UNIVERSITY OF
SOUTHERN DENMARK

PROJECT 2

NAME

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THE PROJECT

The ergonomic bycicle handle

Executive Summary

We were ask to make a business case exploring an technical idea of our own choice. This report will cover the development of a product with the intention to help people with rheumatoid arthritis (RA) regain their independence.

Mission

We want to help people with arthritis back on the bike through a price-effective, ergonomic and non-stigmatizing bicycle handle.

Our solution

A bicycle handlebar designed to relieve joints, increase control, and avoid the need for grip strength.

In this way we will overcome people's fear of using a bicycle.

The market

The market has shown a need for equipment to help people regain their freedom and independence in case they get a mobility disability - such as RA.
We chose to focus on transportation and bicycling. And potential customers have shown interest in the product.

Competitive advantages

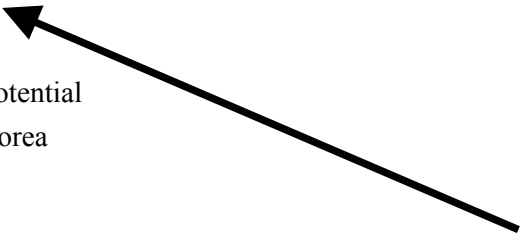
The market contains various solutions, but this product intends hit a sweet spot by focusing on a non-stigmatizing and price-effective design. Future customers will through our solution get: Increased mental and physical health | Reduction of social isolation | Reduced dependence on public care. So they can get a feeling of: freedom and independence.

Financial projection

Based on the actual cost - in the budget - it is estimated that the product should cost 600, which means we gain a profit of 40% pr. sale. The sales goal is set to be 5600 sales - (5.600*600 DKK =3.360.00 DKK). Through a sales forecast we have estimated a return of investment within the first year. More specifically, this means selling 80 products.

Conclusion

Based on the research and analytics of various of sources, the product seem to make a profitable business and solve the overall problem.



Dokumentation of participating and presenting at a business contest

Introduction

"*Arthritis pain affects millions of people worldwide yet we still have only a limited understanding of what makes our joints ache. According to a recent report released by the World Health Organization, musculoskeletal disorders are the most frequent cause of disability in the modern world, and the prevalence of these diseases is rising at an alarming rate. The most prominent reason for loss of joint mobility and function is chronic or episodic pain, which leads to psychological distress and impaired quality of life*." [1]

In article [3] it is discovered that "*Patients with rheumatoid arthritis perceive reduced quality of life in several domains, such as physical health, level of independence, environment and personal beliefs, compared with the healthy population. There is an increasing interest in quality of life in clinical and medical interventions*."

Another research paper [4] describes how "*An estimated 42.7 million Americans (15% of the population) had some form of arthritis in 1995 and, due to the increasing average age of the population, this total is expected to rise to 59.4 million (18.2%) by the year 2020*"…."*The estimated total economic cost to the United States of arthritis is over $65 billion annually. Although the medical and economic consequences of arthritis are of great concern to researchers and clinicians, this disease also affects an individual's capacity to live a full and active life. Thus, it has increasingly become clear that the problems associated with arthritis are not simply medical ones; it also appears to have a substantial impact on a person's functional capacity and quality of life.*"

"*There are more than hundred types of arthritis*"[1] but this report will be focusing on heightening the life quality for patients with arthritis in the hands. Hands is a crucial tool in order to excutive an everyday task - for example ride a bike. And this biking issue will be investigated and solved through the report.

[1] https://www.arthritis.org/living-with-arthritis/pain-management/understanding/types-of-pain.php

Scope

The arthritis association works with four main goals:

- Fewer sufferers - to reduce the number of people in society who are suffering from pain
- **Better life - an increased quality of life for arthritis-affected Danes**
- More knowledge - support for research in prevention, treatment and healing
- **More options - Provide patients with self-help tools**

This project will focus on the two points outlined with bold text. There will in this project not be provided any new knowledge of arthritis, how to prevent -or treat the disease. Instead, the contribution will result in a self-help tool that will increase the quality of life for arthritis-affected people.[6][7]

In collaboration with arthritis patients and a dialog with “the arthritis association” a problem formulation was formed and it involved bicycling. A privilege people with arthritis don't have.

Problem formulation

For people with a disability, cycling has become one activity that belongs to the past. This is due to:

1. Reduced muscle strength.
2. Bad balance ability.
3. Pain in local load of joints.

Which will result in a fear of riding a bike.

Cycling for these people is not just a matter of health and freedom of movement, but a matter of building independence and self-confidence. Being able to move around on their own, without being dependent on the help of others, is very important to these people.

Else Leonard Lund, suffering from abdominal and rheumatoid arthritis:
"I've had to give up a lot of things because of the arthritis, for example, I almost never ride a bike any more because I can not handle my steering wheel properly and if i fall it is hard to get up again. It makes me a bit sad , since the bicycle culture is so much a part of being dane "

Research question

- What is currently done within this market category; bicycle equipment?
- How can we build a competitive solution?
- Can we sell it - and how?

Formalities

The report is build upon primary and secondary sources that has been obtained through desk research, observations and interviews. As a reader you will be presented with relevant findings from the data. The general approach throughout the report is iterative process, which concerns a development in close contact with relevant stakeholders (users, customers, etc). We will make use of lean canvas and minimal viable products (MVP s) to quickly test hypothesis and thereby hopefully execute an efficient and cost-effective development process.

Market research

The following section will provide an overview of the subject and create a describe chapter concerning relevant information regarding arthritis in relation to biking and the market in general.

Basic Research

Grip and arthritis

Let's take a look at the basic issue of riding a bike with arthritis. Grip strength. What is really meant by this statement and why is it crucial in relation to bicycling? Grip strength is stated to be [8]: "*...the amount of force one is able to generate when grabbing something. There are various ways to test grip strength*." In a study described in [8] "*researchers used an electronic gadget called Grippit, a hand dynamometer, which you squeeze. The gadget has a gauge that records the force of the squeeze*." furthermore it is stated that: "*When someone has trouble bending their fingers because they don't have full range of motion (ROM), they'll have a harder time getting any force behind [their grip], and hence record a lower score,*" (Mary Ann Wilmarth, a doctor of physical therapy).

The article [8] also discuss the general use of hands and the importance of relaxation. "*Your hands rarely get a break...*" … "*To give them a bit of a break, when you're feeling weak or are in flare, be sure to use assistive devices so you avoid further weakening or injuring the joints.* "*There are so many [aids] you can buy that can take stress off your hands, Wilmarth says. Be sure to use them when you're not strong enough*." [8]

Another article [9] looks into Rheumatoid arthritis (RA) in relation to grip in general and states that: "*Rheumatoid arthritis (RA) is a systemic inflammatory disease with a particular predilection for causing pain, deformity and functional limitation affecting the hands.*".

Take aways:

- The product should not depend on grip strength.
- The product should allow the users to relax their fingers while riding.
- We should look deeper into the true meaning of pain and what the functional limitations are, through interviews and tests.

Biking with arthritis

Looking into the aspect of fear, and the importance of independence and freedom we found a article from [healthcentral.com] discussing how a RA patient experienced this exact situation and how it affected the family: "*We all have activities we enjoy doing in life and when rheumatoid arthritis comes knocking at our door, there is a huge fear of it taking away those very activities that we love. For me, bike riding is the thing I love doing. During the worst of times with my rheumatoid arthritis, I was willing to give up a lot of other things, but not my bike riding. I tried riding when my knees were swollen and sore, I tried riding when my fingers could barely grasp the brakes, and I rode when my shoulders were stiff and hollered in pain. Why? It was just one thing I could not give up easily.*

However, a time came when the bike didn't make it out of the garage all summer and my son became my husband's regular biking companion instead of me. I was glad it was my son, but it still hurt to accept that an activity my husband and I had enjoyed together even before kids was no longer a reality for me."[10]

Take away:

- The solution will have more than a physical value to the users. It will have just as much mental value.
- The fear is about more than just the a concern of riding a bike. It is about giving up on the "life they know" and how they should handle this new situation.
- We should look deeper into how this fear can be reduce and what will get them back on the bike.

Customer investigation

Based upon the basic research, some questions were raised and some information - crucial to the development - somehow seemed missing. This gap will be covered by interviews. The questions to be answered is:

- What is really meant by pain and what is causing it?
- What are the functional limitations while using hands?
- What is fear to them?

This was done in order to reach a satisfying problem-solution fit.

Two arthritis patients were interviewed - face2face - to get a perspective upon the questions. Both of the interviewees expressed a fear of biking as they dont have control of the bike. They are not capable of maneuvering their “old” bike, due to pain. This pain is released when they put stress on the fingers. This results in a limitation of using the break, gears and generally having a solid grip on the handlebar.

They furthermore explained about the alternatives that would make them capable of riding a bike again. But, there was some problems:

- They had to invest a lot of money in a new alternative.
- They also told that the alternatives to the “standard bike” are quite stigmatising. (Arthritis is “invisible”, so people did not seem to enjoy driving around town on a three-wheeled bike as it send some mixed signals in relation to their social status.)

The main takeaways from the interview was;

Ergonomic: People expressed a fear of riding a bike as they could not control the bike, due to physical limitations.

Price-effective: They can't afford or don't want to spend a lot of money on a new “bike” when they already have one.

Non-stigmatizing: People don´t want to feel socially isolated and the current solutions - except for the electrical bike - make people feel like outliers.

All features that can be built into the solution.

The interviews provided a deeper understanding of the issues and helped cover the gaps from the basic research. Both the basic research and interviews gave the project a foundation that will make it easier to investigate competitors and explore concepts throughout the process. The knowledge obtained through this section will later be used to bring value to the customers.

Competitive market

Based on the alternatives expressed in the interviews we did a competitor analysis. This was done to locate potential threads and analyse competitive operations in order to differentiate our product on the market.

The biggest competitors on the market (based on the interviews) are basically manifested in three ways:

Three wheeler: This product is working within a ergonomic field. The bike is comfortable for people to use, as it fulfill all the requirements in relation to handling a bike without fear. It is price-effective and ergonomic, but stigmatizing. People feel a bit social exposed using this solution.

Recumbent: This bike is a bit unorthodox. It is a different way of bicycling. This will make it easier for people to control the bike if they have arthritis, but it is expensive and stigmatizing. And it is hard to find a parking spot for the bike like this.

Electrical bicycle: This bike is popular at moment. Not only disable people use this bike - it is for everybody. But it has a lack of ergonomy. It does not solve problems for people arthritis, the same way as the three wheeler or recumbent. It is expensive as well and makes it hard for people to effort it.

A brief overview of the solutions:

Regular bike with a electrical motor to ease biking[12]

Strengths: Non-stigmatizing, ≈ ergonomic.	**Weakness:** high-end cost,

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Bike for lying down to remove stress in hand and back [13]

Strengths: Ergonomic, secure	**Weakness:** stigmatizing, high-end cost

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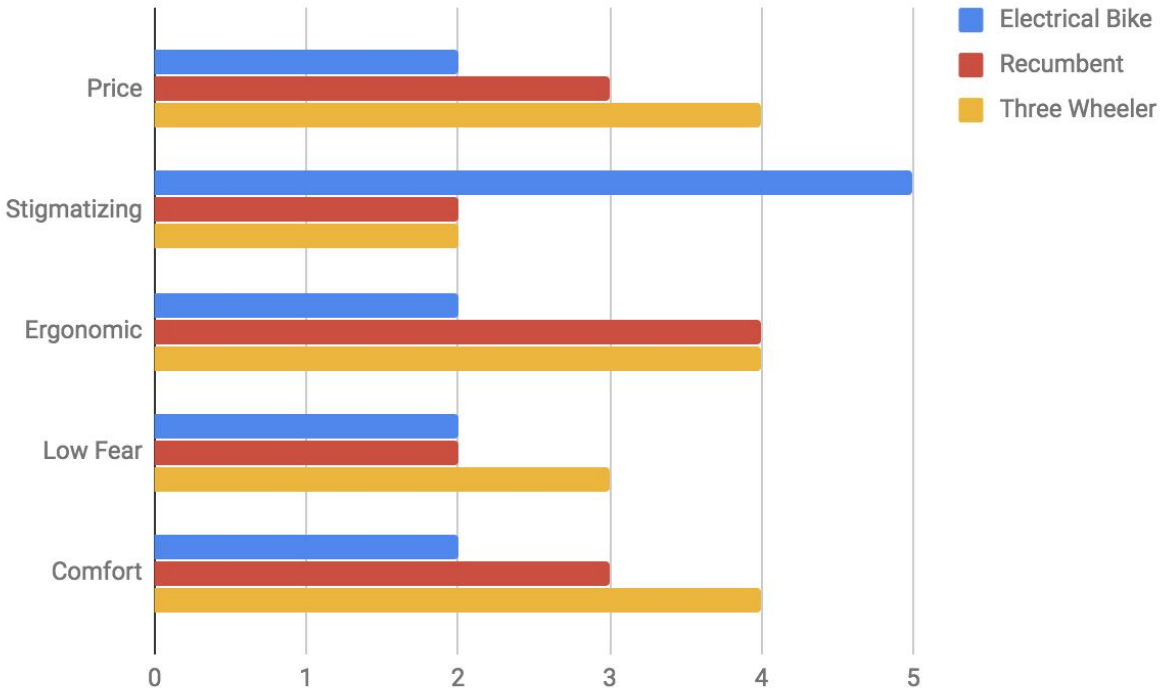
Three-wheeler for improved balance capabilities [14]

Strengths: Ergonomic, secure, low cost	**Weakness:** stigmatizing

Benchmark



By doing a benchmark of the solutions expressed in the interviews we got a overview of the competitive solutions and generated a brief idea of how to differentiate our solution. To get a better understanding we will provide an analysis of the competitors in the next section. This will help to locate the strengths and weaknesses.

Swot analysis

To get a more detailed overview of how these exact features affect the solution a SWOT analysis was executed this would provide an idea of what to look out for and how to deal with aspect of alternatives technologies which may not have been revealed in the interview or the benchmark.

El-Bike [11]

Strengths: - *You won't struggle pedaling* - *You will look like any other person in the traffic*	Opportunities: - *The bicycle can be provided with new handles and components enabling people to ride more ergonomically*
Weakness: - *it's expensive* - *it cause stress in hands* - *You have to carry a battery around*	Threads: - *People can get hurt due to speed and low control*

Recumbent [12]

Strengths: - *it is ergonomic in many aspects*	Opportunities: - *Get a around town on your own*
Weakness: - *It is not like "bicycling as we know it"* - *People need to practise a new form of bicycling*	Threads: - *To radical design change to make people use it* - *It will make people feel socially awkward*

Three wheeler [13]

Strengths: - comfortable to ride for many segments - price-effective	Opportunities: - You can ride it right away and will have no stress on your fingers
Weakness: - hard to get around and park - it is stigmatizing	Threads: - to radical design change to make people use it

The takeaways from the SWOT is basically to keep the product simple. The design changes that occur to radical communicates a negative message - which was described as stigmatizing by the interviewed.

Indirect competitors

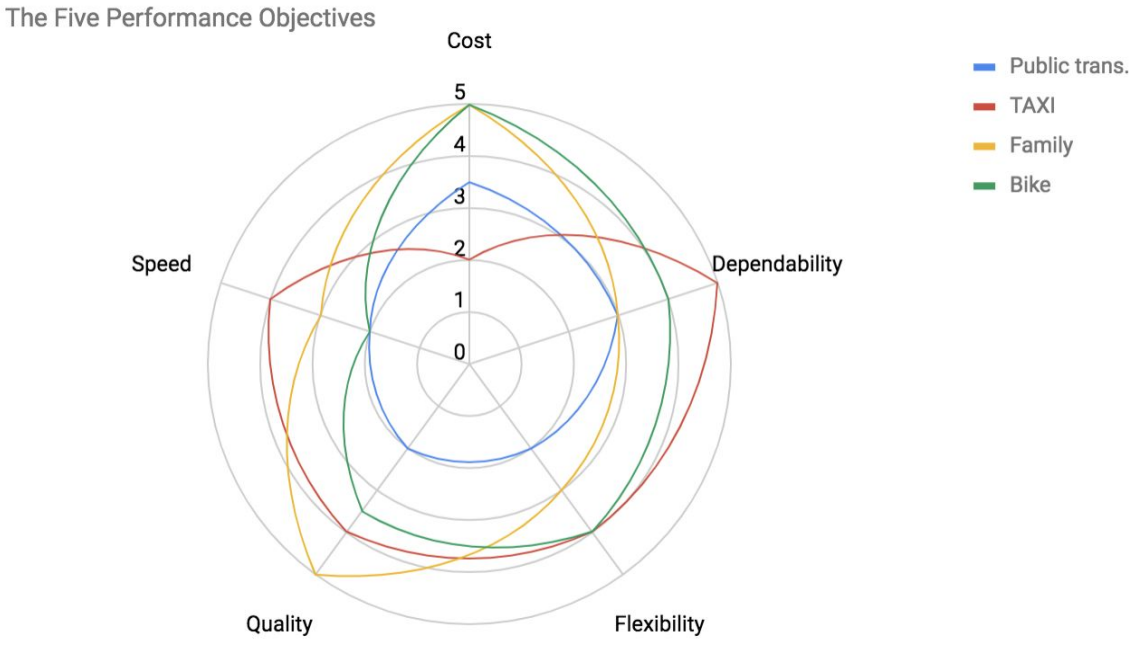
To get a deeper insight into the competitive market we decided to take a look at the indirect competitors. This could be interrelated solutions somehow solving the same customer needs.

This resulted in the finding of:

- Public transportation: people can take the bus/train and get around town by them self.
- Taxa: people can call for a driver to get them wherever they want.
- Family and friends: People can get help from people near to them.

In comparison to biking they all had some characteristics that we should be aware of in the development of the new solution. To specify these differences we used “The five performance objectives”[14]. This seemed as a great tool to investigate the alternative solutions through: quality, speed, dependability, flexibility, and cost, which allows us to draw attention to areas within the performance of a solution and how to deal with it both internally and externally.

The results of each alternative is illustrated in the radar-diagram below:



Looking at the TFPO it is clear that the bike have some strength and weaknesses compared to the other alternatives. In general it has a great score, but let´s analyse the results.

+ Cost: The long term cost of using your bike is far cheaper than, using a taxi, bus, etc.

+ Dependability: If you are taking care of your bike it is a dependable tool. It can be used whenever you want to leave the house. You can't always count on a family member to pick you up or hope for the bus to drive.

+ Flexibility: You can go where you want without waiting for anything. you are not dependent on where the bus will stop and if you can reach your destination.

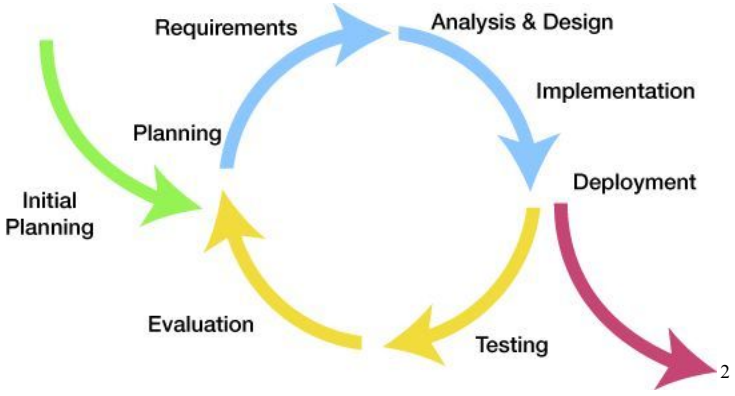
- Quality: in this case quality is defined as comfort. It is more comfortable getting a taxi to get you around, but there is also some quality in relation to a bike ride.

- Speed: It is not always the most quick way to get from A to B, even though it has proved itself to be faster in some cases it is.

Takeaways will be to focus on cost, dependability and flexibility - and be aware of the quality and speed in other solutions.

Concept development

Based on the knowledge gathered in the previous section we decided to go with a iterative design process that would include fast prototyping and close contact to the users. Therefor we started building some solutions on the behalf of the understand we had of the results from the market research.



[2]

The iterative process illustrated above will be a central tool used in the development process.

Proof of Concept

To sell the idea and reach a proof of concept, we started building the first prototype and presented the solution to some potential customers. The prototype was a rough implementation of the knowledge obtained through the market research. This was done to quickly get a understanding of rather or not we fundamentally understood the needs expressed in the previous section. The first prototype is shown on the picture to your right - as well as the first test person.

[2] https://curtisbacon.wordpress.com/2014/10/12/design-iteration/

The prototype was shown to Vivi Nobel and thereby the first iteration started. The design was evaluated and the learning was implemented into the next prototype until the design reached a satisfying level. By showing the first prototype we got a great identification of the concepts ability to perform in the market. The feedback was:

Vivi Nobel, head of the city Nord for the arthritis association.
"It was a great experience to be able to ride again! I have not cycled for 20 years."

Based on the feedback we felt confident about the ergonomic aspect of the bike as Vivi did not feel pain and could control the bike fearfully. This led to various of design that should help overcome the next design aspect: non-stigmatizing and price effective.

Prototype

As the development of various of physical products would require lots of time and resources we decided to bring the product to live through CAD drawings. These drawings were still managed through the iterative design process until we reached a design somehow close to the the final product.

In the picture below you will be presented with some of the designs that was run through the iterative process in order to reach the final product.

Every product received valuable feedback from the users. This led to an interesting design phase and the product took many shapes through the process. But, in the end we came to a conclusion. A satisfying design which seemed to satisfy the users - and possible to manufacture.

To elaborate on the design we decided to make a physical prototype and test the concept. This was done in collaboration with an expert -within ergonomy- and together we ran some tests.

In the picture bellow you will see an illustration of the first physical prototype. (we forgot to take a picture, that is why you are looking at a 3D model).

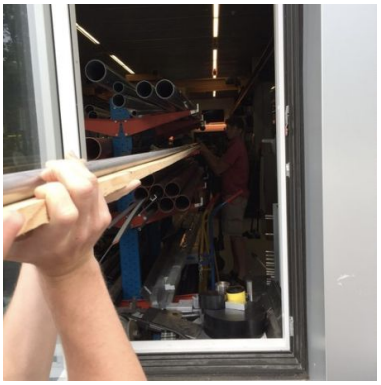
This prototype proved itself to have an ergonomic effect on the grip (hands in general), but the handlebar was to far away, which caused stress on the back and generally discomfort. And now, to the reason we did not get a picture. After a few test runs the product broke. This also caused the next design to be strengthened. And therefore we went back to make some adjustments: Bring the handlebar closer to the body & Strengthen the design.

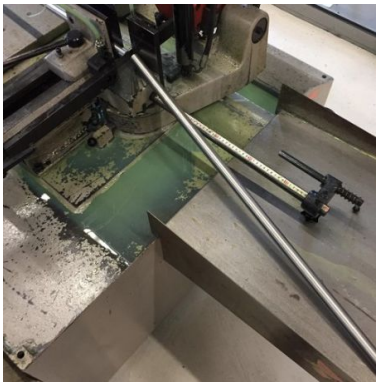
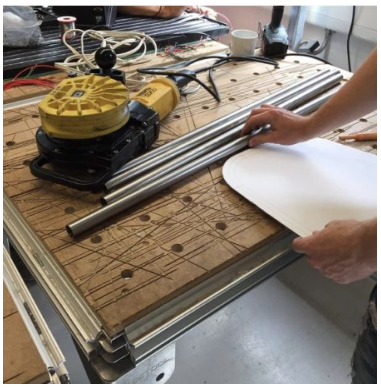
Prototype 2.

Based on the evaluation we sat down and drew a new concept that would solve the issues. We made the design more robust and even more feasible to manufacture. The handlebar came closer to the body. And we expanded the armpad to make it even more comfortable.
Now it was time to put the new design to the test.

Manufacturing of Prototype

And so it began. The production of the prototype two.







Pictures sometimes says more than a 1000 words. The whole product could be made at DTU. We could freely use the workshop at DTU and thereby produce a couple of products for free.

Testing - Folkemødet 2018

As Skylab (the entrepreneurial department at DTU) saw the product we were invited to be one of four products to represent the opening of “the tech tent” at folkemødet 2018. A opening that involved four universities (SDU, DTU, AAU, AU) to present their answer to a future technology. This was considered a great opportunity, as we could test the new product and get free promotion. Therefor we accepted the offer.

On folkemødet 2018 we met a lot of potential customers and we discovered a new perspective to the business. Several elderly people came to try the product and wanted to

discover the value of an ergonomic bicycle handlebar. This segment did not ask for a product to help them release stress in their hands due to arthritis. They were looking for comfort. Some of these people where bicking 10-20 km a day but the ordinary handlebar made it hard to relax.

This opened our eyes to a new market and we started looking into the feedback and thought we had to do some thinking in relation to the business model - as it went from a “special product” to something that had value for average elderly people.

The product survived the testing phase and users was satisfied with the experience. Many people showed interest and we got in contact with influential people that would help launch the product.

Gains from folkemødet:

We got in contact with the arthritis association and other relevant institutions in order to distribute the product to our segment in a trustworthy and price effective way.

We found a new segment that showed great interest in the product. Therefor we felt ready to look into the business model more specifically. As this new segment generated an opportunity to use new sales channels - but also cause the manufacturing to scale rapidly.

Based on the results we decided to look at the final product, reach a satisfying business model and investigate manufacturing opportunity.

Final Product

The solution:

A bicycle handle designed to relieve joints, increase control, and avoid the need for grip strength.

The bicycle handle is used by resting the arms in two rails, rather than seizing a normal steering wheel.

1. The rails distribute the pressure on the arms, eliminating local loads that can cause pain.
2. Do not use gripping force to hold the board to accommodate the user's reduced muscle strength.
3. With the arms resting in the rails, there is a larger interface between the user and the bike, which gives increased control.

In this way we will overcome people's fear of moving on the bike. And reach a competitive advantage.

Manufacturing

As the demand and the sales forecast is within a fair amount of products, the production of the products will be executed in the same manner as the first prototype. But, we can not use the free facilities at DTU forever and therefore we went looking for a opportunity to do it out-house and see what the cost would be.

Lets quickly run through the production to get an idea of the what the costs involve:

First of all we had to order some steel pipes in order to get the materials required, to start a production. These pipes where then cut into two pieces: main part and support pin. The main part where bended into a U-shape. Then the arm pads and support stick where fastend and the product was ready to be painted. When the paint was dry the griptape were added and the product were done. Ready to be mounted on a bike.

Manufacturing Cost

Material/Service	**Reference**	**Price**	**Unit Price**
Metal pipe	https://www.lavprisvvs.dk/VVS-Roer-Fittings-Metalroer-Fittings-Galvaniserede-Roer-Fittings--Galvaniseret-1-2-roer-paa-6-meter-183938.html	139 DKK pr. 6 m	Pr. unit: 23,3%*139 DKK= 32,43 dKK
Cutting Bending Shaping arm pads Welding	≈5 min ≈10 min ≈20 min ≈20 min (≈55 min)	Blacksmith - 1 hour labour = 186 DKK https://www.jobindex.dk/tjek-din-loen/smed-svejser?lang=da	Pr. unit 186 DKK

foam	https://www.billig-fitness.dk/collections/yogamaatte/products/tpe-yogamatte-6-mm-sort	249 DKK	Pr. unit 249DKK/7 pairs = 35,7 DKK
griptape	https://speedline.dk/griptape-3m-5-1x100cm-s-l-sa180112	99,95 DKK	Pr. unit 99,5 DKK
Paint	https://www.castellas.dk/vi-tilbyder/pulverlakering.aspx	75 DKK	Pr. unit 75 DKK
Total cost (Pr. unit)			**428,63 DKK**

The total cost will in time be lowered as we have deliver small quantities and have no “good” partners yet. We buy all material at “normal” market price.

Future perspective

This might not be relevant at the moment, but some thoughts of the future perspective in relation to manufacturing is: Get in touch with a manufacture that will make possible to produce 250+ units, bring down the cost pr. unit and optimize the quality.

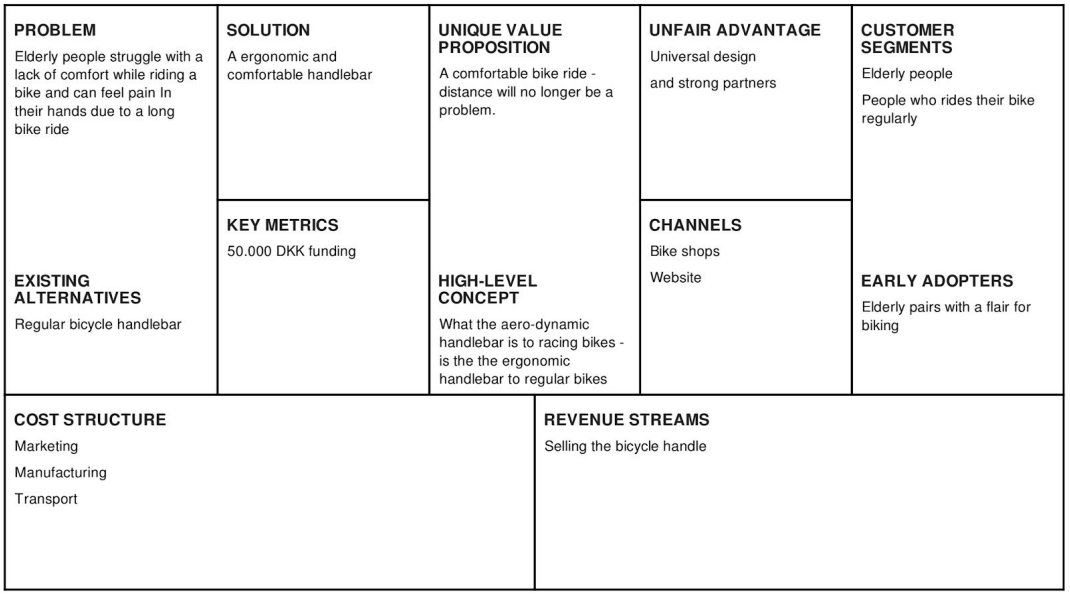
On this journey we got in contact with a guy located in copenhagen specialized in cobber. His son has a manufacturing business in poland producing metal parts. And this manufacture will soon be contacted in order to get a estimate of the production cost.

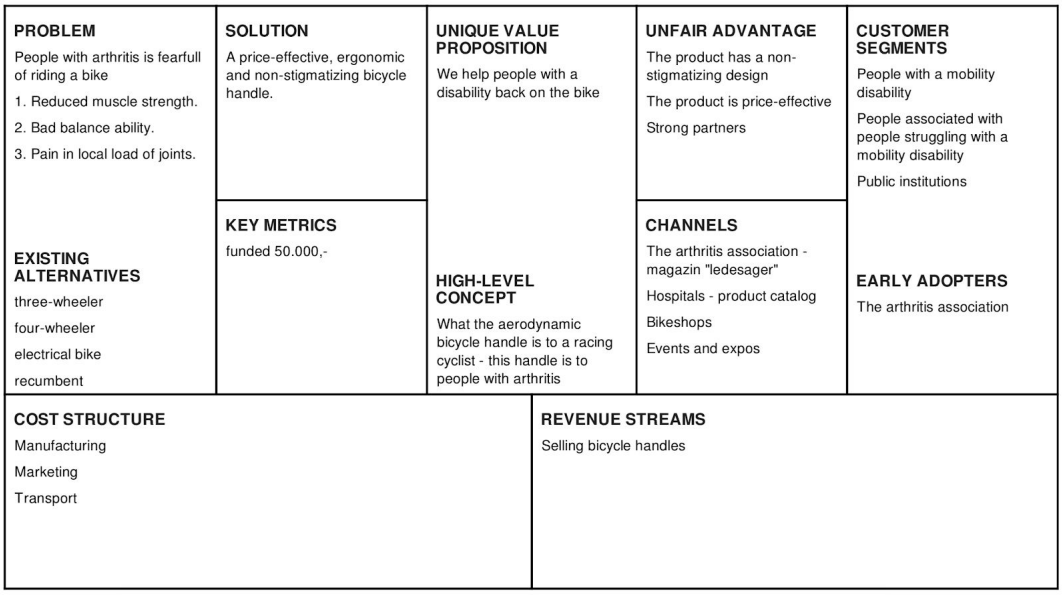
An opportunity that can be considered in the business model.

Business model

In this section we will look into the business perspective of the product and make sure to cover all aspect of the variables involved. Even though we have a confirmation from potential customers, this section will hopefully uncover a business model that will describe how we can generate profit and navigate within the operation.

To do that we will use; lean canvas (x2) . (1) for arthritis and (2) for elderly.





Both of the business models operates in a pretty similar manner - still with some differences in: channels, customer segments & early adopters.

A great part of the variables has been covered through the report, but we still have some uncertainties that should be investigated. These uncertainties is; IPR, Funding, marketing & finance.

The following sections will go into the different parts and uncover what should be done and what to be aware of in this area.

IPR (Provisional Patent Application)

As we kept showing the product at various events and different people we got an advice to look into IPR to protect the idea. Therefor we filled a PPA to protect the idea.

A Patent (application) in this manner is:
”

- *A guard against being copied*
- *An item to trade with, namely your IP right*
- *A better negotiating position if you intend to sell your idea or product.*
- *The value of your product will be higher when you have your rights in order*

“

[17]

This helped the product to move freely in a competitive market without the fear of being copied. How the PPA look like and what documents that were attached can be found in “*Appendix - IPR”*.

Funding

To fund the business we started looking into a funding strategy. This strategy would be executed to ensure the commercial goals. The strategy involves financing the business through four things: university, business competition, strategic alliances & pre-sale.

(Small) business competition & University: To fulfil the requirement of PRO2 and participation in a business competition and pitch the idea in front of a panel, the idea was submitted to: ignite (DTU) and Bevica Foundation.

By sending an application to Ignite (DTU) it would be possible to accelerate the startup and educate the team. The Ignite program would help the team obtain a better understanding of the business through relevant courses. And provide professional manufacturing facilities.

We were admitted to the program and Ignite provided an opportunity for the team to apply a fund concerned with products solving disability problems. Again the team sent a application; asking for start capital. The Bevica Foundation provided the team with a price of 50.000 DKK which could kick start new initiatives.

(See Appendix - Funding)

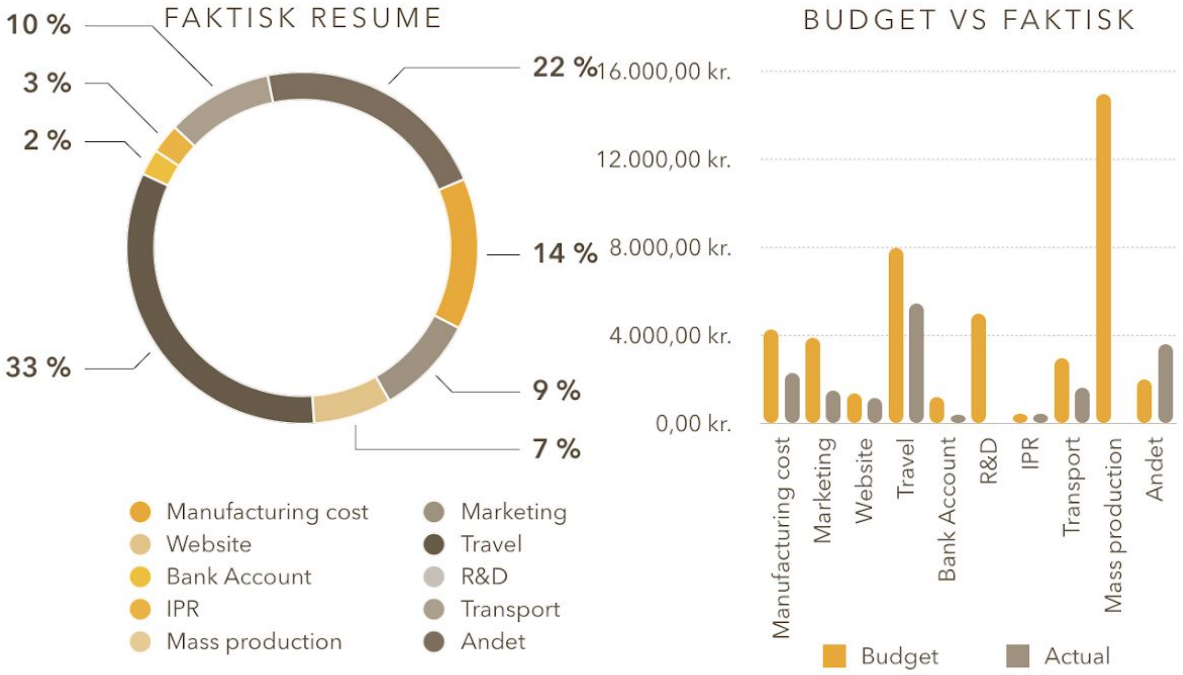
Strategic alliances: Covering the weakness of trust towards customers relations and sales skill in the team, we discovered the advantages of joining a strategic alliances. A relationship that somehow could benefit both parties. The first partner that helped developing the product and showed it self to be a great partner toward both R&D and marketing was “Gigtforeningen”. This partner will soon be handed a example of the final product and hopefully sell through their webshop. This is a way for the foundation to tighten the life quality of their members and a way for us to reach our customers. [19]

Run a pre-sale: To run a test and do an alternative “proof of sales”, the product will be launched on a pre-sale website to prove the attraction of customers and test a conversion of sales before the manufacturing of further products. This will also a be used to finance the production and provide future customer with their products. Generally an investment that will secure some sort of security towards the optimization of resources spend on the startup. [18]

(See Appendix - Website)

Finance

BUDGET (YEAR)



RESUME EFTER KATEGORI

Costs	Budget	Actual	Difference
Manufacturing cost	4.286,30 kr.	2.310,00 kr.	1.976,30 kr.
Marketing	3.900,00 kr.	1.531,00 kr.	2.369,00 kr.
Website	1.370,00 kr.	1.191,46 kr.	178,54 kr.
Travel	8.000,00 kr.	5.474,50 kr.	2.525,50 kr.
Bank Account	1.200,00 kr.	400,00 kr.	800,00 kr.
R&D	5.000,00 kr.	0,00 kr.	5.000,00 kr.
IPR	452,00 kr.	452,00 kr.	0,00 kr.
Transport	3.000,00 kr.	1.626,00 kr.	1.374,00 kr.
Mass production	15.000,00 kr.	0,00 kr.	15.000,00 kr.
Andet	2.000,00 kr.	3.615,00 kr.	(1.615,00 kr.)
I alt	**44.208,30 kr.**	**16.599,96 kr.**	**27.608,34 kr.**

The budget is set to give an economic overview of the business and provide the necessary information to proceed a pricing analyse, sales forecast and market potential. The "budget (year)" is split into two parts: the expected costs and actual cost (what has been spent so far). This is resulting in a "difference calculation". In the table the exact numbers are stated. In the circle diagram the percentage of the actual use is shown. And the bar chart there is a illustration of the actual cost compared to the estimated cost. Let see how we can use these numbers to help the business further.

Sales forecast

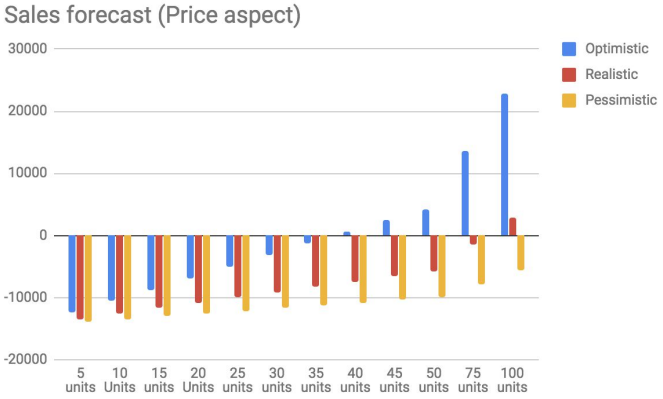
The sales forecast is build upon two perspectives and provides an idea of how much to sell (and at what cost) in order to reach a satisfying level of revenue.

The model is split into three views: optimistic, realistic, pessimistic. This seemed like a great way to prepare for worst case and see how much that actual should be sold to make this business profitable.

Sales Forecast (Price Aspect)

The first forecast is based upon the logic of static amount of sales, but an adjustment in price (profit). All three perspective has the same investment included but will increase a given pace based on the product.

	Optimistic	Realistic	Pessimistic
5 units	-12432,2	-13434	-13857,2
10 Units	-10575,4	-12579	-13425,4
15 units	-8718,6	-11724	-12993,6
20 Units	-6861,8	-10869	-12561,8
25 units	-5005	-10014	-12130
30 units	-3148,2	-9159	-11698,2
35 units	-1291,4	-8304	-11266,4
40 units	563	-7449	-10834,6
45 units	2422,2	-6594	-10402,8
50 units	4279	-5739	-9971
75 units	13563	-1464	-7812
100 units	22847	2811	-5653



The optimistic view is based on a sales price of 900 DKK (428,63 (manu.cost.)*210%). This is a pretty high price and it will cause some problems in relations to competition and sales. Therefore we will have to put more money into marketing in order to reach a satisfying level of sales. Even though we only need to sell 38 products to reach break even, it seems difficult.

The realistic view is set to cost 600 DKK (428,63 (manu.cost.)*140%). This price has seemed to work very well when the customers has been introduced to the product. This enables the product to reach a higher level of sales at a lower and more sustainable price. At this price point we will have to sell ≈ 80 products to get a ROI, which seems more realistic and more cost-effective in relation to marketing and customer value.

the Pessimistic view will cost ≈ 515 DKK (428,63 (manu.cost.)*120%). at this price point we need to sell 150+ products to get ROI. By briefly asking people about the price difference from 515 to 600 it did not seem to affect their decision of rather or not to buy. Therefor this will only cause trouble both in order to start production, sales revenue, etc.

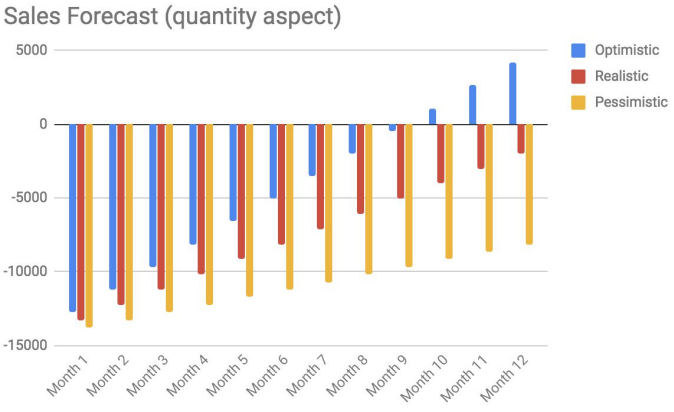
Therefor the the realistic were given the name and the price was set to 600 DKK.

Market potential

Sales forecast (quantity forecast)

The second forecast is based upon the logic of static price, but a adjustment in quantity. All three perspective has the same price included, but will vary on the amount of products sold a month.

	Optimistic	Realistic	Pessimistic
Month 1	-12750	-13263	-13776
Month 2	-11211	-12237	-13263
Month 3	-9672	-11211	-12750
Month 4	-8133	-10185	-12237
Month 5	-6594	-9159	-11724
Month 6	-5055	-8133	-11211
Month 7	-3516	-7107	-10698
Month 8	-1977	-6081	-10185
Month 9	-438	-5055	-9672
Month 10	1101	-4029	-9159
Month 11	2640	-3003	-8646
Month 12	4179	-1977	-8133



The optimistic view is based upon the that we sell 9 units a month. This is not impossible and with the right amount of work and marketing fokus this should be possible. By selling 9 units a month we will reach break even in 9. months.

The realistic view will cause in a break even around first quarter of year 2. The sales is set to be 6 units which i can be accomplished with some work beside the studies, without any serious sales initiatives. But still it is a bit risky to have keep a break even point 1,3 year into the future.

The pessimistic view is 3 sales a month. This number is not very ambitious. And the return of investment is to slow. If we only get 3 sales a month even with little sales activity, something has to change.

Overall the three perspectives has been pretty pessimistic. The sales numbers are set low. This is due to a need of some sort of sales person in the company to take charge of this process to accelerate the revenue.

Looking into the sales goal: Potential Reach:5600 personer *(see appendix - market potential)*

Even with 9 sales a month we will only reach 1,9 % of the customers within the first year. We will look for a sales person to get this number to 5 % with year one. To reach this we will have to sell 23-24 units a months instead. The goal of 5600 persons (in DK) is estimate through some specific keywords within the potential market segment containing hundred of thousands of people (in DK). So what is the sales goal and forecast for the danish market?:

*5600 Units *600 DKK=3.360.000 DKK*

This is a realistic estimate of the sales inside denmark within the lifetime of the bicycle handle in denmark at a sales price of 600 DKK.

Go-to-market strategy

But how do we intent to reach our customers? The goal is set to be 5600 sold units and therefore we will need some sort of strategy to get out on the market.

This was done by exploring relevant channels and initiatives related to bicycling and arthritis. We took various of perspectives that could help the product out on the market - and below the different opportunities is presented.

1. Vivi Nobel; Circuit Chairman of the Capital-Nord Gigtforeningen, has offered us an article in “Gigtforeningens fagblad; Ledsager”. This will be a good opportunity to create awareness of our brand and reach our segment.

- “gigtforeningen” has as well offered the product to appear on their webshop.

The foundation contains 40.000 members with different levels of disabilities. But, we have expected to sell around 800-1200 to the members of the arthritis foundation.

2. Visit the Egmont High School for our next test phase and possible sales to rental at school.

2.1 get in contact with partners to the Egmont high school.

The Egmont high school is expected to buy around 30 units. Which can be used for student if they are going for a bike ride. This is as well considered a great testing environment for future technologies.

3. We will establish a stand at “vind i håret”. This will be a chance to meet our customers and show the product “in real life”.

This event will include brand awareness more than direct sales. Hopefully by showing our product as convensiens like this we can attract some traffic to our website and thereby generate some sales.

4. Public institutions in Denmark concerned with health care.

- Municipalities katalog.
- Hospital katalog.

This can be a great opportunity to distribute the product to relevant customers and get a authority (doctors, ergonomic expert, etc) to recommend the product. It will take some time to get in the catalog of every hospital and municipality, but we start one by one and it is estimate that a municipality such as kopenhagen combined with a hospital would be able to distribute ≈1000-1500 products.

7. Create relationships with international organizations such as Wheels of Wellbeing.

The next step is to establish contact with potential new partner outside of denmark to discover the opportunities of such a product in other countries.

Overall this strategy is supposed to support a sustainable revenue and get the project started. And by looking at the sales estimated through out the different channels, this plan would approximately reach ≈ 48% percent of the estimated sales. By getting this higher the percentage of sales we will look more deeply into the public institutions in order to reach more people around the country.

The overall “go-to-market strategy” seem to be great in order to reach the customers.

Future perspective

The last part of the business plan is to get an idea of where the business is headed - in general future perspective. At the moment we have one product and will need to establish a great level of relations to get the business running. Therefor it seem logical to build more products within the same niche to establish a brand developing ergonomic equipment to people who is on the move. Things that could for into the distributors and business network that will be established through the out the way.

To get help reaching a decision of this character we have decided to join a startup convention in Korea. This event was a offer from DTU - that was given to a specific. (*see appendix - ScaleIt Korea*)

At this event we will be helped to run a sustainable business and the future perspective will be developed through the convention and the business model my as well be adjusted if needed in order to reach greater results.

Conclusion

As described in introduction; the report is build upon the goal of developing a self help-tool that will enable people with *RA* to ride a bike (without fear) and thereby heighten their life quality. Through the report it is stated how this problem formulation was solved by the development of a bicycle handle. The result was obtained through several of analysis and the use of various tools related to the PDI-program.

The chapters building the foundation to reach this conclusion is;

- Market research: Was concerned with the basic research within the field, who the potential customers are and what they need, and who the competitors are.
- Concept development: This section served the purpose of developing a prototype through an iterative process - in close contact with customers. This resulted in a POC, prototype and a testing that build a great foundation for the final product.
- Final Product: This was a brief description of the product that was accomplished through the successful testing phase.
- Manufacturing: To get an idea of the production of this product an analysis of how to produce the product and at what price was executed. This was done to check if we could make a profit, if we should change the design and/or if we should change the way of manufacturing.
- Business model: The product needed a business model, showing how to get a return on the invest and generally how to generate revenue, protect the idea, and get it started.

- Finance: This section was implemented to calculate rather or not it would be a profitable business and what should be done.
- Go-to-market: How should we reach the financial goals stated in the financial section and are we able to reach the goal with our current skill set within the company.
- Future perspective: What should be done in order to keep up the business and build a brand that is worth pursuing on a long term scale.

In the end of the report it can be stated that the product has proved itself worthy through interest from potential users and experts. And the product is overall considered; a business idea worth pursuing.