

Design Thinking and Advanced Prototyping

ELEC-C9821 – Financial Arguments



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Today's agenda

09:15 - 10 Lecture

1. Technical arguments
2. Financial arguments

10:15 - 12 Workshop

3. ..
4. Discussion

Technical arguments for a design concept

Main arguments for a design concept

- **Desirability – Value for users**
- **Feasibility – Technically sensible**
- **Viability – Financially competitive**

What are technical arguments

1. **Explanation of the design problem in terms of the technical performance, i.e., main requirements for the technology**
2. **Evidence that you have in order to claim that your design concept is technically possible**
3. **Further evidence that you have suggest an sensible overall solution to the design problem**

The challenge

- How to tell the key points on the proper level of abstraction
- You know ‘too much’ to tell it all in the concept presentation
- Remember, design concept is a management tool
- What does a ‘manager’ or ‘stakeholder’ want and need to hear?



Solution:

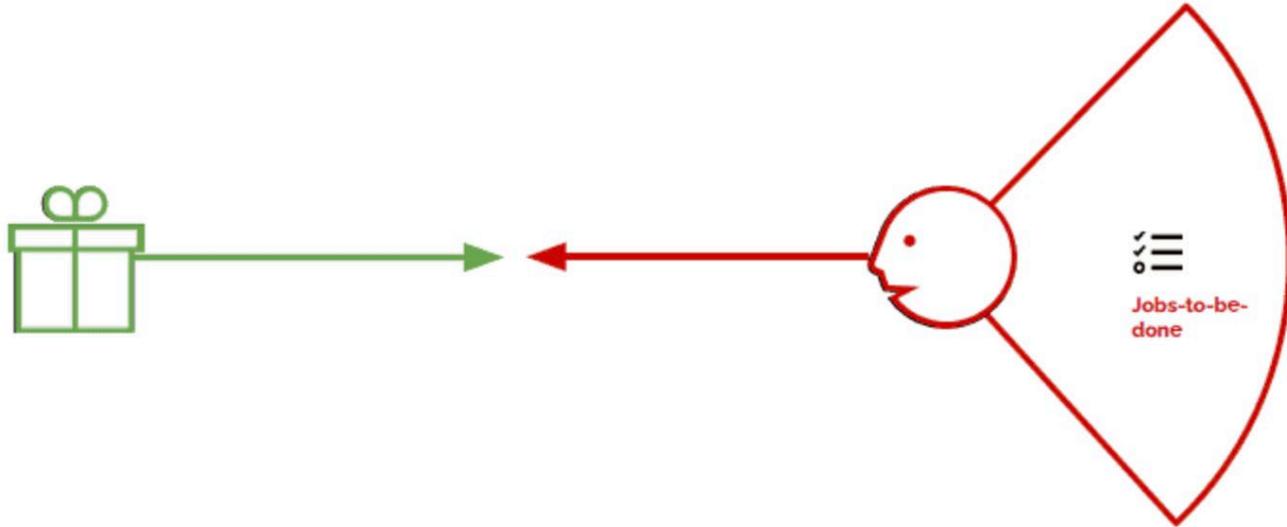
The Value Proposition Canvas

The proper level of abstraction

- **Your ‘client’ (either a user or customer) needs things to get done**
 - For example, they might have a fleet of vehicles to manage, or
 - they are renting our apartments, or
 - they are cleaning toilets, or
 - they are training for marathon.
- **You need to have the functionality and features to meet these needs**

The Value Proposition

Jobs-to-be-done

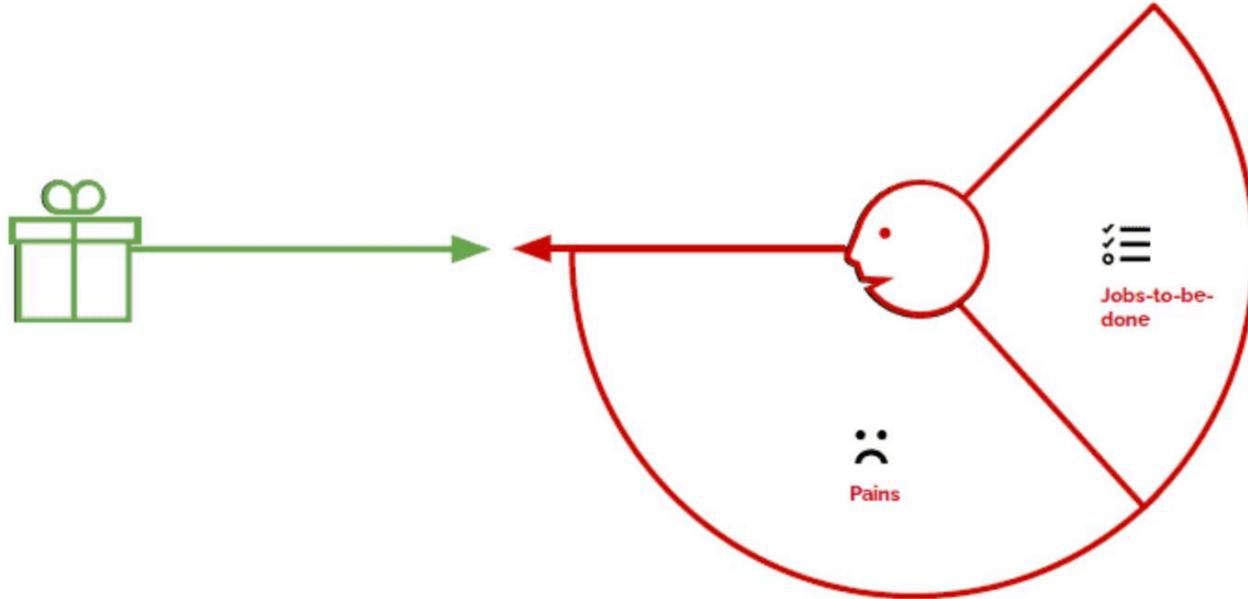


Your client is suffering

- **They have problems in getting things done**
 - For example, they have a solution that is too expensive and difficult to use, or
 - they have to spend too much time and thought for a boring repetitive activity, or
 - they cannot know what they should know.

The Value Proposition

Pains



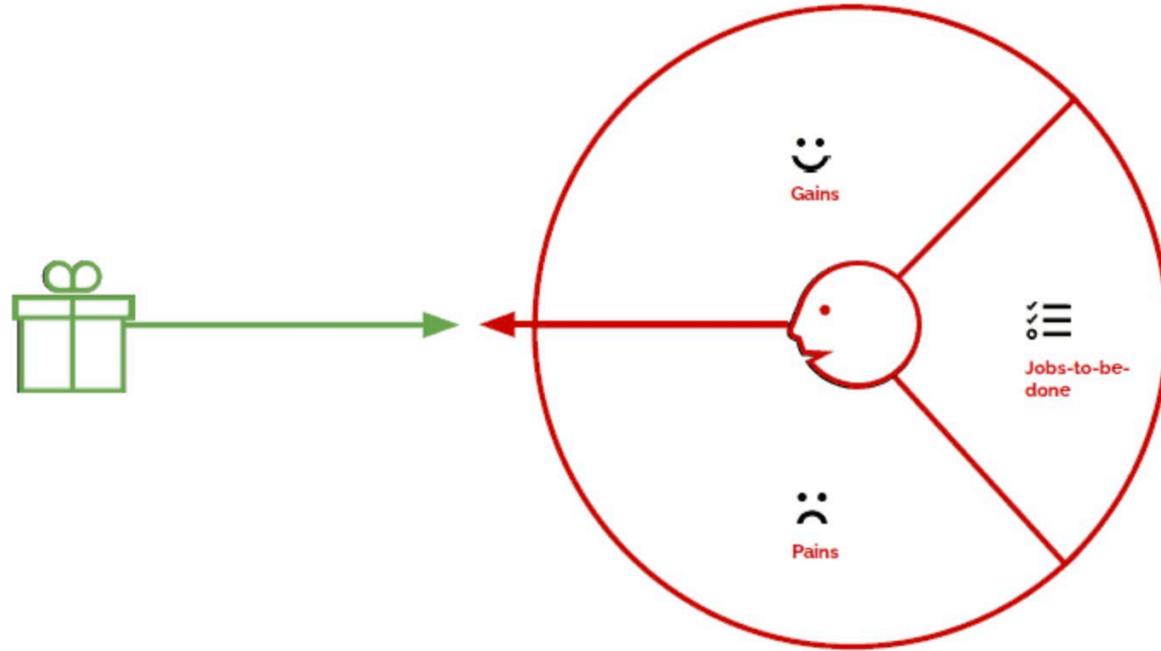
Your client would gladly get rid of their suffering

- **They would like to get things done**
 - for example, so they have a solution that is just at the right price and easy to use, or
 - they do not have to spend much time and thought for a boring repetitive activity, or
 - they can actually know what they should know.



The Value Proposition

Gains

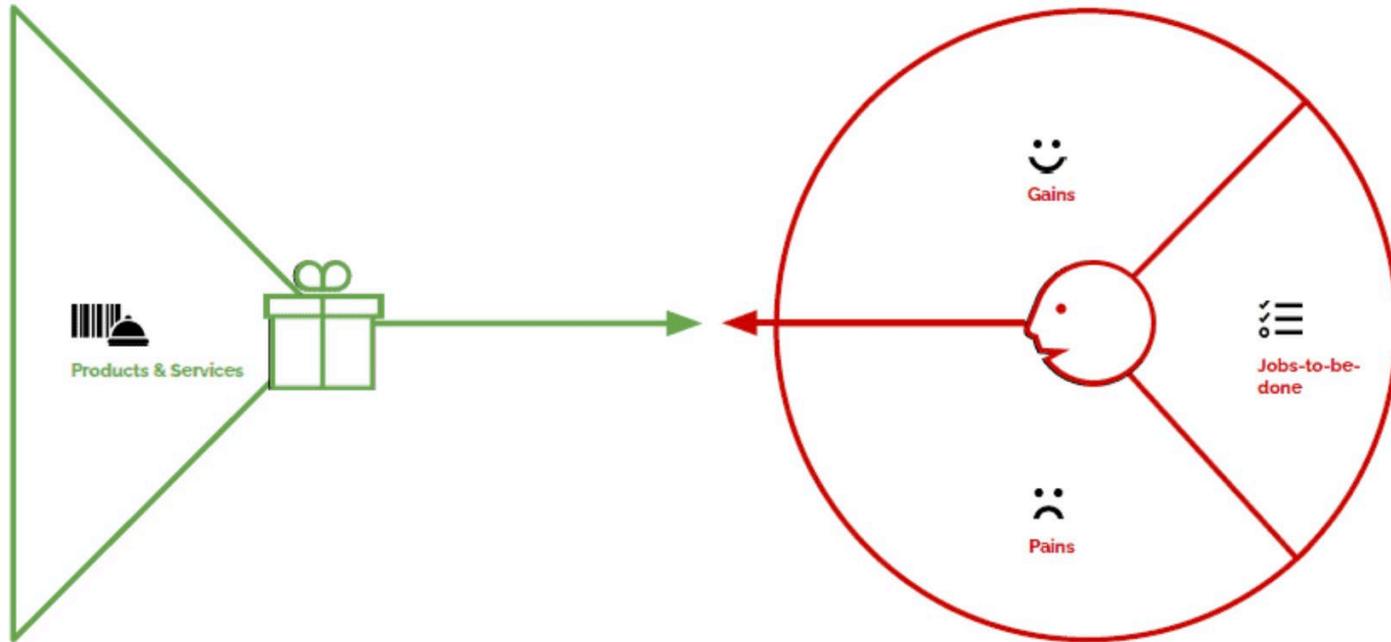


You should address things that your client wants to get done

- **What are the key features and functionalities that you deliver**
 - For example, real-time fleet tracking with traffic data based route optimization, or
 - automatic biometric door lock and access control in rental apartment, or
 - toilet cleaning robot, or
 - smart wearable with novel sensor + app that tracks muscle recovery overcompensation to optimize training

The Value Proposition

Products & Services



You need to tell how your product will benefit the client

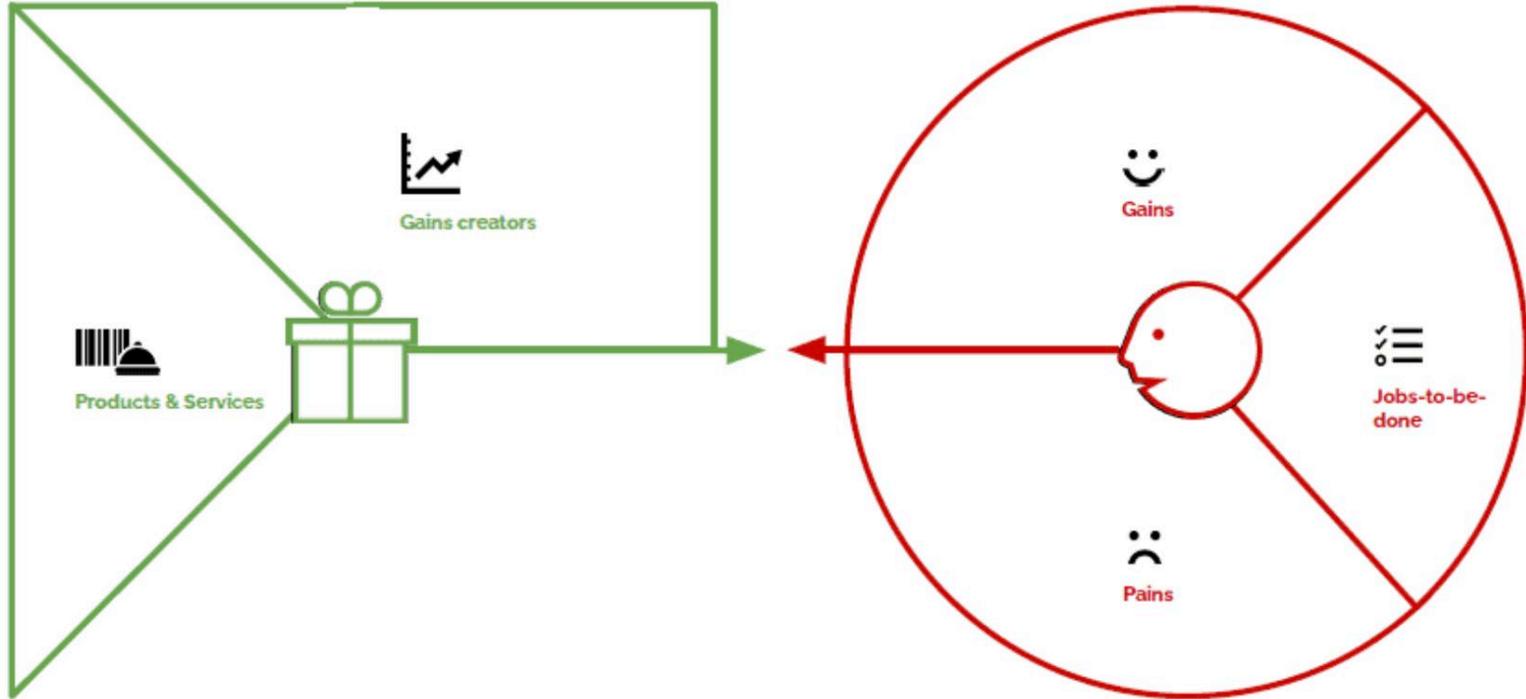
- **How do your product's features and functionalities make the difference**
 - For example, the route-optimization reduces fuel costs by X% and increases the trucks' time-efficiency by Y%, or
 - the biometric door lock and access control reduces the times your client must physically get to the site to hand in the keys to the apartment, and it adds security by identifying the tenants, or..

You need to tell how your product will benefit the client

- ..
- the toilet robot can work in parallel with the client's cleaning personnel and also achieves excellent cleaning results on specific cleaning tasks faster than a human, or
- the new sensor and app combination enables to track the combined effect of nutrients, training, and recovery.

The Value Proposition

Gain Creators



You need to tell what is in your product that solves the problem

- **What is it in your product's features and functionalities that is capable of making the difference**
 - For example, the vehicles in the fleet have trackers that connect to the Cloud via cellular network. The route-optimization uses real-time traffic data, swarm intelligence to update map data, and weather information to calculate estimated delivery times in the accuracy range of 5 minutes.
 - Or...



You need to tell what is in your product that solves the problem

- ..the biometric door lock uses either facial scanning to generate identifiable profile for each tenant. This profile enables keyless access to the apartment and also unlocks desired facilities, such as washing machine.
- Or..



You need to tell what is in your product that solves the problem

- ..the toilet robot is smaller than a human, and thus can reach cramped spots, it also sports a new agility engine that maps the physical environment and enables the robot to dynamically plan the next actions in a task-oriented way, and it uses a combination of spectral, chemical and tactile sensors to analyse the cleaning result.
- Or..



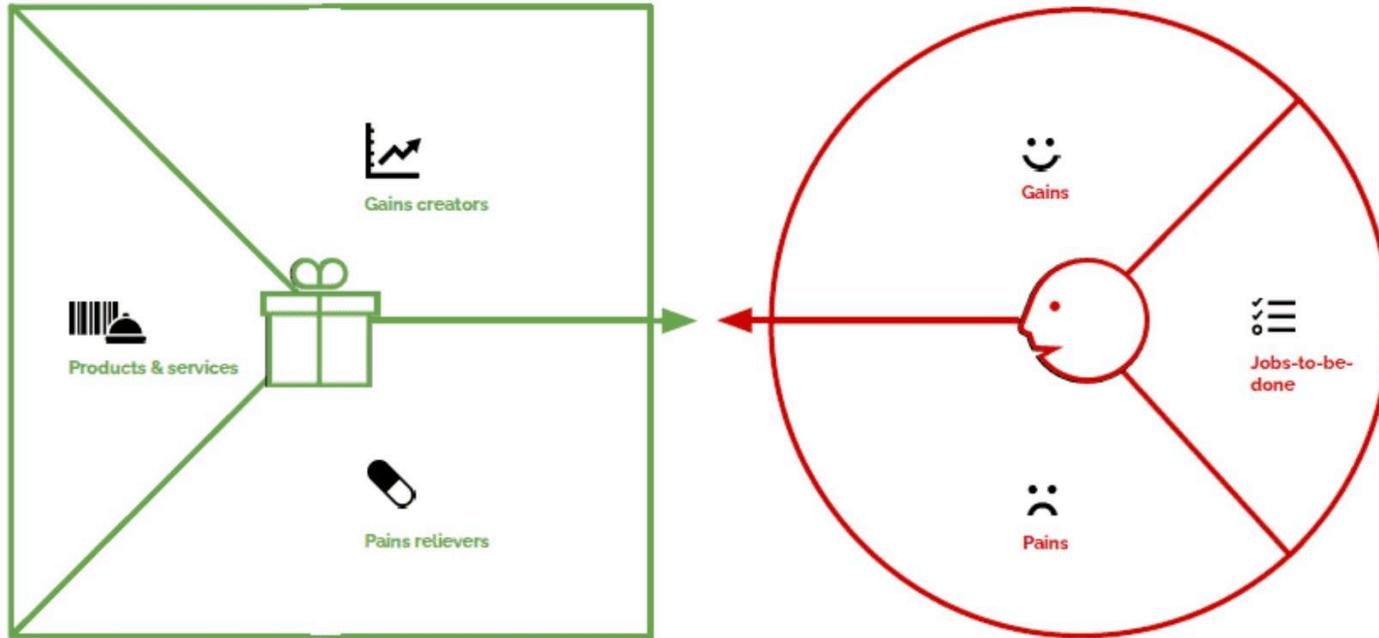
You need to tell what is in your product that solves the problem

- ..the new combined light sensor can detect chemical reactions under the skin of the athlete. The App uses a Cloud-based pattern analysis to create training plans that are adapted to the detected recovery rate. The results are verified by comparing actual sports results to the analysed sensor readings.
- Or...



The Value Proposition

Pain Relievers



Value proposition statement

- **A value proposition is a short statement that communicates why customers should choose your product.**
- **“Smarter fleet management”**
- **“Easier and more reliable Airbnb hosting”**
- **“A robot that makes cleaning faster, better, and cheaper”**
- **“Boosting your sports performance like nothing else”**

So, what are the ‘technical arguments’?

- Each of the above examples are technically challenging, and you should be prepared to answer the possible questions.
- The technical questions can be very different:
 - How does the ‘swarm intelligence’ actually work?
 - How accurate and reliable is the facial scanner in the door lock? Is it the same sensor as in iPhones?
 - How does the robot move around? How long does the battery last?
 - What is the science behind the ‘overcompensation’ in training optimization?



Financial arguments

Main arguments for a design concept

- Desirability – Value for users
- Feasibility – Technically sensible
- Viability – Financially competitive

Financial arguments

- **Design needs to be competitive**
 - It needs to be more attractive for the purpose in the point of view of the customers* than the alternatives
- **Cost and competition**
 - Price point = how much does it cost to a customer
 - What do the alternatives cost for the customer?
 - Costs to you = development + manufacturing + service
 - What does one product cost for you?

Estimating cost per product is tricky

- **Costs**
 - **Development**
 - Cloud design (back-end) – design, coding, testing
 - App design (front-end) – design, coding, testing
 - Physical design – casing, mechanics, tooling, testing
 - Embedded design – schema, PCB, assembly, testing
 - **Manufacturing**
 - Bill of Materials (BoM) – electronics, mechanics, casing
 - Process – creation/purchase of parts, assembly, testing, packaging
 - CoGS – Cost of Goods Sold (the cost per unit sold for you)



What is a 'good enough' estimation?

- You are trying to convince us (=audience, possible clients, managers, financiers) that your design concept should be realised
- In concept design phase you do not yet have all the data, or specifications, and perhaps not a very clear idea of what will be in the final bill of materials.
- Hence, you need to make informed guesses

Use reference designs

- **Reference design is an existing product that you compare your design with**
- **Analyse at least the following**
 - Value proposition
 - Price point / business model
 - Features and functions
 - Bill of Materials



Oura ring



- <https://ouraring.com/>

- **Value proposition statement:** “The most *accurate* smart ring.”

- **Price point & business model:**

- Retail: Price 314 € (=the Thing)

- Subscription: 5,99 € / month with “Membership” ~ 72€ / year (=Cloud + App)



Oura ring



- **Features & functions**

- **Sleep tracking**

- deep sleep, light sleep, REM sleep, blood oxygen levels

- **Activity tracking**

- movement, steps, heart rate, and recovery

- **Readiness analysis**

- using over 20 biometric signals



Oura ring

- <https://ouraring.com/>

- Weight: 4 to 6 grams
- Width: 7.9mm
- Thickness: 2.55mm

Sensors:

- Green LEDs (optical heart rate sensor)
- Red LED (blood oxygen sensor)
- Infrared Photoplethysmography (PPG) sensors
- Skin temperature sensors (negative temperature coefficient sensors)
- Photodiodes
- 3D Accelerometer



Connectivity:

Bluetooth Low-Energy  (Bluetooth Smart®)

Battery & Power:

Up to 7 days of battery life

Oura ring

- <https://ouraring.com/>

Battery: Grepow curved LiPo ~10€
21mAh, 0.0777Wh

MCU: ~10€
Infineon PSoC 6 MCU: CY8C63x6
32-bit Dual CPU Subsystem

- 150-MHz Arm® Cortex®-M4F
- 100-MHz Cortex-M0+



Battery management: ~€1
Texas Instruments BQ25155

Titanium ring: ~2€

Sensors: ~2€

LEDs: ~0.2€

Other components: ~5€

BoM TOTAL: ~30-35€

Batteries Reference Prices

- Ring-size curved, 20 mAh, ~10 €
- Wristband-size 50-70 mAh, ~3 €
- Watch-size 200-500 mAh, ~7 €
- Palm-size 1.4 Ah, ~7€
- Book-size 8 Ah, ~50 - 100? €



2021 MacBook Pro has 12 battery modules...

2021 16-inch MacBook Pro, 99.6 Wh battery (11.45 V, 8693 mAh)



Batteries from the 16" (top) and 14" (bottom) 2021 MacBook Pros. Click to enlarge

Dedicated assistants

Each team has an assistant

1. Shahram

2. Carl

3. Aleksi

4. Shahram

5. Carl

6. Aleksi

7. Shahram

8. Carl

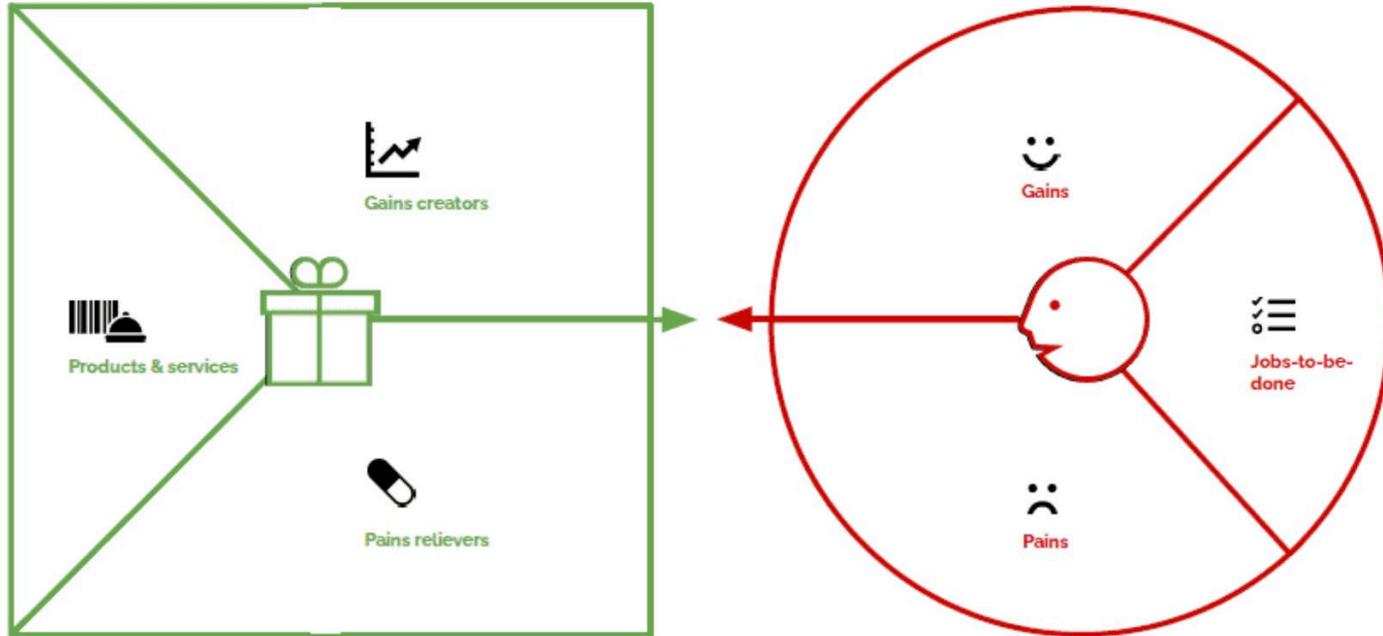
9. Aleksi



-- Presence Check --

Workshop: Value Proposition Canvas

Create Your Value Proposition



Circuit Shop Schedule

We have a scheduler on MyCourses to help you to distribute across the week so that the small space does not get too full.

Circuit Shop (piiripaja) is located in front of the Electronics Workshop (Sähköpaja).

Available times are during the regular exercise times (may be adjusted if needed)

This week

- **Project: Test your Proto V1 and report in MyCourses**
- **Write your weekly diary and submit it**
- **Exercises (mini project) (Fri 14-16, Mon 14-16, Tue 10-12)**
 - **VOLUNTARY!**