabinets can be used as a part of the new service solution.

When the cabinets do not match the product platform, they are sold off to a key partner. From there they are either sold as used kitchen or dismantled to recover the raw material that then can be fed back into the supply chain. This strategy is also known in the automotive industry as a powerful persuader to get the customer to commit to buy.

**Step 2**

The customer is introduced to different methods of payment: cash, financing or leasing as seen in figure 3. The payment method does not dictate the customers' willingness to purchase, however it does influence the level of gratification the customer seeks. Being able to finance or lease a product heightens the ability for Kvik to upsell and thereby reach a higher gratification of the customer. If another financial model than leasing is chosen the CE cycle ends at this stage.

### **Step 3**

Step three is the installation of the PSS. This means the customer receives the service agreed upon by the customer and Kvik. The service includes the kitchen modules, alliances and extras that are withheld in the lease agreement installed in the house by installers working for the Kvik store.

### **Step 4**

During the leasing period the customer can call for service, if something is not satisfactory to the customer. An assessment will be made to figure out whether the error is caused by the product malfunction or the customer not treating the product properly.

### **Step 5**

If the maintenance team finds broken parts these are changed in order to prolong the lifetime of the kitchen.

### **Step 6**

When reaching the end of the leasing period a meeting is set up with the customer and the Kvik representant. The focus of the meeting is to figure out if the lease can be prolonged for a new period and perhaps which changes need to be made in order for it to happen. The contract is prolonged and the loop starts over again.

### **Step 7**

When the lease ends or the contract is terminated, the kitchen parts are collected. This process is completed by the installers from the Kvik store. They ensure the parts are disassembled in a manner that makes it possible to reuse the parts. All parts are shipped to the factory in Vildbjerg.

### **Step 8**

The parts from the dismantling process which directly can be used again, are stockpiled alongside new goods and the parts that are outdated or decomposed is recycled in the most suitable manor to get the most out of the raw material.

### **Kvik presentation**

The BM was presented to the managerial team at Kvik and in general they found the strategy interesting. The managerial team had previously discussed the necessity of CE as a company strategy and also discussed leasing as a possibility in their sales strategy - however they had not connected these two ideas into one. Especially the trade-in system was new to them. They knew of the strategy from other industries but had not thought it could be relevant for their type of business. Especially since every kitchen producer has their own individual platform. As an example Kvik works with XL and XXL cabinets which most of the other retailers do not. So Kvik posed the question: "What do we do if someone wants to buy our product using the trade-in system, but currently has a different retailers' kitchen"? In this situation we would see the possibility for Kvik to establish a new customer and thereby still encourage them to trade-in the "off brand" kitchen. Thereby creating an excellent customer relationship and by implementing Kviks own platform other retailers will have a difficult time "stealing" customers back - especially if Kvik nurtures their customer relationships.

Another question posed by the managers was what our expectations were for the competitors on the market. Would they follow in the same footprints or would they expect the leasing to not catch on? According to (Danmarks statistik, 2016) the financial leasing agreements across Denmark rose, for the second year in a row, with 7.5 % and contributing with a value of 42.3 billion DKK of the total credit amount approved by financing companies in Denmark. Leasing is a growing form of transaction and the trend does not seem to change at the moment.

Kvik has a unique opportunity to become first movers in the kitchen leasing market, and significantly increase their market share if they can create a customer relationship worth changing brands for.

### **Standard kitchen example**

The knowledge gained through previous sections give an idea of how the theory of leasing could work in an industry as Kviks. However, there is a need for understanding the tangible scale of what such a BM would bring to the business in the form of monetary flow, but also what it would mean to the entire world in a CE aspect.

Through interviews with the Operations Manager and one of the Product developers, each kitchen item was divided into three categories, Reusable (green), Refurbishment (yellow) and scrap (red) depending on the expected level of degradation after a 10-year installation; see table 1. Green represents the theoretical possibility of using 100% of the materials in each relevant category. Kvik evaluated the re-usable percentage to be 100%, but in reality some kitchens are more worn down than others, so in the further research the material usage is calculated to be 90%. The refurbishment is coded in yellow and is set to a reuse percentage of 50. The red category, scrap, is set to a reuse level of 0%.

Table 1: Kitchen parts divided into reusable categories

Kitchen parts	Reusable	Refurbishment	Scrap	Kitchen parts	Reusable	Refurbishment	Scrap
Cabinet		x		Countertop		x	
Front		x		Rubber matt	x		
Drawer tray	x			Oven			x
Drawer slides	x			Refrigerator			x
Faucet		x		Freezer			x
Sink	x			Cooktop			x
Plinth leg	x		x	Microwave oven			X
Cutlery tray	x		x	Extraction Mechanisms		x	
Garbage can	x						

To evaluate the possible saved amount of product, a standard kitchen is selected by the product development team. The kitchen chosen, seen in figure 6, reflects the typical combination of cabinets and items chosen by a customer when purchasing a new kitchen. Kvik estimates that they sell 36,000 kitchens a year.

#### Standard kitchen

The standard kitchen is depicted below.



Figure 6: Standard kitchen

The standard kitchen includes ten lower cabinets and two tall ones. Three of the lower cabinets each contain three drawers with a single front on each drawer. The kitchen has 20 fronts in total. Each drawer cabinet also includes a drawer tray and therefore 12 drawer slides are used. Each cabinet is placed on four plinth legs. There is one faucet, one sink, one cooktop, one oven, one microwave, one refrigerator and freezer. Small extra items such as two cutlery trays and three garbage cans with extraction mechanisms and ten rubber mats in the bottom of each cabinet. The kitchen has touch opening systems so no handles are used.

In the next section we will combine the knowledge of the standard kitchen and the leasing system to define the potential savings in product amount and CO<sub>2</sub> emissions.

## Calculation

In order to calculate the savings some assumptions have been made. Firstly, it has been chosen to rely on Kvik's estimate regarding annual market growth. The company uses 10% annual growth as their guideline. Secondly, from the standard kitchen example it has been stated that the green parts and the yellow parts can be reused. So, for this calculation the first estimates of green equal 90% reusability and yellow 50% reusability is utilized.

The savings is calculated over a ten-year period. This have been done using the following method. Year zero is the first year where the take back system is in order. From there it is estimated that an additional three years is required before the system is ready to incorporate the used parts as part of its production / service. Therefore, the first three years the company is only stockpiling reusable parts and not reselling them. From the third year onwards, it is estimated that 40 % of the kitchens sold will contain parts that are reused.

The same 60/40 percentage is used for the rest of a ten-year period.

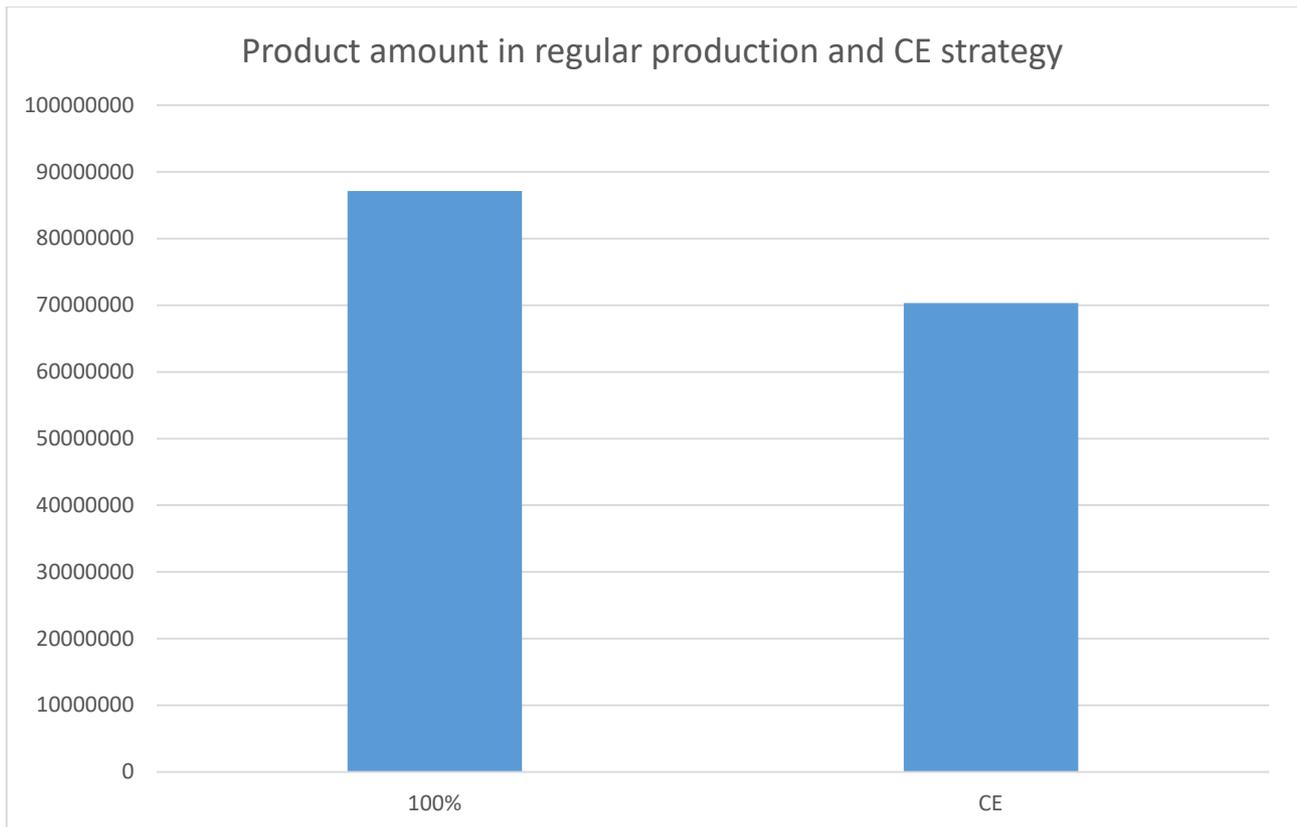


Figure 7: Product amount in case of regular production or with the use of CE

From the graph in figure 7, it can be seen that the total number of new products produced by and for Kvik is reduced from 87,106,826 pieces to 70,317,270 pieces over a ten-year period. In total a reduction of 19%.

Kvik on average receives 10 trucks with raw particle board and 3 trucks with cabinet fronts each week. The latter comes from northern Italy, while the particle board trucks are shipped from all over Europe with variations each week. In order to create a viable estimate regarding the climate impact through less transport by utilizing the CE strategy, an average of 1,600 km per cabinet front freight from Italy and an average of 500 km per freight particle board freight is selected (Frausing, 2018; Pedersen, 2018). Each truckload weighs between 23t and 28t (Frausing, 2018).

According to The European Chemical Industry Council (CEFIC, 2011) the CO<sub>2</sub> impact is calculated by:

- 50g CO<sub>2</sub> / tonne-km for truck freight.

## Front

The impact per shipment:

$$1,600 \text{ km} * 25.5\text{t} = 40,800 \text{ tkm}$$

$$50 * 40,800 = 2,040,000\text{g CO}_2$$

Which totals to 6,120,000g CO<sub>2</sub> per week.

By incorporating leasing as a BM and thereby only using 60 % new product the emissions per week could fall to 3,672,000g CO<sub>2</sub> per week.

**Particle board**

The impact per shipment:

$$500 \text{ km} * 25.5t = 12,750 \text{ tkm}$$

$$50 * 12,750 = 637,500 \text{ gCO}_2$$

Total of 6.375.000g CO<sub>2</sub> per week, which could be reduced to 3.825.000g CO<sub>2</sub> per week.

Combining the truck freight, the CO<sub>2</sub> emissions reach 12,495,000g CO<sub>2</sub>, also equivalent to 12,495kg CO<sub>2</sub> per week if continuing the same production strategy as of now. If Kvik decides to introduce CE, they can reduce their CO<sub>2</sub> emissions to 7,497kg per week. In figure 8, the impact of CO<sub>2</sub> over the next 10 years is shown. The first three years there is no reduction due to implementation of the CE strategy.

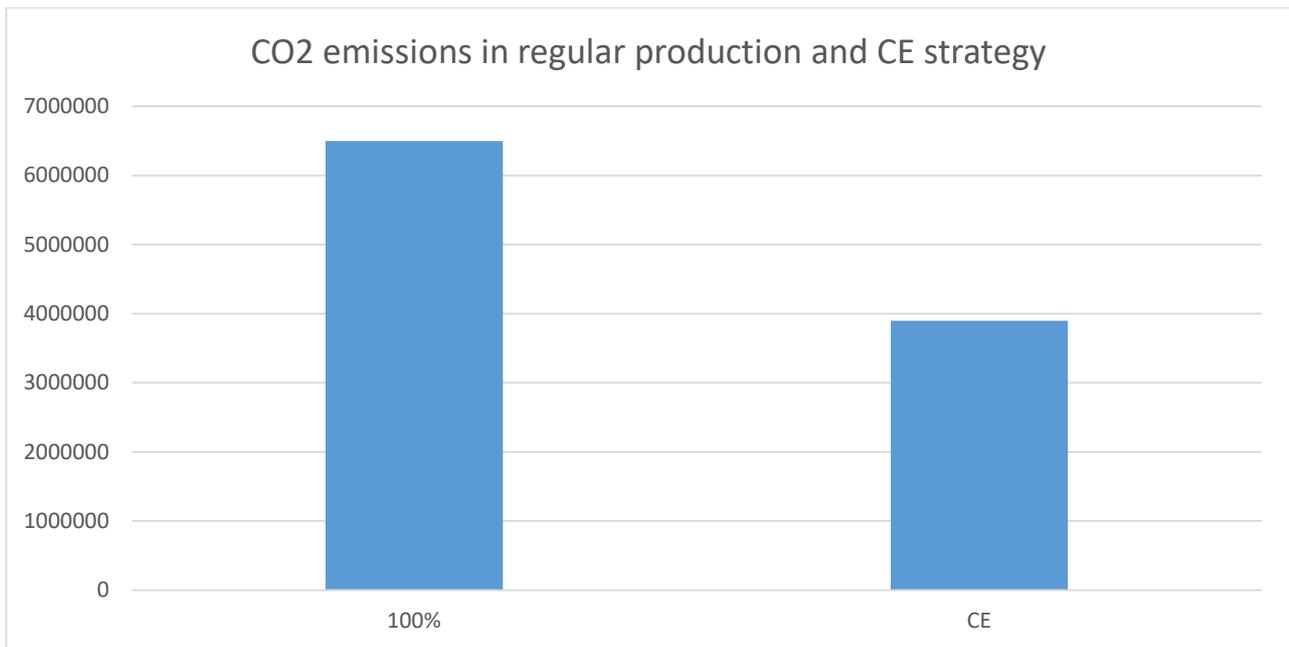


Figure 8: CO<sub>2</sub> emissions through regular production and CE

Over a ten-year period Kvik will currently create 6,497,400kg CO<sub>2</sub> emissions through trucking freight (only inbound), by using the CE strategy mentioned in this article they can reduce that impact to 3,898,440kg CO<sub>2</sub> which amounts to a reduction of 40%.

**Discussion**

The theory in CE is not new but has been proposed before, in different forms. From the time when people realized that raw materials could be used up and until now, different theories have arisen to avoid depletion of materials. The most effective theory has been to minimize waste. Since people do not change their lifestyle the usage of raw material is still rising. Manufacturing has gone from mass production to mass customization as a reaction to the higher demands from the customers. And yet the customers are still more demanding and consuming than ever. This could be the reason for believing that the time has come to embrace the notion about CE.

The theory's closed loops support materials being recycled instead of being sent to energy recovery or disposal. To drive the high consumer demands further the thoughts behind PSS could lead the way for short product life cycles to decouple with the high material usage, since the PSS evolves around leasing of a service instead of buying a product. The impact of the overconsumption mentality will not have such a large impact on the environment, if companies using PSS design their products for reusability.

The proposed business model in this study is based on the business model canvas, and describes the different dimensions within the business model, but it offers little understanding regarding the relations between the different dimensions. This might have an influence when presenting the business model since the reader might interpret the relations differently than intended. This fact might have influenced the Kvik case since the lack of relations might have given the readers different understandings. A different model with more focus on relations might have created another result. The lack of financial

angles in the study might alter the business model if pursued, this needs to be addressed by the case company in order to make sure that the BM is worth pursuing. The long timeframe of the implementation can cause the focus to be changed while still working towards the goal of a complete CE loop.

It is important to understand that regarding the CO<sub>2</sub> calculation, only the inbound freight was incorporated into the calculation. The complete emissions calculation should include the outbound logistics, which might give a completely different end result.

The unanswered questions within the business model might have an impact on the use of the BM by other companies. But the answers might not even be useful since the companies in the industry are not bound on the same principles.

## Conclusion

The intention with this research was to look at the theory behind CE and manufacturing to see if it was possible to use circular thinking within the area of manufacturing. It was found to be plausible since the automotive industry has adopted leasing into their business models. Along with the thoughts about PSS this means that the customers buy a service rather than a product.

From this the work continued to analyze whether the same could be concluded within the realm of kitchen manufacturing. It has been found that it is possible to introduce the theory of CE into the realm of kitchen production, although it has to be in the form of small incremental steps in order for the organization to change its behavior. Also customers have to somewhat adopt to the new way of thinking like it has been seen within the automotive industry. This means that the new business model has to coexist with the old. This will allow for some customers to buy kitchens as a product while others buy a service that contains the functions of a kitchen, limited to a certain time plan.

The research was concluded by a calculation of the lowered amount of new products needed to be produced and the lessened CO<sub>2</sub> emissions (on in-bound logistics) if Kvik decided to introduce CE as part of their business strategy. It was found that Kvik could reduce their production with 19% and their CO<sub>2</sub> emissions through in-bound logistics could be reduced by 40%.

## Suggestions for further research

Researchers wanting to dig further into this subject might want to look into the financial aspect of the business model. How can a kitchen manufacturer ensure that implementing CE is financially viable? There will most likely be a timeframe in which the new strategy is costing money so when would it be expected to turn around?

Another issue is the logistics; will the return of products decrease the sustainability of the business model due to transportation. There might be an interesting Life Cycle Assessment project in regards to the new loop (as seen in figure 5).

Also creating an implementation strategy for the new business model in collaboration with Kvik or another similar company. Since such an implementation has not been done before in the kitchen industry there might be unforeseen challenges in need of being addressed.

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