Innovation Management in Startups

Building a Sustainable Tech Startup

Master's Thesis 2015
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INNOVATION MANAGEMENT IN STARTUPS
Building a Sustainable Tech Startup

A Thesis

By

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ABSTRACT

Technological advances have created the foundation for an increasing number of tech startups seeing the light of day. These startups are working with innovation in an organization and situation that is radically different from big companies, which has traditionally been the primary forces in high tech innovations. This has created a need for new theoretical and practical frameworks to manage innovation, which accommodates the uncertain reality experienced by startups. In the last couple of years the need has been answered by startup literature such as 'Lean Startup' and 'The Startup Owner's Manual'. This project seeks to find relevant theories and methods to manage innovation in the tech startup *Spiio*. Some of the most popular startup literature is reviewed and compared to acknowledge findings from innovation studies in science, technology and sociology (STS). The report finds that there is good alignment between the suggestions from STS and the reviewed startup literature. A few suggestions is made to enhance the startup literature with STS findings for considering and manipulation relevant actor-network configurations. Spiio is then analyzed using key findings from the reviewed startup literature and STS. First part of the analysis results in identifying a misalignment in the actor network and a new configuration is proposed to align interests and create stability. A strategy for establishing the new configuration was first formulated and subsequently executed with success. In the last part of the report a business model analysis is carried out using methods and frameworks from the startup literature. The analysis identifies a series of knowledge gaps in Spiio's business model. Resulting from this suggestion is made for a number of areas, which Spiio should prioritize.

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1 Introduction

1.1 The beginning of dream

In the past decade we have seen a rapid increase in the number of small technology based startups trying their luck in the global Klondike of software and embedded hardware. The reason why we are seeing this trend now is that a number of innovations has made it more accessible to found a technology product development company without having large initial corporate or monetary backing. Historically it has been expensive and very knowledge intensive to manufacture electronics hardware, prototype casings, while keeping costs low, setting up distribution channels and so forth [1]. But this has changed in the last few years: Cheap and rapid prototyping with 3D printers, laser cutters and CNC routers changed the landscape enabling quick and affordable fabrication iterations. Hardware prototyping platforms such as Arduino, Raspberry Pi and SparkIO are inexpensive. Combined with the huge and easy accessible online open source communities this makes prototyping of electronics easily available. Access to computers is normal and CAD programs to aid sophisticated design has become easier to use and highly advanced quality open source versions are available to everyone with an Internet connection for free. Smart devices (phones, tablets..) have become widely spread worldwide and in particular in developed countries. While the smart devices are becoming increasingly popular as device for interfacing between humans and connected hardware, the huge demand for these have had dramatic impact on driving prices on parts and components down. Small-batch manufacturing of hardware has become easily accessible through the Internet, delivered by mail directly from Shenzhen, at very affordable prices. Open sourcing such as Alibaba, Aliexpress and Taobao has given small startups and individuals a door into ‘fabrication China’. All in all what we see is that in less than a decade an ecosystem has been grown which mitigates many of the headaches and game stopper historically faced by individuals wanting to manufacture hardware and become IT entrepreneurs. And this leads us to the motivation for the chosen subject in this report: I have also seized the opportunity and am current trying to build a technology hardware startup. The startup name is Spiio and during this master’s project, I have been running and building Spiio alongside building the project, using Spiio as a case.

Spiio.com is a recently launched startup by the Martin Graulund Dal, a student at mediology AAU CPH and the author of this thesis. Currently we are trying to solve problems for companies who sell and maintain plants to office buildings and the like - 'Office greening service providers'. By far the primary cost in the industry is labor- and transportation costs concerning the personnel who maintain the plants. We are trying to help these companies save resources, money and time. We do this by measuring vital parameters - revealing if plants are thriving or not - ensuring that the service personnel arrives to water the plant exactly when it needs it. The main purpose of our solution is to provide our customers with insights into their own business and save costs by optimizing their processes.

The idea for Spiio started sprung from a single comment from Claus the owner of Decoplant A/S, a Danish service provider of indoor plants and interior landscaping. This was at an informal meeting with said thesis writer and his group in regards to a project trying to bring vegetable production indoors. At a point in time at this meeting Claus utters that he has a dream of sitting at a desk with his feet up and monitoring the wellbeing of all his living walls and activities around the country. The comment sparked the interest of one certain design student at the meeting (me). Martin and I created a simple prototype, which could measure soil moisture and visualize it on a computer along with some controls for switching on mechanical devices (such as valves and pumps) on and off. Both of us had a entrepreneurial want and a fondness for building stuff, we hoped that Decoplant could see a potential solution in some of what we presented through our simple prototype. We brought it to a meeting with Decoplant in order to create an interest and investigate if there was a basis for a shared project between the two parties. The prototype worked well as an interessement device [2] and it was agreed upon to look into the possibilities of optimizing the maintenance of living walls by use of technological assistants.

This was how Spiio started and since then both Martin and I have put a lot of time and effort into Spiio trying to realize a dream that one day Spiio has evolved from being just a startup into a full fledged company from which we can make a living. In this process a question kept entering my mind: What does it take for startups to become profitable companies?

1.2 The perfect idea is not enough

We all know the classic narrative of the successful entrepreneur. It features a genius guy who first gets a great and genius idea (Steve Jobs, Edison etc.). Then he starts working hard day and night in solitude creating and building his genius idea. And finally the idea has been materialized in some form and boom he is on cover of Forbes or some other magazine being very successful. In reality however, this is rarely what happens. The founders rarely make the great product and less so makes it to the podiums and the front pages. Reality is that the genius entrepreneur did not figure it all out flawlessly in the beginning and the materialization of the idea did not happen in solitude alone and isolated [3]. On the contrary the initial idea was probably changed and modified many times over before it became a success. The changes came as result of the inventor getting out of the basement and exposing his idea to the real world. This revealed important uncertainties and false assumption ultimately forcing changes of the initial idea to avoid ending with a product failure [4]. Traditionally to understand these uncertainties and foresee if the idea will result in success or failure, it has been the founder's job to write a business plan. Typically this is a 1-3 years forecast, which describes the business idea including the problem to be solved, how to solve it, what the economic potential is and a detailed budget for what it will cost to develop and introduce the idea to the market [5].

I have experienced this myself when trying to get a bank account and in applications for funding such as "Venture Cup" and the regional growth initiatives such as "Regional Væksthuse". Writing such a business plan involves dealing with the headaches of trying to make a static forecast whilst in the midst of the thick fog of uncertainties, which is familiar to the early phases of product development [6]. However it seems that business plans rarely survive first contact with customers. As the boxer Mike Tyson once said about his opponents' prefight strategies: *"Everybody has a plan till' they get punched in the mouth."* [5]

During this project a director from KPMG told me "it's all just bullshit numbers, but we put them in anyway" referring to the business plans. My guess is that the plans are written and the bullshit numbers are put in because creating new successful products is hard. Innovation is a struggle surrounded by uncertainty and the bullshit numbers and resulting business plan are the best we got - it's probably better than nothing right? So creating business plans has become a standard component in new business ventures and new product development.

Along with this companies needed frameworks to structure the process of developing the new product to ‘fulfill’ the business plan. And indeed such frameworks, methods and tools have been developed to help companies maneuver through new product development. The methods have worked well for companies, so picking them up for my startup seems obvious at first, but realizing that they were made for large companies and not for small startups questions arise: Are these methods well suited for driving innovative product development in startups? And if not, what is then?

Answering these questions in order to raise the odds of Spiio becoming a success has been my main motivation behind the master's project described in this report. It has led to my final problem statement:

Problem statement: A critical assessment of how Spiio can benefit from managerial concepts for product innovation.

Research question: Identify key concepts suited for managing innovation in a startup.

Research question: Make an informed analysis of Spiio’s situation using findings from the literature review.

2 Methodology

In this chapter I will explain the way I approached answering my problem statement and research questions. This chapter also serves as a general reading guide where you, the reader, can see what to expect from reading the different chapters.

2.1 Methods for generating data

Most of the methods I have chosen to use are essential tools for designers. I have tried to adopt them to my own needs. Generally throughout the project many conscious choices I have made are based on what I learned from existing literature and earlier findings. My efforts are overall based on a number of epistemological assumptions concerning data validity and how methods should be applied to interpret the data [7]. Below is a walkthrough of the general methodological assumptions I have been influenced by throughout the project work.

2.1.1 Literature review

Design methods proposed by Jones in regards to finding relevant literature states that "To find published information that can favorably influence the designers' output and that can be obtained without unacceptable cost and delay." [8].

Through conduction literature reviews a (semi-) structured exploration of relevant literature can achieved. The process is structured in the sense that the review should be pursued with specific goals. Nevertheless the actual literature review can be performed in a way where it is adapted to the given design challenges [8]. There are different ways of conducting literature reviews. A systematic quantitative review might be the most strategic and scientifically diligent approach. It can be founded on huge data sets using keyword inquiries in major publication databases. The results can then be synthesized and coded to achieve knowledge through statistics [9]. However literature reviews does not need to be so rigorous in order to yield relevant results. Using semi-structured review of literature as part of the design process can work to generate qualitative knowledge inputs at early phases of the design process. A way of conducting such semi-structured reviews is by examining literature and compares the literature with findings from earlier literature. This process is sometimes referred to as the

'berrypicking technique' [10]. Using this technique the literature is reviewed less rigorous but in a more tailored way to the specific problem at hand. In literature reviews where there is no common terminology or the topics sought investigated can be explained in different way (often the case if it is across theoretical disciplines or fields), getting meaningful results from the keyword-based structured methods can be hard and sometimes misleading. In this thesis I am reviewing literature from one discipline (the startup literature) with literature from another discipline (STS). Many terminologies and phrases are not the same, which is why I have preferred the semi-structured more 'berrypicking' review technique.

2.1.2 Interviews

Much of the knowledge generated in this project has been using interviews. Interview can act as great tools to gather qualitative data. Generally interview is a simple cost and time efficient way of gaining insights about people. Most interviews will be of conversational forms evolving around a specific topic [11]. Preece et. al suggests four categories of interview types [12]:

1) Open ended or unstructured
2) Semi-structured
3) Structured
4) Group

The main separator distinguishing the three first types from each other is based on the predetermination of the questions asked. The more predetermined the more structured and less open-ended. An interview is a conversation and it can be shaped highly as it goes along dependent on the topics discussed. The main benefit of using more open-ended interviews is that they can yield rich deep data. This can lead to more wide findings into areas which importance was unknown to the designer before the interview. The cost of the open-ended interviews is that the data generated often will be messy and unstructured. It can be hard to use for statistical purposes and an increased time is often spent analyzing, coding and structuring the data [11]. The group interview is basically interviews with multiple persons at a time. This type of interviews can lead to more diverse findings, however it can also lead to group members holding back on sensitive subjects.

In this project I have mostly been using open ended interviews due to the very limited number of participants talked to on each subject and because I wanted the benefit of gaining potentially broader findings. Many findings have also come from conversations which was not structured as interviews but as everyday forms of communication [13]. Examples of this are ad-hoc phone calls and meetups. Much of such data has not been stored in a log file or otherwise documented with precise dates and locations, but have merely been stored in the personal memories of Martin and I. However I still believe that they can propose a source for valuable data [13].

2.1.3 Prototyping

I have been using prototypes as a large part of my project. Prototypes are often a key component in user centered design processes. They are used as tools to translate knowledge across barriers [14], by manifesting design decisions and opportunities. They can serve for evaluation purposes and to clarify the quality of design decisions [15]. Often prototypes are distinguished into two major categories:

1. Low fidelity prototypes: These can typically be made from paper, cardboard, Styrofoam or are simply drawings on paper or the like. They enable fast and cheap prototypes to be made. They can serve as strong visual and tangible boundary objects. They are often used before more expensive and advanced prototypes are made. An example of such can be sketches in UX design made before more complex wireframes are drawn. Because of the simplicity of these prototypes they will usually require a facilitator in order to present and explain before the prototype can create valuable feedback.

2. High fidelity prototype: these are often working hardware or software prototypes, used to test more explicit user interactions and reactions. High fidelity prototypes can often ‘work on their own’ with the user without the need for a facilitator. High fidelity prototypes are more time consuming and resource consuming to develop than their low fidelity counterparts.

Due to the circumstances of this project when it started I have mainly been using high fidelity prototypes. This also enabled the prototypes to work on their own in the socio-technical context, which they are designed for.

2.1.4 Evaluations

When doing interactive design methods for evaluating how well a design, prototype or proposed solution is resolving user problems is I needed. Generally four different evaluation paradigms are described, for evaluating the usefulness of prototypes. They all relate to the notion: *"evaluation is driven by questions about how well the design or particular aspects of it satisfy users' needs."* [12].

Quick and dirty: Simple and effective, quick and dirty is the informal feedback collection from users or other relevant stakeholders. They are used as 'good enough' validation that the product design is on the right track of solving user problems. The power of quick and dirty is the speed because extensive documentation is made. This is also what can be the drawback if the documentation is needed for purposes such as scientific input or other.

Usability testing: Generating quantifiable data on user behavior to analyze 'typical' use. Performed in controlled environments. Often seen in software development where large user groups can be evaluated easily, often without them knowing, and at low cost.

Field studies: Evaluating the design in its natural socio-technical context can increase the understanding of workflow and how the design functions in the natural setting. This can reveal insights otherwise hidden in 'the lab'. Qualitative tools often accompany Field studies.

Predictive evaluation: No users involved. Expert reviews step through processes using the prototype with suggestions for improvement.

Through the project I have most been using quick and dirty collecting feedback in order to learn more quickly. I have not conducted usability testing through our software due to the B2B focused design the amount of users is limited. We have also conducted some field-testing with the prototypes.

2.2 Reading guide

2.2.1 Pre-analysis (Literature review)

The pre-analysis is a literature review where I have had the pleasure of spending a lot of time digging into popular startup innovation management literature. This was done to ensure a

thorough understanding of the topic for myself as well as readers of this report. During this I wanted to identify trends, methodologies and key aspects from works in this area. Because I was unfamiliar with the school of thought in the startup literature and because much of it is relatively new in an academic context, I have tried to make comparisons to previous findings from STS (science, technology and sociology) innovation studies. This was done see if the teachings from the startup literature complied with findings from these studies and possibly identify knowledge as mismatches between the two 'schools' of thought.

2.2.2 The Product Idea

Lean startup starts with founder's vision and founders idea. This chapter leads the analysis chapter by introducing the product idea and its vision. I choose to do this even though the foundation for many design choices will first later be explained during the analysis chapters. The product idea is core to the methodological frameworks provided by the startup literature. Hopefully by providing the reader with an understanding of the product early I will enable a better understanding of the analysis that will be encountered later in the report.

2.2.3 Analysis - Accelerators and Actors

This is the first of three overall analysis chapters. This chapter is focused on some primary actor groups earlier discussed: 'Mentors and Accelerators' and 'Early Adopters'.

An analysis of Spiio's situations in regards to 'Mentors and Accelerators' is created. Then a short breakdown of some mentor and accelerator programs offered to tech startups. Last a strategy for aligning these to Spiio's benefit is described.

In the second and last section I will introduce how and why Spiio's relationship to Decoplant A/S was misaligning and breaking down when this thesis project started. Then an analysis conducted to establish whether or not efforts should be made to repair the relationship with Decoplant A/S. Last it is explained how the relationship was repaired and a new actor network configuration was achieved.

2.2.4 Analysis – Business Model

This is the second three overall analysis chapters. This chapter is focused on analyzing Spiio using the business model canvas.

First I will use the business model canvas to develop and dig into Spiio's business model hypothesis and make suggestions for Spiio's next move. This sheds light on uncertainties so experiments and measures can be taken to account for them.

2.2.5 Analysis - Spiio and the Customer Development Process

This is the third and last overall analysis chapter. Based on the findings in the business model analysis this chapter briefly analyze where Spiio is in the customer development process. This is followed by suggestions of how Spiio should proceed towards next step in the model.

2.2.6 Conclusion

Arguments from the report are drawn up and problem statement and.

2.2.7 Personal Reflections on The Process

Explaining some successes and failures and general reflections on the project work from a personal standpoint.

3 Pre-analysis (literature review)

In this chapter I am looking at different popular concepts and methodological frameworks for managing innovation and product development.

First I will analyze what traditional linear frameworks such as the waterfall- and stage-gate model suggests and how this complies with the situation of a startup. These results in identifying a mismatch between what the frameworks offer and what a startup needs.

Second I will investigate some of the frameworks, which has emerged in the last decade, targeted specifically at managing organizational- and product development in tech startups. I will look into the ideologies behind these as well as make a walkthrough of some principal core methodologies. Last I review what is said about early adopters, advisors and accelerators - actor groups who receive special attention from the startup literature.

Third I review concepts from science, technology and sociology studies (STS) and make a rough comparison to the findings from the tech startup literature. Then I point to some areas concerning actors, and suggest that the startup literature could benefit from what STS teaches us.

Last is a brief summary visualizing the differences and focus areas I revealed in the review?

3.1 Corporate New Product Development - Innovation vs Execution?

New-product development models, management and strategy tools such as the Boston Consulting Group 2x2 growth share matrix, Strategy Maps and the Stage-Gate model", became popular teachings in business schools and consulting firms during the 20th century. Starting in the 1950's in the manufacturing industry it spread through other industries and to the technology business beginning in the 1970's.

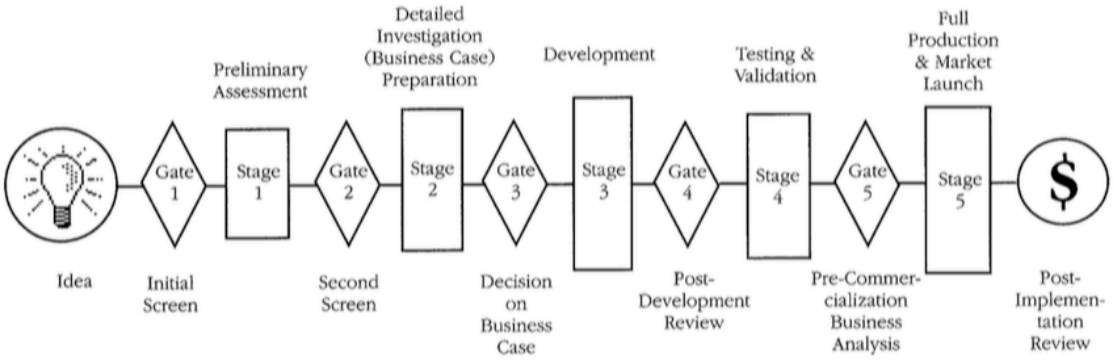

Figure 1 - Stage Gate process model

The appeal of a tools such as the Stage Gate is obvious: Idea in at one end and then a few steps to ensure progress towards money at the other end. Generally the premise is linear and product centric: A product or service concept is formed and a business plan is formulated. Generally linear processes drive the product through a path of fixed goals and checkpoints towards getting the product ready and shipped to customers. First technical development of the product begins based carefully formulated requirements specification. Then a series of structured customer tests is conducted on and feedback is collected. Engineers and technicians fix the technical "bugs" and the product is launched [16]. Generally this way of driving product development has been be working well for many companies. Academia embraced and validated the value of the models and methods [16], and they became a widespread approach to managing and driving product innovation in organizations [17]. Usually these new product introduction models are used with the assumption that the underlying business model, explaining what customers want, who they are, how the particular market is etc. is full of facts already known to the company. And as a result the models are working well when the customers are known, and product features can successfully be specced upfront [18]. Through these linear models product development can be planned up front, and the plan can be executed. This fits well with how the companies usually operate:

"A company is a permanent organization designed to execute a repeatable and scalable business model." [18]

The business model for the assumed new product success is being "executed". Little attention is paid along the way to if the assumptions for who customers are, type of market, customer problems, problem-solution etc. are right or not [19].

The reason for this behavior in companies trying to introduce new products becomes obvious when you realize their origins. They started as startups searching for a repeatable and scalable business model - those who found one began executing and repeating it, scaling while becoming more and more efficient at executing the business model.

When striving towards higher efficiency the measure for success in the company becomes metrics that reflect how well the business plan is being executed: The execution of the assumed known business model becomes organizational goal. Measures and metrics are established to evaluate and determine results as being successful or not [20]. Referred to as Key Performance Indicators (KPI's), public company success is often measured in financial KPI's [18]. These metrics, and the tools to achieve the goals set by them, are from an organizational viewpoint very important aspects of evaluating the performance of new product development. History has however shown us that instruments such as these, rarely leads towards successful product innovation, because they are inefficient at identifying relevant knowledge for evaluating and developing the idea at hand [17]. A better understanding of why it is so is gained from understanding some fundamental pillars of what innovation is. Pavitt formulated a general framework for understanding what an innovation process is:

"Innovation processes involve the exploration and exploitation of opportunities for new or improved products, processes or services, based either on an advance in technical practice ("know-how"), or a change in market demand, or a combination of the two." [21]

Accepting this premise is becomes understandable why the linear innovation models are suited for iterative innovation within a known business area, but that they are likewise unsuited when searching for a new business model. It also makes intuitive sense that executing a plan full of knowns, over and over again hardly is the best way to discover something radically new [22]. Since the KPI's purpose is to intensify the focus on this sort of repetitive execution it follows that the metrics used for the execution are ill suited for an innovative process searching for something new [23]. So when a company in an attempt to

innovate writes new business plans based on new product ideas, and then apply methods for execution in order to "bring the new idea into the world", they fail to realize that the new business model, unlike their old, is unproven.

"Failure to take into account the content of technological innovations results in the widespread use of simple linear models to describe the process of innovation." [24].

Reality is that innovation in new areas is inherently uncertain [17] and that *"the impossibility of predicting accurately the cost and performance of a new artifact, and the reaction of users to it."* [21] calls for another approach to manage this type of innovative process. The models simply fail to take into account that the plan was full of 'bull shit numbers'. At the time they are our best guesses, but just like the inventor in mom's garage companies did not figure it all out flawlessly in the beginning. In this lies an inconvenient truth for companies: while becoming increasingly fine tuned machines for execution they become equally constrained in ability to innovate.

3.2 Startup literature

3.2.1 The need for new innovation models

Until recently many startups have been adopting these same methods of innovation that was taught on the MBA's and used in big companies around the world. However the nature of startups is not to execute a known business model. Far from it; startups venture in unknown territories, and thus the methods from large companies are ill suited and seldom produces the desired or expected results. Eric Ries defines a startup as*:*

"a human institution designed to create new products and services under conditions of extreme uncertainty" [3].

In my opinion this definition captures the essence of the mismatch between startups and the linear new product development models pretty well. Innovation in startups is not full of facts and knowns, but on the contrary full of mess and chaos [21]. As a result a startup cannot put down a foolproof 'plan' at the beginning and iterate it through static gates and expect success and 'money out' at the end. Essentially the startup has no proven business model and is ultimately in a situation where it is desperately searching for a repeatable and scalable

business [19]. The inherent mismatch between the linear product development models and the startups lack of a proven business model, drove entrepreneurs to evolve new managerial tools more suiting to the challenges they faced. In the last decade of 20th century and since the beginning of the 21st century the work has been intensified led by software- and mobile development companies. Resulting from this we have seen a rapid increase in the popularity and amount of methods and literature conceptualizing how to manage the innovative process in startups.

Inspired by principles from agile software development [25] one of the first real breakthrough of the 'startup management movement' started in 2005 with the emergence of Steve Blank's best selling startup book "The Four Steps of Epiphany: Successful Strategies for Products that Win". Claiming that startups were not smaller versions of companies and introducing the 'four-step customer development model' it was probably the first templatization of best practices for building technology based startups that got widespread. "The Four Steps of Epiphany" inspired the 'Lean Startup movement", which was pioneered by Eric Ries with the release of his book 'The Lean Startup' in 2011. Since it has become widely popular among entrepreneurs and the 'Lean startup movement' is not just consisting of Eric Ries Lean Startup. Contributions such as 'The Lean Entrepreneur' [26], 'The Hardware Startup' [1], 'New Frontiers in Open Innovation' [27] and 'The Startup Owner's Manual' [19] are part of the movement, each with their own slightly different interpretation or presentation of the philosophy and methods. They all promise to provide a series of best practices which are reducing the risk and increasing the feasibility and chances of success for entrepreneurs. The tools are different from those traditionally used to execute business models, but the curriculum is becoming as comprehensive as that of traditional MBA's. Now the new managerial tools for startups are being taught, discussed and applied by scientists and engineers in MBA and entrepreneurial courses on universities such as MIT, Stanford, U.C. Berkeley and many more [19].

3.2.2 The beginning of a movement

***"Lean**: adjective 1) (of a person or animal) thin, especially healthily so; having no superfluous fat: his lean, muscular body."*

Lean principles were pioneered and developed by the Toyota Company in Japan starting after in the 1930's and more intensely after the Second World War labeled the Toyota Production System. In the western hemisphere we would have to wait until the 1990's before the production methods got their breakthrough with the book "The Machine That Changed the World" [28]. The methods became known as 'lean manufacturing' or 'lean production', adopting the word 'lean' because the underlying idea behind the Japanese success story was to make production process more efficient by reducing waste in the process, essentially cutting everything away that was surplus and do more with less and less. This entails reducing both human and material waste by eliminating redundant or excess activities and expenses, such as reducing storage space and redundant tools by mapping where value is created and seeking to perfect the flow [29].

Lean startup sprung from the IT industry for software startups but its principles are now more broadly applied to startups in general and in internal innovation ventures in established companies [30]. It borrows primary ideologies from lean manufacturing and seeks to transfer the principles manufacturing with minimum waste to innovating with minimum waste.

"The biggest waste is creating a product or service that nobody needs" [3].

Lean startup also evolved from the 'customer development' method proposed by Steve Blank [31]. Generally this is about finding and understanding the potential customers in order to more efficiently innovate towards a product or service that actually has user and customer demand. All so that we do not end up 'creating products nobody needs'. The lean startup movement promises an approach to product development that is a radical improvement over the traditional waterfall models so commonly used in the 20th century to drive product development and grab hold of the market [19].

3.2.3 The Customer development heritage

Lean startup takes a stance and assumes that everything in the business model is a guess. This leaves the startup in a situation where it is searching for a working business model. It teaches us to shift the focus from executing a business model to finding one by maximizing learning throughout the development process. At the heart of structuring this learning process (the search) we find the 'Customer Development' model [31]. To create and gain an

understanding of how the model tackles these challenges and structures the search I will make a brief walkthrough of the main methodology suggested.

In general the framework suggests 4 overlying steps. Steps 1 and 2 is about searching for and validating a business model. In steps 3 and 4 it is about executing the business model from steps 1 and 2. Because of this it is these first two steps that receives the most attention in startup literature [32] and it will also be the two steps I give the most attention in this literature review.

1. Customer Discovery here the founders idea and vision is formulated into a number of business model hypotheses (guesses). Then experiments are formulated and carried out to test customer reaction to the hypotheses. The intent is for the founders to discover an appropriate customer group, a customer problem and to validate whether or not the problem is worth solving [31].

2. Customer Validation test if the business model based on customers and problems discovered in (1) is repeatable and scalable. Basically test if the market is large and open enough for a viable business [26], and if the product is something people want and are willing to pay for [32]. If these cannot be validated the startup returns to customer discovery.

3. Customer Creation this is first step of execution, here things become less circular and more like a waterfall model, striving to build products serving end user demands, drive them into sales channels in order to scale the business.

4. Company-Building at this point the startup should seek to make a transition into a company tuned for executing the validated model.

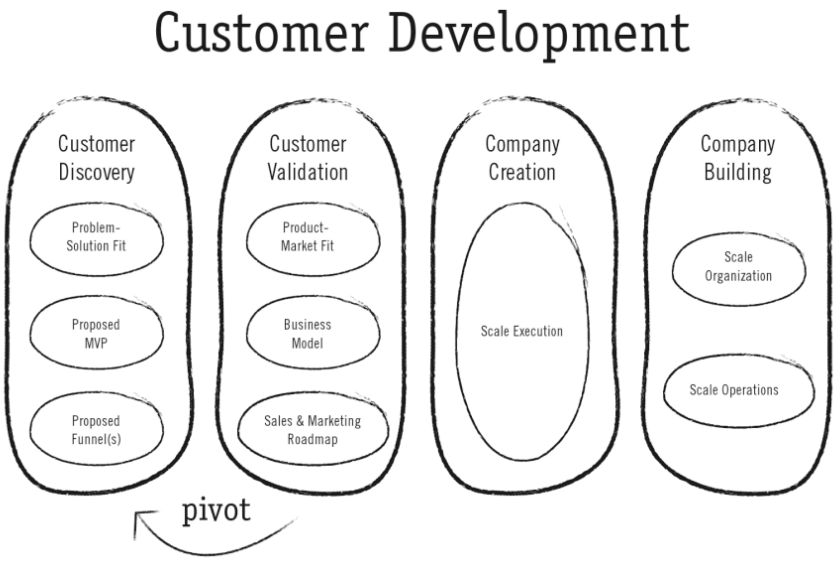

Figure 2 – Overview of Customer Development process model

3.2.4 Customer discovery

In customer discovery phase the company searched for the "problem/solution fit" essentially by answering the two following questions: Did we identify a problem a customer wants solved? Does our solution solve the customer's problem? At the core it is about finding out whether the startup's value proposition matches the target customer segments and if the pricing, sales channels etc. matches with customer needs. First when this is achieved does the startup have a proper problem/solution fit. Doing this can be split into 4 phases for structuring the process [26]:

Phase 1: Break down the founders idea into the nine parts proposed by the Business Model Canvas (customer segments, value propositions, channels, customer relationships, revenue streams, key resources, key activities, key partnerships and cost structure) [33]. This will result in a number of guesses (or hypotheses) for each section. Then the startup team should create analysis for each of the sections, including ideas for tests, experiments and tasks that should be conducted in order to prove, disprove or learn more about each hypothesis.

Phase 2: Overall this phase is about testing 'the problem' Here the startup should conduct the experiments, tests and research identified in phase 1 which most relates to what we think is the customer's problem. This includes testing the hypothesis relating to value proposition,

pricing and sales channels. The goal is to gain a thorough understanding of the customers business, workflow and product needs.

Phase 3: Here the startup tests their 'solution'. Presenting the customers with relevant business model features such as pricing and presenting a minimum version of the product idea to find out if the problem and needs have been understood correctly. The goal is not to sell but to see if a minimum problem-solution fit has been identified.

Phase 4: This is where the startup decides whether or not it is ready to move to part two of customer development 'Customer Validation'. Making an evaluation of what was learned in phases 1, 2 and 3 does this. The startup should verify that it has a:

- A deep understanding of customers problems and needs
- A value proposition which answers to these problems and needs
- Identified that there exist a considerable amount of customers for the product
- Revenue from the business model can be profitable

With this in hand decide if the startup should go out and try to sell an early version to a few early adopters, or if you should go back to customers and learn some more first. On if the startup is successful in Phase 4 should it move to customer validation [19].

3.2.5 Customer validation

In the customer discovery process the different aspects the business model was tested through a relatively small group of customers. This was mostly done through asking questions and in other ways getting quantitative and qualitative data to prove or disprove the business model. In customer validation getting rid of uncertainties is taken a step further by not ask for opinions but for orders.

Phase 1: Is about getting ready to sell. Consists of six activities: product positioning, sales and marketing materials, hiring a salesperson, setting up distribution channels and refining a sales roadmap. The activities are meant to prepare the startup team to start selling

Phase 2: The ultimate test: Validate business model by selling the product. Try selling the unfinished product to customers. Gathering insights from feedback is as important as sales. It is about validating if the business model is repeatable and scalable. Validating all aspects in regards to sales channels, sales roadmap, value proposition, segments, revenue etc does it.

Phase 3: After having made some sales and gathered enough information from customers to properly develop the company and product market position. This position should be tested in meetings with analysts, industry experts and face to face with customer audience.

Phase 4: Stop activity and conduct a detailed analysis deciding whether to proceed or pivot. It's about verifying that customer validation is in fact complete and the company has a good idea about how to scale. Basically it comes to down a simple question "is the business worth doing" [19].

3.2.6 Roundup - Customer Development

Core to the model ideology is that it recognizes the great uncertainty inherent to innovation. The main argument is that the model account for the business plan being based on 'bullshit numbers and assumptions'. To account for it they recognize that everything in the business model is just 'best guesses' and needs to be tested and verified continuously along the way. This is done by getting out of the building and interacting with customers to learn more about them and test our assumptions. Otherwise we will just waste time creating some product without actually knowing if a feasible business can be made from it.

3.3 Build-Measure-Learn

One of the main methodological frameworks used throughout the 'customer development' process is the "Build-Measure-Learn" feedback loop. It is a methodology developed to apply with the philosophy of the two first steps of 'customer development'. In general it's about getting as fast around the loop as possible, in order to test assumptions and gain insights. It is done by exposing assumptions to the real world, observe and measure customer reactions and behavior, learn from your findings and then use the findings to revise your hypothesis if needed. Through the repeated loops Startups learn if they should iterate based on the current idea or if they have to make a pivot.

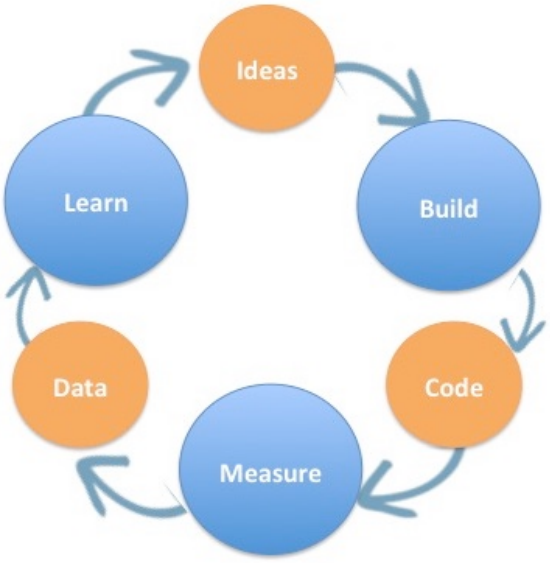

Figure 3 - The Build-Measure-Learn feedback loop

Seeing the diagram for 'build-measure-learn' and hearing the name it easy to get the understanding that the intention is to just build something, more or less at random, then measure how well it works and then learn something from it. Looking into the actual methodology of the build-measure-learn loop [3] becomes apparent that this is not actually what is intended. In fact startups are supposed to build based on wanting to test a hypothesis founded on a specific idea. As so it might be more intuitive to describe it as 'hypothesis-experiments-tests-insights' [34].

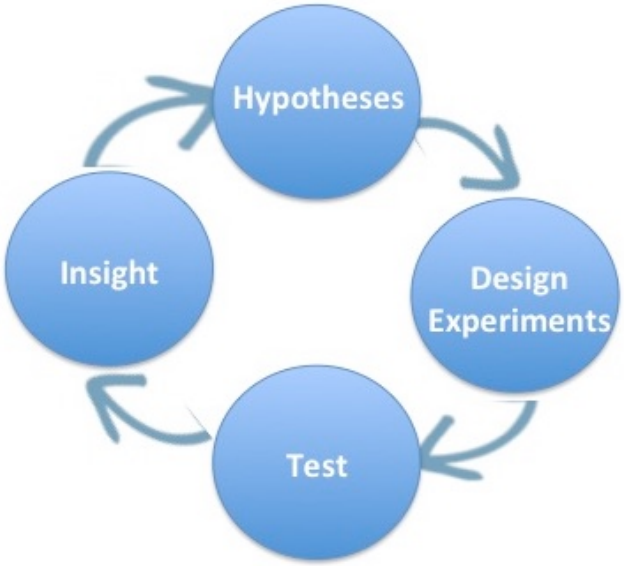

Figure 4 - Suggested interpretation of 'Build Measure Learn'

Contrary to linear product development models where innovators assumed to have an understanding of who their customers and their problems and need, the build-measure-learn loop assumes that we do not know what the customers want before we test it. From this follows that the innovators cannot write a detailed technical requirement specification early in the process and then focus on getting the features rightly implemented. Therefore unlike the linear development models the direct goal of using the loop is not to build a final product ready to be shipped or even a prototype of a product. The goal of the 'build-measure-learn' loop is learning [3]. To gain valuable learning the loop tries to imitate a classical scientific hypothesis based experiment [35]. The loop is used as the guiding methodology in both customer discovery and customer validation, ultimately testing different aspects of the business model and product designs whether to keep going in the same direction or to pivot.

3.4 Generating hypothesis

As earlier established according to the lean startup framework the startup is searching for a repeatable and scalable business model. Alexander Osterwalder and Yves Pigneur defined a business model as how an organization creates, delivers and captures value. They proposed that this could be captured in nine general components shaped into 'The Business Model Canvas' [33].

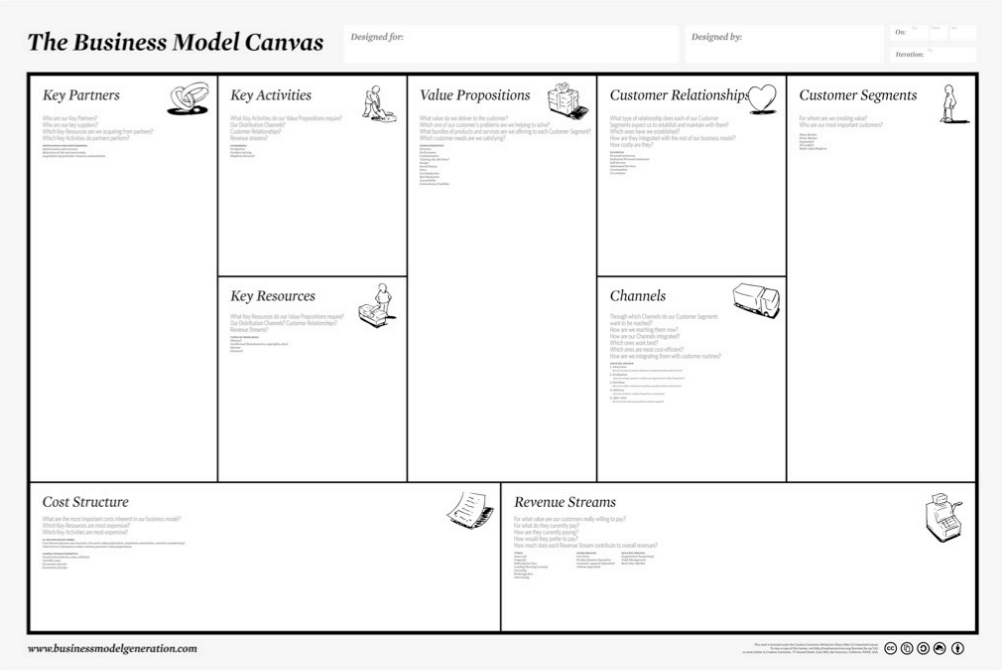

Figure 5 - Business Model Canvas by Osterwalder and Pigneur

The canvas was suggested by Leans startup to serve as a launch pad for the startup to generate and track hypothesis about the product idea. This way the canvas aids to visualize and articulate the uncertainties influential to the current innovation project. This is used as a first step in getting around the build-measure-learn loop.

As a tool to handle uncertainties each hypothesis is going through fail/pass experiments and the startup learns how to move forward [3]. The startup is essentially taking a qualified guess about their customers resulting in a problem or solution hypothesis: who they are, what they want, what their problem is etc. The startup starts by designing/brainstorming their business model by considering each of the nice categories in the canvas. Next each of the nine boxes is translated into a number of hypotheses for customer discovery or customer validation (dependent on the startups current 'position'). It is suggested that the startup updated the canvas in regular intervals, keeping the old canvases as track records for change. In this way new hypothesis are also being generated fitting to the current situation of the startup, factoring in the leanings from earlier.

3.5 Design experiments and testing hypotheses (MVP)

Recognizing that the hypothesis is in fact just a guess the startup seeks to test their hypothesis. What the startup is looking for is a strong indicator whether the hypothesis is false or true, so not necessarily a precise answers, but 'adequate' to move forward with the decision-making. To do this the startup needs to design an experiment, which can test the hypothesis. Exposing the hypothesis to the real world seeking to test the hypothesis with the least possible effort commonly does this. This is the "build" step of the loop, because a minimal viable product (an MVP) is build, to test the hypothesis. The MVP is a core element in lean startup. It's important to really understand that the MVP is not a more scrappy version of the 'real product' with less features. The MVP is the simplest thing you can imagine to test the hypothesis. For example one should not build a webpage to test a hypothesis if the same could be learned from a simply hand drawn sketch or a power point. In other words strive to get most learning with the least effort [3].

"[..] MVP is that version of the product that enables a full turn of the build-measure-learn loop with minimum amount of effort [...]" [3].

As development continues (and if you learn that the idea stays good) it is common that the MVP will have to evolve more and more from low to high fidelity in order to test the hypotheses of the startup. It is proposed that the actual product being developed by the startup should be the result of an iterative, moving forward, agile engineering and design process of MVPs. The goal is to find out if the startup understood the customer's problem well enough to figure out and define key elements in the solution. This helps the team to stay focused on the most important and indispensable features for the customer [19].

3.6 The Pivot

The pivot is a fundamental part of Lean Startup and new customer development. It's a consequence of what is learned in the build-measure-learn loop. *"A pivot is a substantive change to one or more of the 9 business model canvas components."* [36]. There is a Chinese saying that goes "if we do not change our direction we are likely to end up where we are headed". Essentially the pivot is about avoiding to keep heading in a bad direction and change the course.

3.7 Early adopters

The focus on the 'early adopters' originates from the "get out of the building and test" mantra in the Lean startup movement [19]. In order for the startup to tests its hypotheses it needs to get in contact with the presumed customers and users. In essence testing the hypothesis with any type of the presumed users is useful, but lean startup proposes a special segment of users which often are somewhat more desirable to use as 'test subjects' than others: The Early Adopters, also called 'Early evangelists'.

"Passionate, early users of new technology or products who understand its value before mainstream markets. Acquiring early adopters is important to jumpstart product adoption." [26].

They are enthusiasts who will spread the word of the product, they are often willing to test and even buy unfinished and bugged versions of the product, and are in such willing tests cases for the startups MVPs [19]. The Lean startup movement is passionate about the importance of acquiring 'early adopters' of your product. It's a term from the concept "Technology Life Cycle Adoption Curve" trying to explain how new technology is adopted

by users. The concept segments the adoption into five phases and links the adopters in each phase with certain characteristics [37].

1) Innovators — aggressively pursue new technology, often out of pure interest in technology.
2) Early adopters — are the first to pursue technology for its intrinsic benefits.
3) Early majority — rely on benefits of new technology, but will wait for others to work out the kinks.
4) Late majority — not interested in technology per se; waits for established leader to emerge, buys de facto standard.
5) Laggards — don't want anything to do with technology; uses technology when it's without knowledge of its existence.

Moore argues that there is a gap (the chasm) in the early adoption face, which the product needs to bridge before the products starts to become adopted by the majority. Main characteristics of this customer group are that their motivation in engaging the new technology is to solve their (or their companies) problems. They are willing to take a risk and adopt the product without references from other early adopters, because their main concern is to solve their problem. Early adopters have shared interest in the success of your product and they will often freely participate in solving real problems and improving the product. Moore argues that the early adopters are important because they can help bridge the gap [37]. The lean startup movement inherited the ideas about early adopters from Moore and argues that the intrinsic qualities of these are important for tech startups [26].

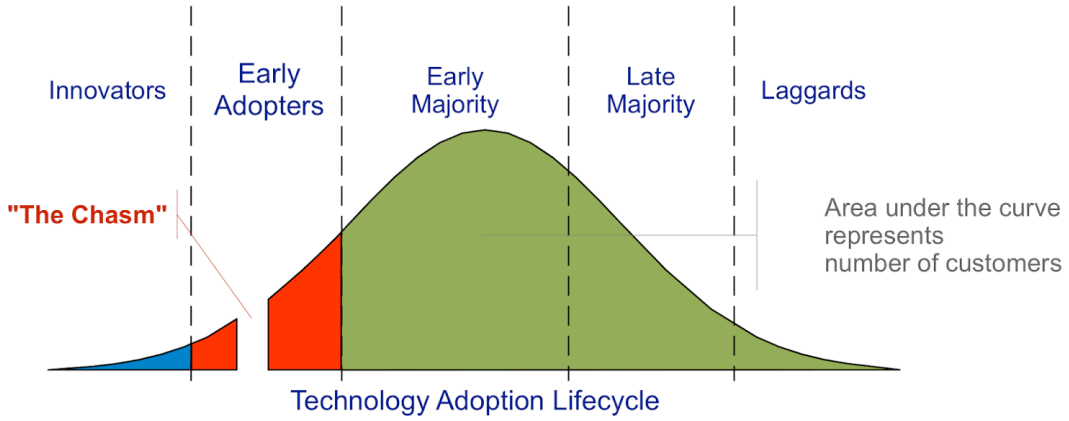

Figure 6 - Technology life cycle adoption model

3.7.1 Early Adopters as business partners

The notion of early adopters in startup literature is mostly targeted towards private customers, however in its original form as suggested by Moore, it is also targeted towards B2B customers [37]. Other literature supports this notion and it is argued that startups, which have a limited record of achievement, trying to get a breakthrough in the market with a technologically advanced product can benefit greatly from collaboration with an established intermediary, such as an accomplished player in the particular market for the product [38]. This relates to the familiar concept of "liability of newness" which claims that young firms will face disadvantages, because they cannot point to client references where they prove their worth. The often costly implications established corporate users will face in the case of enrolling a non-performing product into their business, creates a situation where the exclusive dependence on an unproven startup, is not an acceptable position [39]. This is especially important to capture the large 'early majority' customer group [37]. Such relations to an 'early adopter' can be especially important in dealing in B2B. The early adopter B2B customers can be much more than just willing 'test subjects', but actually function as valuable ambassadors. When the startup is trying to scale into i.e. an international market, it is worth to consider if the early adopter should become a partner for distribution and after sales procedures. Research has shown that having to create very client-specific product customization can act as a strong barrier when startups try to go international with their product, but that when startups sell into foreign markets through a distributor this barrier is weakened considerably [40] [41].

For niche technologies with a vertical customer focus the finite size of the national market, especially true for smaller countries, may call for international expansion in order to make the business model viable. This raises an issue of providing user support outside their domestic market, which requires certain competences and trained staff [42] [43]. This may leave the startup with little choice but to establish relations with a larger company, which can serve as distributor and intermediary. The startup can then 'transfer' these skills and competences of the intermediary, who can then handle handling the customer support [38]. Therefore when time comes it is of great managerial relevance to carefully consider between direct export and sales through distributors [38]. There is not necessarily a right or wrong here and it depends on the nature of the product, generally if the commercialization of the

product is resource intensive, distributors represent an interesting solution for startups to ensure effective customer support and market entry [38].

3.8 Mentors and Accelerators

The startup literature has some focus on advisors and accelerator programs. Accelerators typically accept pre formed teams who have been working on an idea for a period of time, often months or longer. The purpose of the accelerator is to help the startup scale the more wisely and faster. Mentors, capital and facilities are often provided to achieve this. The benefits of accelerator programs can be very valuable to startups and new founders in particular [1]. Many early accelerators were targeted primarily at software startups. Hardware companies deal with specific challenges such as manufacturing, supply chain and fulfillment, which are not associated with software. Therefore it is generally of greater value for hardware startups if the can be accepted in accelerators that have also incorporated measures that can address these needs specific to hardware companies [1]. The mentors/advisors in the accelerator programs often provide great value for the startup and it is encouraged that the startup try to establish lasting relationships with skilled and experienced advisors even without being in an accelerator program [19]. Research has shown that advisors to startups helping small businesses survive can effectively enhance learning. This is due to (if it's the right advisors) the advisor's ability to help solve technical problems, introduce customers and share their business expertise [44]. Some advisors will be especially good in designing and getting products manufactured, some will be more skilled in business aspects and others might have been through launching several startups themselves. Generally having mentors and advisors seems to provide lasting benefits to the startup [44].

3.9 What can we learn from STS

From the viewpoint as an entrepreneur and startup owner myself trying to figure out how to manage my start-up in the best way possible with no prior experience in the field, picking up stuff from the 'Lean startup movement' seems straightforward and promising. But before I take a leap of faith and start managing Spiio using these frameworks, I will make a critical assessment of how they align with findings from STS.

3.9.1 Customer Development vs. Design Thinking

Customer development is a user driven innovation strategy. It bears resemblances to another widely used and accepted user driven innovation strategy 'design thinking'. Design thinking was pioneered and made mainstream in late 1990s and has become increasingly popular in the last decades [6]. The primary driver behind 'design thinking is similar to that of 'customer development' - trying to identify and understand user needs in order to invent desired solutions for them [35]. As with design thinking and user centered design, 'customer development' is focusing on trying to solve complex problems which does not have a single right answer, may change over time and the problem itself might be unknown from the get go. This type of problems is sometimes referred to as 'wicked problems' [45] [46]. The user centered design method has become popular teachings and frameworks for dealing with this type of problems because of academic 'backup' and success in innovation in companies [47]. The repetitive learning through an iterative process, which is both, embedded in the 'customer development' model and 'build-measure-learn' shares merits with the iterative learning process from design thinking [48]. There's a notable difference though that 'design thinking' will start with a problem or a question where as customer development will start will start with a founder's vision and an idea for a product [49]. Fundamentally it can be seen as different, but in essence I will argue that whether or not you start with the idea or the problem, both methods do somewhat of the same thing, they strive to find a problem-solution-fit, just in different order, and ultimately both problem and solution is validated by user centered methods in both cases [35]. As lean startup tries to test hypothesis and gather user feedback using MVP's design thinking uses rough prototypes in order to avoid building something nobody wants [50] [51]. However because design thinking typically starts with a challenge and not an idea [35] there is a user research period in the beginning of the project asking "is there a problem here which needs solving?" [48]. This user research also exists in Lean startup, but it offspring's from a preconceived idea about a solution and asks "does this actually solve a problem for anyone?". The initial user research in design thinking is often an extensive period using methods such as ethnography and participatory design [52] [53]. These activities and methods often become part of what is known as 'The Fuzzy Front-End' of new product development (NPD) [54]. The fuzzy front end has been adopted by companies who are in need of finding a new problem to solve, and not so much bare companies who have an idea they think might be great, like most startups do. Therefore it is

typical that the fuzzy front end is 'put in front off' the ordinary stage-gate execution model for big companies [54], much as 'Customer Discovery' and 'Customer Validation' is put in front of the execution steps 'Company Creation' and 'Company Building' in the customer development model.

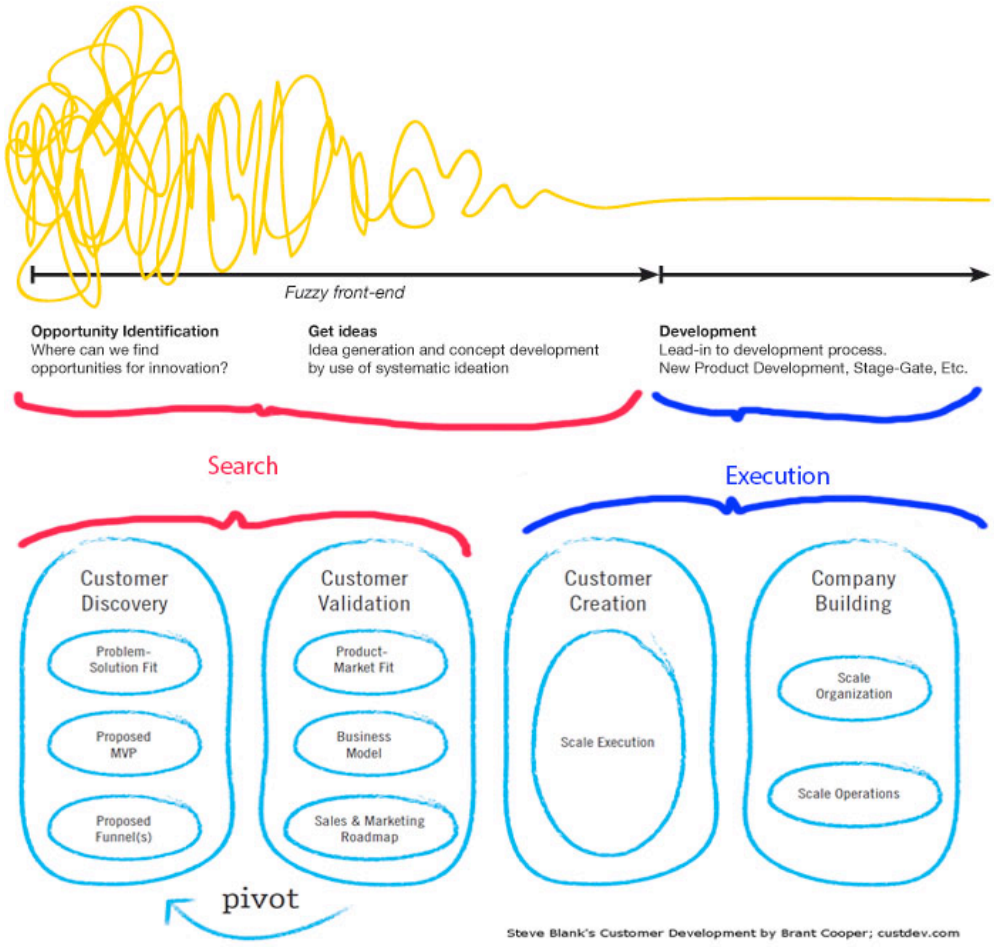

Figure 7 - Similarities between 'fuzzy frond end' model and Customer Development model

It is not rare to see the fuzzy activities go on for a prolonged period of time without any or only little technical development of the problem solution or the business model behind it. A company can assign multiple designers to work for months observing, interviewing and in other ways gaining user insights, but around the time when the implementation of the knowledge is about to begin the product development stops because of technical or market related issues which was not factored in earlier [53] [55]. This sort of hit or miss search is perfectly suited in situations where the process is not engineering driven, and time and money are abundant. It might be more suited in companies who have the resources to put the

foot on the gas pedal and spend millions developing the new product fast when the right problem and solution is found, but who can also take the 'minor' loss of having a few employees searching for some months [56]. These kind of expenditures and manpower is however not a luxury that many startups can afford. Brown [57] claimed there are three criteria for innovations to be successful; it must be desirable (solve a problem), viable and feasible. With the focus on business model aspects (the canvas) and technical driven user tests (MVPs) results is that startups are being forced to consider to 'iterate, pivot or stop' constantly [35]. The MVPs force the startup to develop the technical solution parallel to also creating a business model and doing user studies. I will argue that this forces the startup idea to be tested for desirability, 'viability' and 'feasibility' during the process. I find that this is one of the main strengths of customer development and Lean Startup methodology, since it provides a framework for both product, user and business development, without the need for "ok we got the perfect plan, push the button, develop and manufacture in 3 months" capability of big companies.

3.9.2 Importance of actors

The concept of actor network theory 'ANT' describes a heterogeneous link between non-human and human actors [58] [59]. The social and technical issues are entangled and interdependent. As a consequence the faith of a technology or innovation is heavily influenced by network of actors around the innovation. Therefor trying to build the right network, including and excluding actors, and aligning their interests with the interests of the product can be of utmost importance for product success [4]. Theories and frameworks from STS has been proposed as to how one can ensure that the mobilization of actors and alignment of their interests [2]. In this section I will investigate how the linear models and startup literature align with findings from STS on the importance of actors when innovating.

In the linear Stage Gate / Waterfall domain the view on innovation and the methods related to development is sometimes known as the model of diffusion [4]. The metrics being used to explain, develop and evaluate the success of the product being developed, are all intrinsic qualities [4]. The model for diffusion and intrinsic metrics have been widely used and favored by scientist, engineers and management as a means for evaluating and driving innovation, it has been argued that they only have a weak link with reality [4]. The nature of this weak link is due to a reality where the adoption of an innovation, such as the concept

being discussed, is heavily reliant on the users who are going to adopt it. As described by Akrich, Callon & Latour:

"Adoption of an innovation, whether that of Porvair, the continuous flow method or the installation of a robot, goes through a series of decisions which depend on the particular context within which the innovation is to be inserted. The evaluation of the disadvantages and advantages of an innovation is entirely in the hand of the users: it depends on their expectations, their interests, on the problem which they raise." [4].

In this lies an understanding that the technical object, which is being designed, is subject to constant interpretations and reinterpretations by the actors in contact with it. This is an important part in understanding that the notion of being able to consider the exact situation and socio-technical context in which the concept is being introduced, without exposing it to the actual environment in which it must exist is contrary to what has been found about successful innovations [4].

"Innovation is perpetually in search of allies. It must integrate itself into a network of actors who take it up, support it, diffuse it. And this depends very much on the technical choices made." [4].

The underlying assumption in the startup literature is that the startup cannot assume knowing anything about their customers for certain before testing it in real life, which aligns well with the above. The usage of 'The Business Model Canvas' as a tool to visualize, articulate and share information about what the unknowns are [14]. Through use of MVP's the unknowns are exposed to the socio-technical context and the users who (we guess) are going to adopt it. Exposed to *"the actual environment in which it must exist"* [4] the MVP's acts as boundary objects transferring and translating knowledge between the startup and the users [14]. This acts to strengthen the common understanding of problems and solutions between the startup and the users. Achieving such common understanding can help avoid making technical design choices, which cuts the product from allies [60]. Overall the startup is trying to learn in order to present a qualified answer to the question "Should this product be build?" instead of "Can this product be build".

In startup literature the startup is assigned a role acting as both designer and product developer. From this position the startup can take part in both the discussion and decision making of the product development. This type of position is favorable in order to develop and modify solutions amidst a variety of actors and interests [61]. However, in most of the startup literature I have reviewed there is much focus on one particular actor group; the customers. There are methods to develop the idea of customers and find out who could be 'early adopters' or 'lead users' [62] [63]. The customer development process has considerations four different types of customers: Users, influencers, recommenders, economic buyers and decision makers [32]. STS considers the product being developed to be in the midst of an ever-changing whirlwind process of actors and actants [4]. Here many different actor groups are considered important. This includes financiers, competitors, legislators, and regulations to name a few. Choosing to exclude or include certain actors and appointing the right spokespersons are seen as key to ensure product success [4]. STS research provides tools to handle these specific actors. STS points out that many different actors can be valuable and provides a set of method and tools to ensure alliances [2]. While the startup literature includes considerations for a range of actor groups through the business model canvas, which forces the startup to consider key human resources, key partners etc.. However it does not provide general frameworks to modify the actor network, make alliances, avoid breaking up relations and repairing broken ones such as what is provided by STS [2] [64] [65] [66]. Therefore I do believe that the frameworks provided in startup literature could benefit from some of these suggestions from STS.

3.10 Summary of findings from the literature review

This section is meant to create an overview of findings from the literature review above. I will use a figure to illustrate main differences and similarities identified regarding the different three different product development ideologies: waterfall (stage gate), startup literature, STS (design thinking).

Generally it seems that the linear product development models have some merit when it comes to the more foreseeable iterative innovations, such as when Canon image quality on a new camera or when Intel makes a faster CPU. In these cases the core business model assumptions such as customer problems, sales channels, cost structures etc. are pretty safe and static [22]. Nevertheless linear models might actually cripple innovation success when

venturing in more uncertain areas of innovation, because they fail to factor in the great uncertainties inherent to more 'radical' innovation.

Contrary to this, the models proposed in startup literature and STS are iterative and nonlinear. They assume uncertainty in innovation and accounts for it by applying methods and frameworks which tries to reveal, unravel and create answers to the uncertainties - creating knowns from unknowns - seeking to enhance success in innovation processes.

	Waterfall models	Startup litteartur	STS (design thinking)
Product development philosophy	Linear, technical	itterative, agile, technical	itterative, agile
Business Model Centric	YES	YES	NO
Assumptions about knowledge	Certainty. Being wrong is the exception	Uncertain. Being wrong is assumed	Uncertain. Being wrong is assumed
Begins with	Product idea	Product idea	Search for problem
User Centered	NO	YES	YES
Actor focus	--	Customers. Methods to learn form customers	Many actors groups. General methods to handle actors

Figure 8 - Table showing key differences and similarities of the reviewed innovation frameworks

The literature review also revealed number of key areas for startups to focus on during product and business development. These can be see in the figure below. During the analysis in the report I will attempt to cover these areas using Spiio as case material.

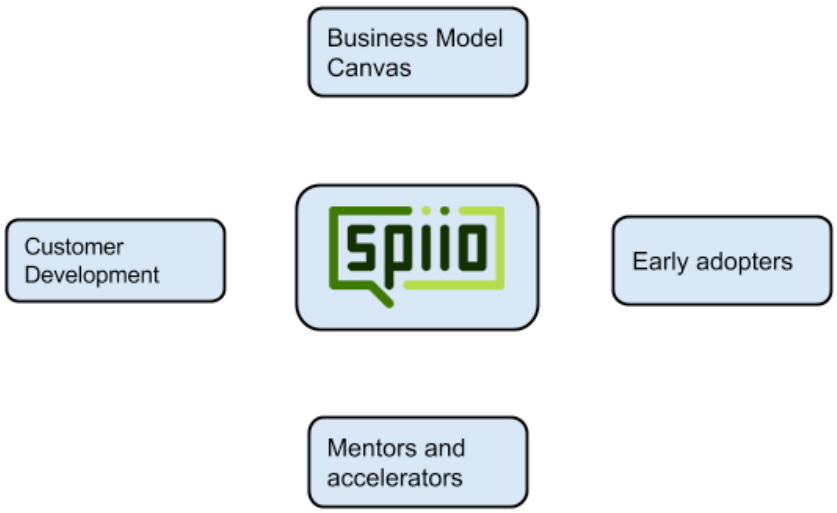

Figure 9 - Identified core areas of interest

As a final comment I will say that generally from my literature review, I find that here is a good compatibility between what I have learned from STS literature and what I have read in the startup literature reviewed here. To me it seems overall that adopting the methods suggested by the startup literature and STS to Spiio seems as a reasonable way to go.

4 The Product Idea

Lean startup starts with founder's vision and founders idea. Like this I will also start with introducing the product idea and its vision. I choose to do this even though the foundation for many design choices will first later be explained during the analysis chapters. The product idea is core to the methodological frameworks provided by the startup literature. Hopefully by providing the reader with an understanding of the product early I will enable a better understanding of the analysis that will be encountered later in the report.

The product it self serves as a vital part of testing our problem solution fit and will later serve as primary component of testing product market fit during customer validation. As a result much time has been spent developing the combined hardware and software product. This chapter gives an overview of what has been developed and why, without going into the technical details behind the design. A report was made giving a detailed technical walkthrough [67].

The design choices have been based on findings from meetings, dialogue, interviews and interviews with management and employees at Decoplant, and as a result of the MVP requirements for testing certain hypotheses. The iteration of technical working prototypes of combined hardware and software has assisted the process of knowledge generation. We have sought to implement the working prototypes in places where the end users would use them in real life situations in order to test hypothesis.

4.1 How the product has changed over time

The product has been iterated over time in terms of purpose, features, functionality and finish. It has gone from being hand soldered breadboard prototype to factory assembled production ready prototype. This is a short description showing some main product iterations.

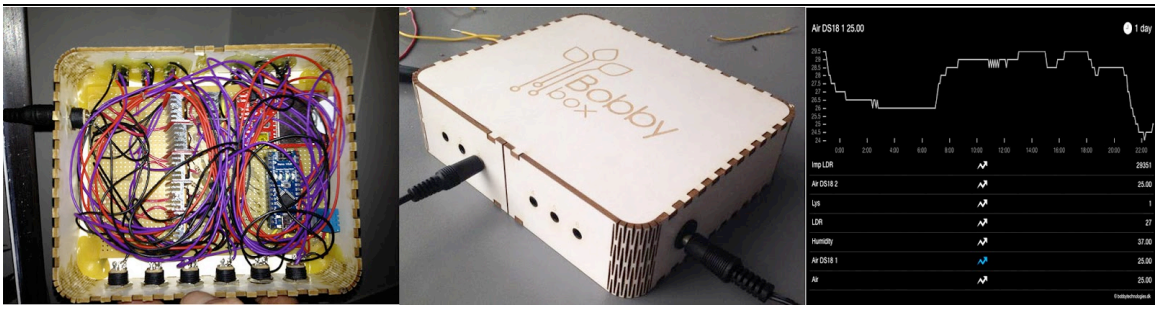

Figure 10 - Combined monitoring and control 'box'. Several sensor inputs with external wires. External power. Simple UI for single unit only. Mostly build as an interessement device and boundary object.

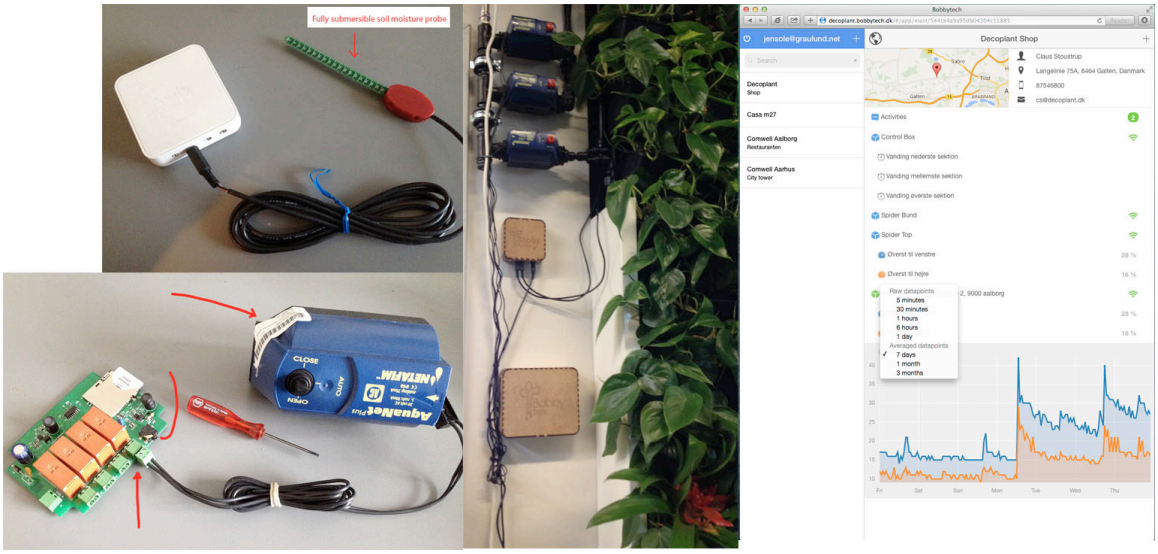

Figure 11 - Separated monitoring and control units (due to valve not in same room as plants). External sensors with wires. External power supply. Advanced 'enterprise UI' with many features. High cost targeting living walls

4.2 Current Product

The current product will be used to test hypotheses described in later the Business Model Analysis' and serve as minimum viable product (MVP). The primary focus with the MVP is to test the problem solution fit by seeing if it answers to the identified problems and the associated value propositions. Furthermore it also serves to give insights about cost and price structure. Will online access to sensor data help our customers reduce amount labor needed to service their customers? Can the data provided by the software to our customer reduce the risk of their plants dying, because they get intelligence to take appropriate action in time? Can the product help the customer gain insights into their own business? From interviewing and doing experiments with Decoplant we have come up with a set of minimum features, which the product should have in order to test this.

Measuring soil moisture, air temperature, air humidity and light level will most often be enough to evaluate if the plants needs to be watered or not. Because Decoplant has almost 2000 customers they find it critical to couple the sensor data with a function, which notifies in advance if plants needs to be watered. So these functionalities have been implemented in the MVP.

Different user groups within Decoplant will be using the product as part of the experiment. These are the service personnel who visit customers, the IT department and marketing. According to Decoplant it is necessary to create different user groups with different permissions - some should be restricted from having access to crucial setup functionalities in order to limit system wide mistakes from individuals. This has also been implemented as part of the MVP. Because the different users use different platforms (computers, tablets, phones) cross platform functionality was needed, so this has also been implemented.

Decoplant has many customers and each customer will typically have more than one plant or living wall, which needs monitoring. Example: 'TDC Skjern' has 14 sensors, 9 of them are grouped in the living wall in the lobby and the last 5 are in various places around the building. In order for Decoplant to navigate in the data from the different sensors we have implemented features so sensors can be named and grouped according to customers and where the plants are.

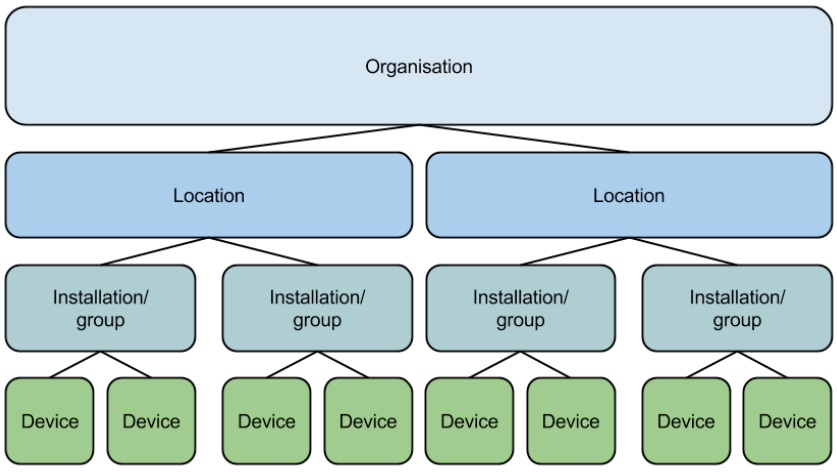

Figure 12 - Overview of how devices can be nested in to groups, locations and organizations in software.

According to Decoplant sharing knowledge between people in the organization is key to optimize their maintenance therefor a logging function has been implemented so comments can be made. Hopefully this can serve as a base for knowledge sharing and replace the vast number of emails they are currently sending to do this. According to Decoplant it will not be possible to install power for every sensor unit, especially not when trying to go large in volume and also monitor individual plants, therefore the solution is battery powered.

4.3 Materializing the product idea

Going from design concepts and product features to having an actual product in hand can be a big task in and of itself. In the early phases of developing the product solution fit a cardboard mockup or a low fidelity prototype using plug-and-play development kits such as Arduino and Groove can suffice. But as the certainty about the problem-solution fit gets better the product must move forward towards something, which can be sold to customers [3]. This is more time consuming and knowledge intensive. On Spiio's path to the current product revision we have been using advanced product development software and test equipment. We have learned how to communicate with Chinese factories using technical boundary [14] objects resulting in functioning products arriving from Shenzhen. The latest results of these endeavors are visualized below. In summary they feature: Only monitoring and no control. Integrated unit no wires to external sensors power. Low cost aimed at high volume targeting both living walls and individual plants. Simple software interface with crucial functions only identified to test problem solution fit.

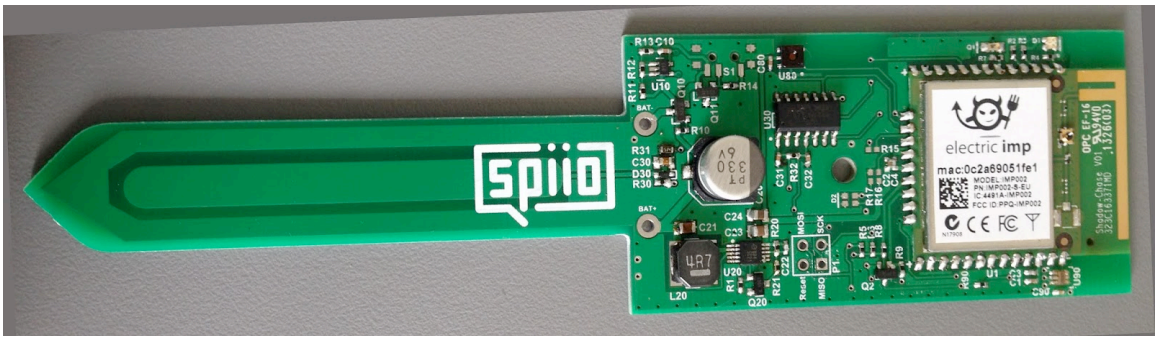

Figure 13 - The digital finger without casing.

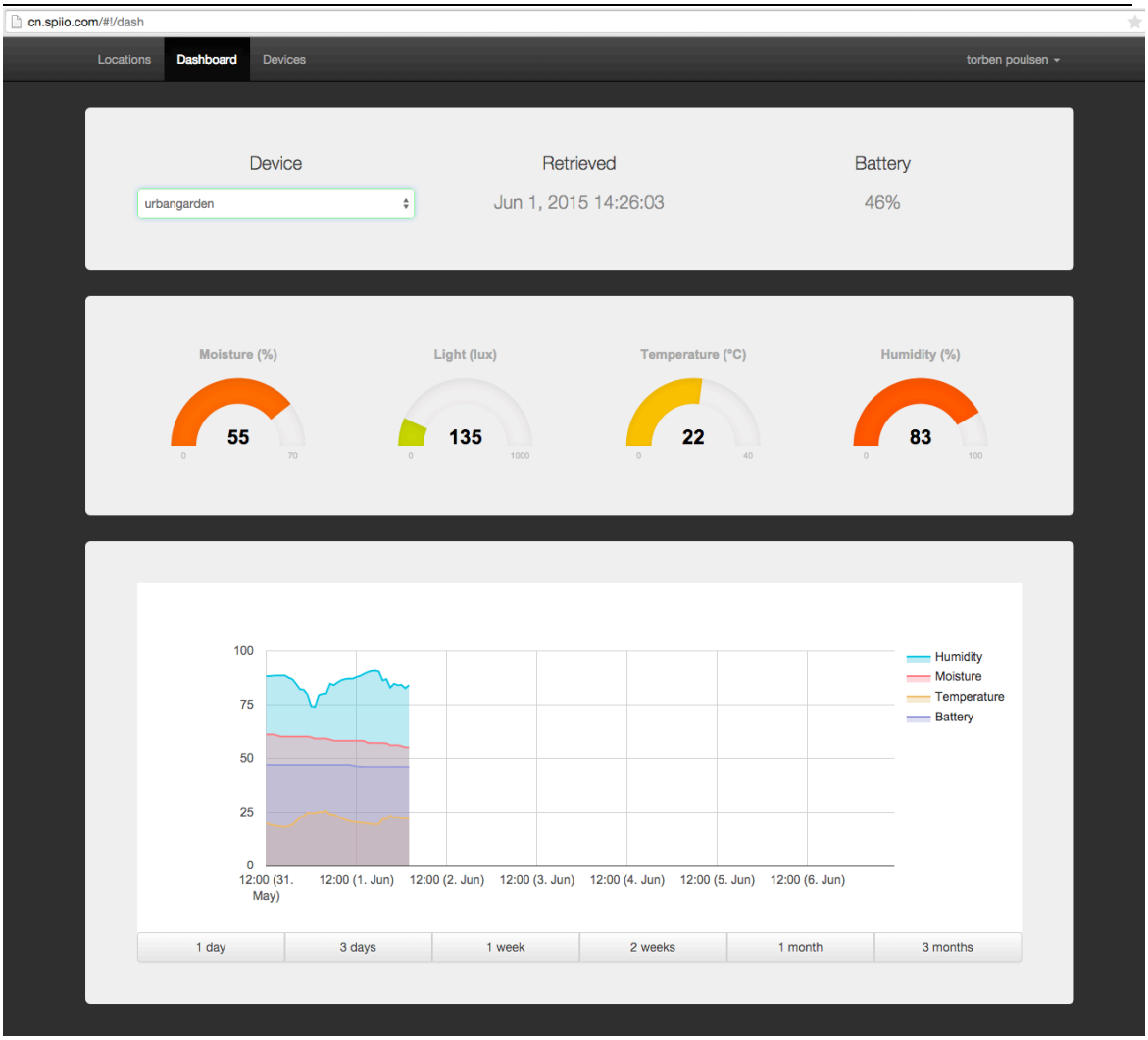

Figure 14 - Screenshot from in-house developed MVP software

5
Analysis - Accelerators and Actors

This is the first of three overall analysis chapters. This chapter is focused on some primary actor groups earlier discussed: 'Mentors and Accelerators' and 'Early Adopters'.

In the first section I will make an analysis of Spiio's situations in regards to 'Mentors and Accelerators'. This will consist of an evaluation of how Spiio can benefit from this. Then I will make a short breakdown of some mentor and accelerator programs offered to tech startups. Last I will describe our strategy for aligning these to our benefit.

In the second and last section I will introduce how and why Spiio's relationship to Decoplant A/S was misaligning and breaking down when this thesis project started. Then I will make an analysis to establish whether or not efforts should be made to repair the relationship with Decoplant A/S. Last it is explained how the relationship was repaired and a new actor network configuration was achieved.

5.1 Accelerators - shaping alliances and securing resources

The literature review revealed the value of having an experienced mentor team and being accepted into the right accelerators. This chapter makes a brief sum up of some relevant Danish programs for startups. Then looks at their value for Spiio. It explains how Spiio sends applications to all but one. Finally during the thesis writing Spiio accepted into one of the programs and has not heard from the rest yet.

5.1.1 Accelerator Programs

Danish Tech Challenge (DTC): Is The Danish Industry Foundations and DTU's accelerator program targeted at hardware startups. It stretches over a four-month period. The accepted startups will move the daily work to a 'co-working' space at Scion DTU. A number of resources will be put at the participant's exposal, including office space, mentoring, relevant courses, prototype facilities and more. Finalists have a chance of winning a prize of 500.000 DKK and/or getting investors. The primary goal of DTC is to help hardware startups accelerate and grow in attempt to increase their chances of success.

Innovationsfondens Iværksætterpilot (IVP): The IVP program invests in startups founded by persons who are on the last semester of their education or who have just graduated. Accepted applicants will receive a monthly pay of 14.473 DKK (for each person the startup who applied) for a period of 12 months and a one-time fee of 34.000 DKK (also pr. person). Additionally the participants will receive mentoring, relevant workshop courses, office and meeting facilities. The IVP program is looking for applicants with potential for growth and creating jobs.

Markedsmodningsfonden (MF): The focus is on customer validation and testing product market fit. MF can help testing the product/service with potential customers by establishing contacts and provide funding. Key focus in MF is to bring the product from functioning prototypes to market introduction. Therefore it is required from applicants that they have a working prototype which has been successfully tested in a demo, lab experiment or similar. At the time of application there must already be an agreement with at least one potential customer who will take part in testing the product. The accepted applicants will be granted money. Small companies will have to provide 40% of the funding themselves and receive the last 60% from MF. The budget must at least be 3M DKK.

Venture Cup startup competition (VC): Venture Cup is a non-profit organization seeking to discover and develop university startups. The applicants are competing for a price of 25.000DKK in six product categories and an additional first price of 200.000DKK to the overall winner. Besides from this VC provides feedback from mentors and training such as 'Learn to Pitch' and 'Learn to write a business plan'.

DTU Mentor Match: As the name infers DTU Mentor Match seeks to match mentors with businesses. It is specifically aimed at startups and young companies. The accepted applicants will receive a team of mentors with experience in different fields of business development. Unlike many other accelerators the program does not have specific entrance criteria. Instead the received applications are screened and presented to the mentors in the program. If mentors find it interesting they can choose to be mentor to the startup.

5.1.2 Applying for accelerators

Given that both Martin and I have no alternative income when finishing school this summer Spiio could use some cash to keep development of business and product going. The literature revealed that advisors with experience generally help startups towards success [44].

Many of the programs offer somewhat the same on paper: some funding and some mentoring or a combination of both. DTC has a really good reputation and is hardware company specific so to Spiio this seems like an obvious choice. There is no direct funding connected to DTC but finalists will be introduced to investors and potential partners. The IVP program also looks very interesting. It is targeted directly towards students on their last semester of education, which is the case for both Martin and I. The funding it provides will allow us to work 100% of our time on Spiio. Markedsmodningsfonden can help put the foot on the gas pedal by injecting some serious amounts of cash. Applying for this Spiio and partners must be able to provide 40% of at least 3M DKK (1.2M DKK). However this does not have to be in cash, work hours and other assets can be counted towards this. Applying for MF requires that the timing is right (or near) for spending large sums of money [19]. VC seeks university startups so Spiio fits the criteria. VC is generally offering less than both DTC and MF, but even the lump sum funding and the workshops could also benefit Spiio. The DTU Mentor Match provides only mentoring, but here Spiio would receive a team of mentors who specifically had asked for mentoring our case, which could mean their level of engagement is high [2].

We ended up spending much time creating applications for IVP, Tech Challenge, Venture cup and DTU Mentor Match. We have not yet applied for 'Markedsmodningsfonden' but have been recommended to do it and are considering it, but we need to figure out we are ready for it before due date which is mid august 2015. We have tried as best we could to 'lobby' for our applications by trying to establish relevant actors with ties to the different programs as our spokespersons [4]. Hopefully this has increased our chances of being accepted.

5.1.3 Results on applications rolling in

UPDATE: In mid April we got accepted into the Mentor Match program. Five mentors saw our case as interesting and would like to be our advisors. The team consists of a managing

director at a full service strategic agency specializing in design, engineering and production. Another is director at KPMG specialized in small and large companies. One is doing business development management at Philips. Another is specialized in business development of hardware companies and the last has a top position at DTU Scion.

So far the mentor team has been very helpful to us by shedding their expertise on us. We realize that keeping the mentors active and interested in our case could prove of great value to Spiio [44]. Therefore we have put efforts into 'bringing something to the table' and 'showing commitment' in order to keep the advisors interested and enrolled [2]. We have done this through acting fast and effective on for instance 'homework' they assign to us and in general been responsive and showing dedication. So far it seems to have worked, on a meeting with the lead mentor he told us (unprovoked) that the mentor team had been impressed with our dedication and how fast we acted. Given how valuable the advisors seems we should keep on trying solidifying our relations to them and potentially finding new advisors.

UPDATE: In late may Spiio received an email explaining that we had moved to next round of DTU Tech Challenge which is 'screening meetings'. The screening will be on June 17th.

UPDATE: Spiio did not move on to become a finalist in Venture Cup.

5.2 The early adopter - Decoplant A/S

5.2.1 Misalignment in the network

When writing of this thesis started in February 2015 the good relationship between Spiio and Decoplant was beginning break down. I will start the following by explaining what led to this break down.

As a part of the user centered design process we had installed a couple of low-fidelity prototypes on living walls in Decoplant's HQ. After a short while Claus the owner of Decoplant called Spiio. He was excited about the product and wanted to buy 10 of what we already had installed at their living wall. We agreed to this but suggested that we would try to get units produced by a factory and that Decoplant would pay a for the Devices to cover the production costs - first half up front, second half on delivery. With this small batch of units

we wanted to see if Decoplant could actually use the product as hoped when it was moved outside the safe heaven of their HQ and installed on living walls at their customers. We had not set on a strict deadline for delivery of the hardware to Decoplant but we had made some loose assumptions about when we could be ready. At this time we had zero experience with getting hardware fabricated and it took longer than expected before the hardware arrived from Shenzhen and we could deliver it to Decoplant. In the meantime this had created some frustration and anxiety for Decoplant who had become pressured by outside circumstances "rumors that their main competitor was developing something similar".

Finally we receive the hardware and deliver it to Decoplant. Shortly after Lars from Decoplant discovers some significant inconsistencies in the measurements provided by the devices. In Spiio we started a process of finding and correcting the error on the devices. Meanwhile we discover that Decoplant was holding the second half of the money back. At this point it becomes very clear that Decoplant and we had very different understandings about the nature of our relationship and what they had paid for. Martin and I had thought it was clear that it was a product development phase and discovering technical issues was a rule rather than an exception. Decoplant on the other hand had a clear understanding that they were buying a product working out of-the-box. Nevertheless a month or so later we have fixed the issues with the hardware and receive the second half of the money. But the situation had impacted the relation to Decoplant in a negative way, and this was especially true in regards to the guy who had developed our software (At this time the software we and Decoplant were using had been created by Martin's dad who has his own 1-man software company IT2Go). The misalignment of expectations and interests were beginning to destabilize the network [4].

From this point in time the intensified mistrust and dissatisfaction with the relationship between Spiio and Decoplant was mainly concerned around developments (or the lack off) on the software front.

In reality there was no lack of development on the software. IT2Go had been working all along creating a competent software platform on our development servers. However IT2Go never released any of these updates to Decoplant.

So why didn't IT2Go release the software? Well at this point in time IT2Go had created a personal grudge towards our contacts at Decoplant. The grudge had been buildup along the way by what may seem as pedestrian circumstances. IT2Go felt that Decoplant 'demanded' things instead of asking politely, and that they displayed a 'bad tone' in email and conversations. And last but not least when Decoplant withheld money the grudge, and hence the misalignment in the network as a result of non-heterogeneous interests between the actors [4].

A couple of times during this time period we at Spiio would suddenly receive a phone call from Decoplant desperately explaining that they all of a sudden could not login to the software. When we contacted IT2Go to resolve the issue, we would find out that their user accounts had been banned as an act of 'terror' as IT2Go explained. Getting IT2Go to open the accounts backup was uncertain and took several days every time.

The situation was beginning to take to much of a toll mentally on Martin who was trying to deal with his father on both a professional and personal level. Furthermore the interests which was embedded into the technology was becoming increasingly misaligned and as a it was increasingly destabilizing our relation to Decoplant [4].

At this point in time Martin and I decided to put the relation with Decoplant on hold while we tried to figure out what to do. We had explained to them, that unfortunately at the moment we could not do anything to reopen their access to the software and we would start building our own and they would simply have to wait for that. And if speed was imperative to them they should start looking for other solutions than Spiio.

It was now clear to us that this was not a lasting situation. It also seemed that creating a lasting and stable network configuration between IT2Go and Decoplant A/S was not a viable option. Thus we were facing a tough question: Exclude Decoplant or IT2Go? Or framed otherwise lose our software or our first customer and user input?

5.3 Decoplant - Exclusion or Inclusion

In order establish an informed basis for making this decision I sought to analyze how important Decoplant was to Spiio as an ally and an early customer, drawing on the findings from the pre-analysis.

The value of ‘acquiring’ early adopters [37] is stressed in the customer development framework. Accordingly every industry has its number of visionaries who are willing to take a leap of faith and buy a product before it is finished. The characteristics of early adopters: they have a problem or need, they understand they have a problem, they’re actively searching for a solution, the problem is so painful that they have tried to make their own solution, they have committed or are willing to commit money to do a purchase [19]. So far Decoplant has been aware that they have problem: They do not know how their plants are doing before they sent someone to check on them and put a finger in the dirt - this is inefficient and expensive.

Before we met Decoplant they had been actively searching for a solution, but had not found a proper one. Therefore Decoplant had actually started to develop their own online sensor and watering solution at the time we met them. Decoplant has shown willingness to pay for the product and they indirectly and directly expressed that they have money in the budget for the product.

Early adopters can be relied on for valuable product feedback and early sales and help to test some of our business model hypothesis and the problem solution fit [19]. Spiio experienced just this with Decoplant who has shown a strong interest in the product being finished and ready for them to use. They have invested many hours into using the prototypes, provide us feedback and attend in interviews and design games [60]. Moore argues that early adopters are needed onboard in order for the product to be acquired by the majority of customers, because without the early adopters the majority of users will not dare to take the chance and buy something ‘new’ from an unreferenced supplier [37] [39].

On earlier occasions Decoplant had mentioned that if we were interested they could become distributors of our product to their ‘peers’ in Europe. Having an established player in the european market for indoor office greening use our product and sell it could establish Decoplant as more than an early evangelist but also as an ambassador for our product [68], helping to surpass the ‘liability of newness’ which sticks to a startup [39].

From the above it is seems that Decoplant classifies as an early adopter. As result they can prove to be of great value and play part in a number of Spiio's activities: Designing the product (feedback, design games, interviews, interaction with prototypes)

- Testing the problem-solution fit (implementation of solution in Decoplant's daily routines)
- Developing our Business Model hypotheses (we gain insights about workflow, problems, pricing etc.)
- Potential sales partner.
- Reduce our liability of newness
- Generate early revenue to Spiio

Realizing the value potential of Decoplant to Spiio the conclusion from the analysis was that Spiio should engage in activities to re-establish the relationship to Decoplant. However due to the personal 'angle' of the story relating to IT2Go being Martins father we were still not fully sure that we would keep on working with them. But then something happened: While Martin and I was in the process of doing above analysis and deciding what to do with Decoplant and IT2Go we had our first mentor meeting as part of 'DTU Scion Mentor Match'. When the mentors heard about the development with Decoplant they all agreed that getting back with Decoplant was probably a very good idea. Mending the relationship should help test product, have a strong reference to other potential customers, to not make enemies and to use Decoplant as 'Proof of concept' if we wanted to convince and attract investors or partners

The mentors created a convincing argument which 'put the nail in the coffin' in regards to whether or not we should continue with Decoplant and we decided to see if we could re-establish the relationship with Decoplant.

5.3.1 Rebuilding Alliances and Breaking Up Old Marriages

5.3.2 *The Battle Plan - Reconfiguring The Network*

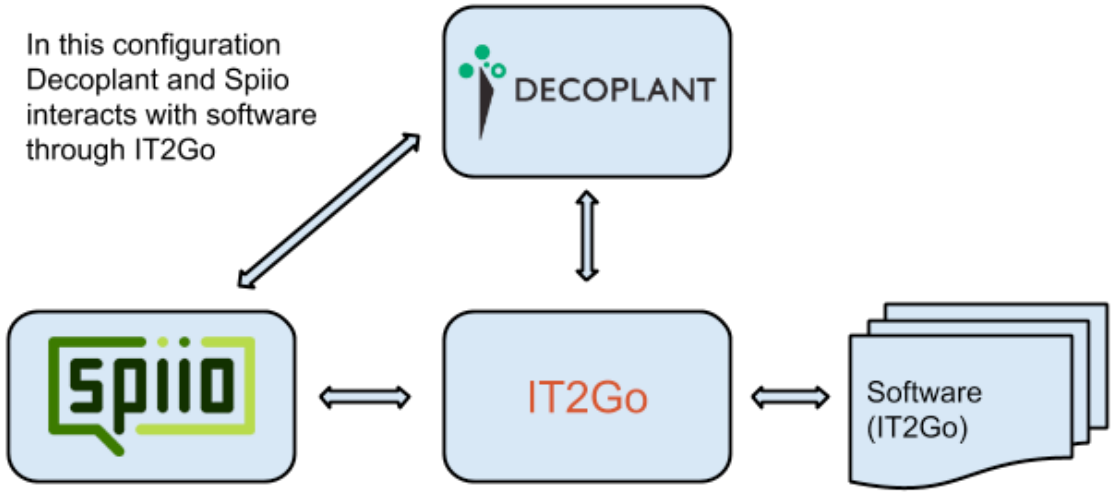

Figure 15 - unstable actor network configuration

The gridlock caused by Spiio's dependency on IT2Go's software and the personal difficulties experienced between Decoplant and IT2Go, made rebuilding our relation to Decoplant an exercise in network reconfiguration [65]. We had to establish Spiio as an obligatory passage point for interacting with the software and remove IT2Go from that same position [2].

The advice from the Mentor team was to clarify our options in regards to the software IT2Go had developed: Find out if we could work out a deal with IT2Go to use his software, possibly in trade for some equity in Spiio, but without him being involved with customers or actual decision making about what gets developed or not. After gathering intelligence about possibilities relating to IT2Go we should proceed to contact Decoplant and see if we could come to agreement on a continued collaboration. In regards to Decoplant they advised us to have a clear non-disclosure agreement with Decoplant and only take money from them with a very clear common alignment of expectations.

Martin and I took the advice and created two plans, A and B:

Plan A: Repair relationship to Decoplant. Make them use the software we developed in-house.

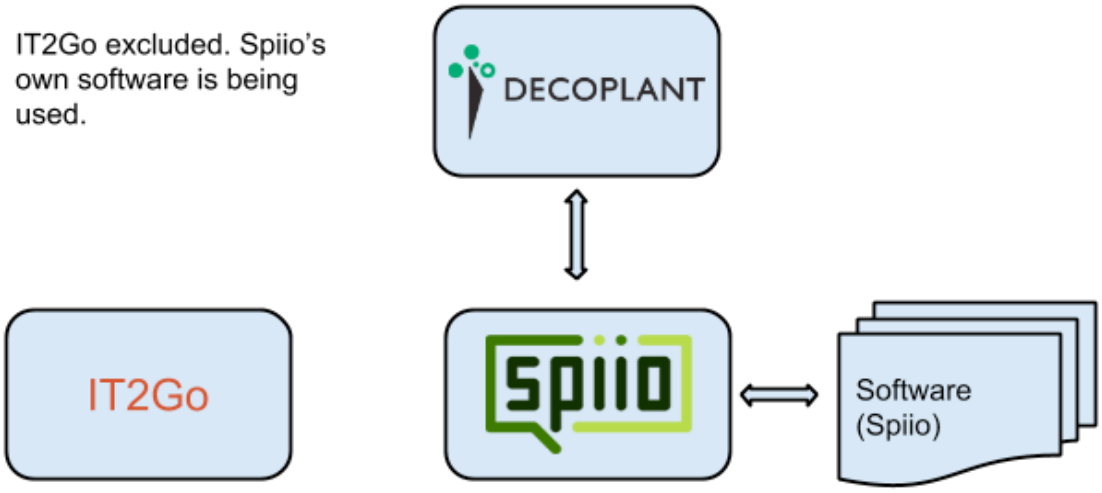

Figure 16 - desired actor network configuration

From a design perspective ditching the old software and starting with new software developed in-house was probably a good thing. Many design in the old software had been taken by IT2Go without us having much or any ability to influence it. This meant that, even though Decoplant displayed satisfaction with parts of the software, there was a still vital part, which they (and we) asked for that was never implemented. The situation with the new software was radically different. With the development in-house we had the ability to tailor the software, as we liked responding to what we learned and the insights we gained our customers. however Decoplant had grown fond of the old software, which was at professional enterprise software level the technical side. As a result we were not sure whether or not Decoplant would at all be interested in using the very early-stage software we had developed in-house. Therefor a Plan B was made:

Plan B: Repair relationship to Decoplant. Use IT2Go software to stall situation while we develop new software in-house.

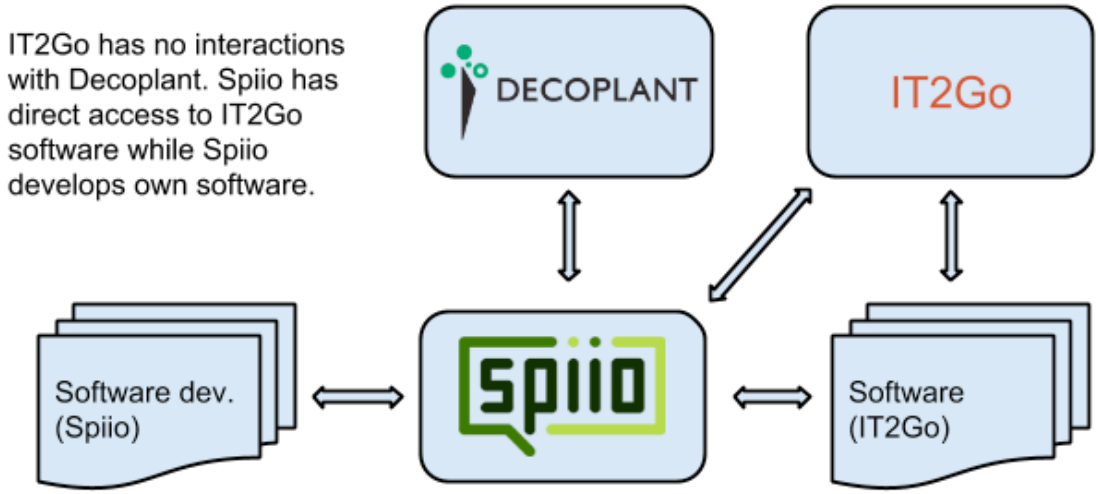

Figure 17 - Plan B actor network configuration

The plan was to arrange so we had the IT2Go software in the backhand if it proved absolutely necessary in order to repair the relationship to Decoplant. Then use the old software to keep them satisfied until we had come far enough with developing our own software. For Plan B to be successful, avoiding the network from breaking down again due to personal differences between IT2Go and Decoplant was paramount [2]. Therefore we would have to align the network in a way where IT2Go and Decoplant had no interactions with each other. Also we would arrange a clear deal with IT2Go that no software updates, closing of accounts or anything would happen to Decoplant's end of the software without Spiio's full understanding and consent.

5.3.3 Plan In Motion - A New Beginning

Even though Plan B was a secondary choice we would have to make the needed arrangements with IT2Go. We tried to do this, but we could not come to an agreement with about renting or using the software. So when we called Decoplant we had to rely on Plan A only. To our relief they were happy to hear from us. They told us that 'they had nothing else to substitute us' and that they had hope to begin working with us again.

A few days later we had a meeting with Decoplant at their HQ in Galten. At the meeting with Decoplant we presented the early stage software we had developed. We had built the

software as an MVP trying to test what still was what we considered to be the main to test hypothesis at this time: “Decoplant can optimize their maintenance routines via the data we provide them from our ‘digital finger’”. To our liking Decoplant was not at all disinterested because of the new software situation. On the contrary they had been of the notion that IT2Go was the reason for all the delays and mishaps, and now with Spiio fully in control of both hardware, firmware, backend and frontend they explained that they felt allot less uncertain about the faith of the project. Now we explained that we and they would be interested verifying or debunking the hypothesis that they could actually maintain their plants and make savings based on the proposed problem-solution-fit. Decoplant agreed with this and together we defined a limited set of features, which would have to be there in order to make the test.

Up until now Decoplant’s problem focus and our problem solution had been very focused on monitoring and maintaining living walls. At the last mentor meeting we had discussed that as well as Decoplant could benefit from monitoring the living walls they should be able to benefit from monitoring some of their smaller installations such as ordinary potted plants, trees in lobbies etc. Developing our solution to fit this product segment would dramatically increase the market size for our product. By Deco Plants own numbers they only had a couple of hundred living walls. In contrast to this they have more than 1800 customers each with multiple smaller plants. We asked Decoplant what they thought of the idea. They had some initial concerns about pricing but it seemed that the monthly fees and one time prices they would be able to pay would also make sense in our business model. Resulting from this we arranged with Decoplant that during June, after Martin and I had turned in our bachelor's project and master's thesis we will start deploying measurement units and start hypothesis testing.

5.3.4 Summary of ‘The early adopter’

Resulting from the analysis we aligned actors so that a stable network configuration benefitting Spiio has been reached [4]. The meeting with Decoplant to repair the relationship went well and both parties seem excited to be together in the project again. To reach the stable configuration of actors we had to exclude IT2Go along the way [66]. Resulting from this Spiio is now building its own software and is now in full control but suffered a ‘setback’ being further from a release version, but hopefully the finished version will be better due to

being based on a more user centered design methodology. Maybe most importantly of all Martin is no longer under mental strain from the complex family-professional configuration and him and his dad still have a good personal relation and socialize regularly.

6 Analysis - Business Model

This is the second of three overall analysis chapters. This chapter is focused on analyzing Spiio using the business model canvas.

First I will use the business model canvas to develop and dig into Spiio's business model hypothesis and make suggestions for Spiio's next move. This sheds light on uncertainties so experiments and measures can be taken to account for them. Last I will summarize findings from each section of the analysis.

The analysis is structured in following sections: 'customer segments', 'value proposition', 'channels', 'customer relations', 'revenue streams and costs structures', 'key activities and key resources', 'key partnerships'.

Each section starts with a brief summary of the most important hypothesis changes and what led to them.

Following is a more thorough analysis of Spiio's current situation. Some of the analyzed aspects will be concluded with a hypothesis and pass-fail experiments (MVPs) to test the hypothesis, while other aspects will be concluded with a more general guideline of what Spiio should pursue in order to identify hypothesis for these areas and create pass fail tests

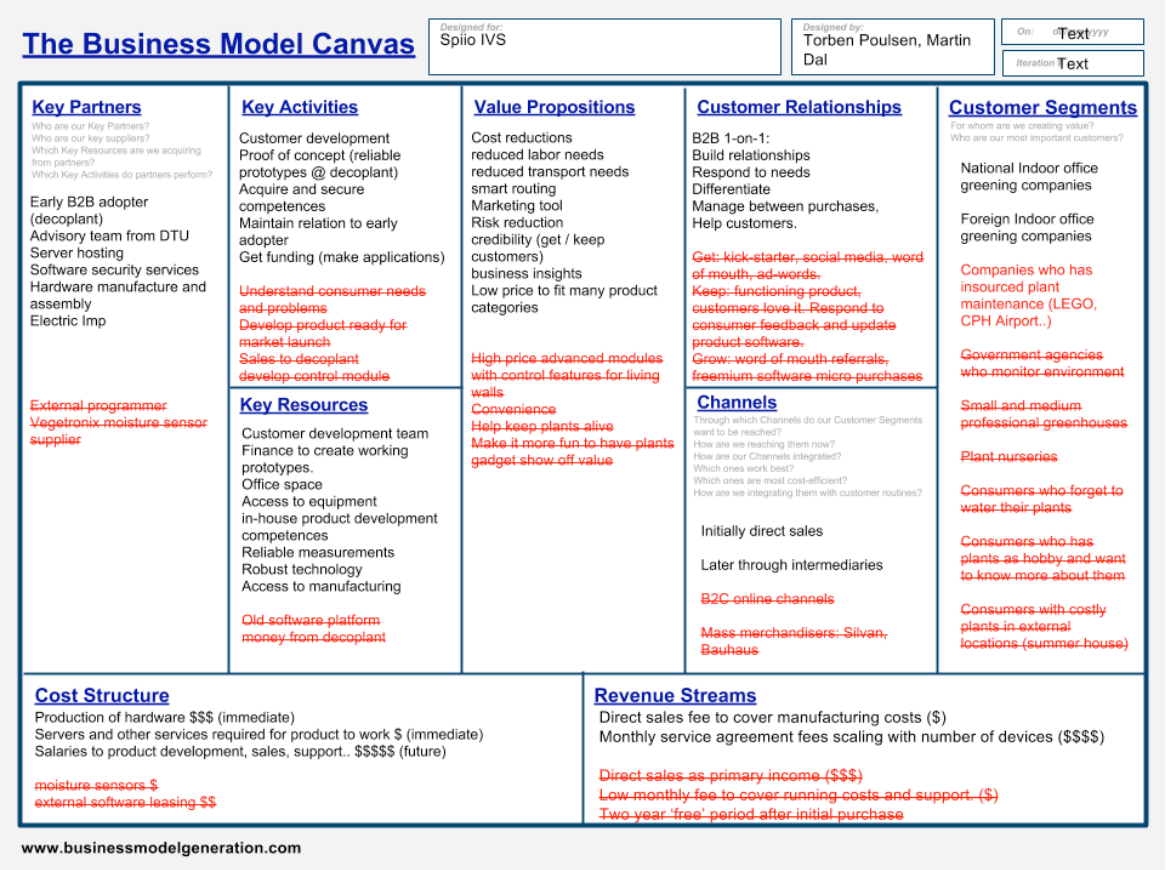

Figure 18 - Business Model Canvas, Spiio June 2015

6.1 Customer Segments (CS)

6.1.1 Pivots in Customer Segments

Due to the bad relationship with Decoplant and It2go when this thesis writing started, we were focusing on exploring new customer segments. In the B2B segment we contacted owners of commercial greenhouses. The result was that we could not identify meaningful parameters where we could positively differentiate our offerings from the competitors leaving us with a poor chance of successful market entry [26] and therefore we pivoted away from this segment also, realizing that the customer segment we had first identified proved the most promising.

6.1.2 Customer Segments Analysis

We have only really been in contact with one specific customer about problem solution - Decoplant. Decoplant has an idea for solving the problem, they were in the act of creating a solution when we met them, and they proved prepared to pay for a better solution than their

own. This type of problem recognition fits the description of ‘a vision’ on the ‘problem recognition scale’ [19], and as thus the organizational impact of the problem and the pain it causes appears to be substantial.

The problem experienced by the company (our customers) has direct impact on their revenue and profits. Claus from Decoplant explained that not knowing how their living walls where doing and if they were being watered correctly was stressful because a wall dying could cost in hundreds of thousand DKK in new plants and it would look bad to Decoplant’s customers. This brings some aspects of the problem into the ‘mission critical’ category and might even cause our customers to ‘lose sleep at night’ [26]. These are characteristics of problems, which with the right problem-solution can be an opportunity to capitalize for the startup [19].

As seen in our current business model canvas Figure 18 - Business Model Canvas, Spiio June 2015, Spiio’s main customer segment is service providers of office greening. The companies primarily base their earnings on monthly service fees as part of a product-service agreement. They deliver plants to their customer’s offices and ensure that they stay healthy and green. On the canvas we segmented this of customers into two categories: National companies mainly operating in Denmark and companies who are operating in other countries. We have gained insights into understanding the national customer base in Denmark. We know there is a bunch of companies competing for the market, such as Decoplant A/S, ISS Planteservice, Grønning Plantemiljø A/S, Deichmann Planter ApS, Jydsk Planteservice A/S and more. The bulk of these companies are small and medium sized businesses. From calling around to a few of them, they all seem to have the way they operate in common and the general business model is the same We assume that the other national players have some of the same problems as Decoplant. Also we have assumed that given the other Danish companies have the same problems; they would also be interested in buying the same solution and thus be our customers. It is important to recognize that this is assumption, guesses, hypothesis, which should be tested. The same is true for the ‘Foreign market’ companies. These are the Decoplant and Deichmann of Germany, Holland, France and so on. We know that office greening is big in most of the world [69] and we assume that in EU at least, because salaries are high there will be a range of companies experiencing the same problems as Decoplant who could be interested in buying our product. Again these are hypothesis, which needs testing.

Hypothesis (CS National customers): A fair share of the Danish office greening companies are facing similar problems as Decoplant and could benefit from the product we are creating to alleviate their problems.

Hypothesis (CS Foreign customers): There is an international market for our product. In accordance with lean-startup [3] we should now test these hypothesis by creating experiments and 'getting out the building'.

6.1.3 Designing the experiment to Hypothesis (CS National customers)}

How to contact customers: On the surface testing the hypothesis requires a simple 'get out of the building' approach and confront a number of the Danish office greening companies. We want to get an idea of the urgency of the problem. Is it as with Decoplant perceived as a high priority mission critical problem, which they have already allocated resources to solving? Or is it seen as a more passive problem, which they aren't motivated to solve or are not aware of the opportunity to change it? Is it even seen as a problem at all? If there is a problem do the customers agree with the problem-solution fit?

There are several ways of reaching out to the potential customers ranging from simple phone calls over face-to-face interviews to 'selling before buying' [26]. It is argued that picking up the phone may be necessary due to geographical circumstances, but that it otherwise often is the method that will yield the lowest quality of insights. It hinders observing physical and emotional initial actions and reactions to what they are being presented. Observation such as do they bring a colleague in? Do they lean forward and speed talk? Can hold valuable hard to quantify insights which will not be learned through the phone [70].

Selling before building' can be an effective: are customers actually being willing to pay for the product? However it has potential downsides: Firstly getting "no not interested" from a potential customer who does not see the need for our current problem-solution gives insight but also inhibits from learning the direction of a potential pivot.

Secondly when establishing a seller/customer it is likely that the customer will be less willing to give detailed honest feedback about pricing, competitors, internal processes, business model etc. Spiio experienced this with Decoplant earlier trying to figure out how to price the product; it was a very secretive and un-open process, since Decoplant had financial interest in

keeping our price down [26]. We have experienced that contacting people presenting your self as students seeking to learn more about this or that often renders good results.

Avoiding destabilizing the network: Contacting Decoplant's competitors might upset them. We know from Decoplant that this is true since they mentioned on many occasions that they dislike us sell the product to their competitors. Earlier the value of having Decoplant as an ally was established, therefore we should be careful to not damage the relationship and create mistrust. This poses a tough question, should we try to confirm this hypothesis to learn more of the business model feasibility by contacting other potential customers or should we leave it unconfirmed for the time being in order to ensure the stability of our relationship to Decoplant?

The experiment (suggested next move): My suggestion would be to start out by gathering insights and testing the hypothesis in foreign European markets. Establishing whether or not there is a market here will have influence on how important it is to find out more about the other Danish market actors, although the learning effects from intermediaries may be more easily gained in the domestic market and potentially at less costs [38]. This approach leaves possibilities for action open without closing doors yet [3]. Furthermore I would suggest that when/if contacting Decoplant's competitors on this matter Spiio should conduct interviews.

6.1.4 Designing the experiment to Hypothesis (CS Foreign customers)

The experiment (suggested next move): The learning goal here is more or less the same as for hypothesis one: Does companies in other countries experience the same problems as Decoplant and do they regard our proposed product as a solution to the problem. One potential way of gaining insight might be talking to Decoplant. We know from earlier that they suggested distributing the solution to their 'colleagues' in EU, indicating that Decoplant assumes that the European colleagues have the same problems. Talking about this to Decoplant could give us a better understanding of on which basis they make this assumption. More to the point is making a list of customers in foreign markets and then start contacting them. This could be a combination of calling and sending emails to see which yields the best response. Dealing with customers in foreign markets it is of course important to be aware of language barriers and try to find someone who can communicate adequate in languages which Spiio masters. The nature of the inquiry should start with a discussion of the problem

leading into discussing the problem-solution fit [31]. Optimally this would be in a face-to-face interview as described earlier. I suggest trying to find a suited prospect. Call them first, get initial reactions and then try to arrange a meeting if the reactions speak in favor of this. Subsequently a Skype interview or the like can give some (but not all) of the benefits of face-to-face meetings without the same economic and time barriers related to long travels.

6.2 Value Proposition (VP)

6.2.1 Pivots in Value Proposition

After pivoting away from consumers and greenhouses and back to office greening as main customer segment we updated our value proposition. Up until now the focus for our value proposition in regards to office greening companies had been focused on providing equipment to maintain living walls. On the first meeting with our mentor team we realized that the amount of living walls was considerably smaller than the amount of normal potted plants and trees sold and maintained by our customer segment. Therefor providing a solution which could be technological and economical feasible for our customers to adopt to a larger range of their product offerings could dramatically increase the volume of our sales. This new focus would also make it feasible for us to zoom-in and pivot away from also providing a control module for scheduling watering of living walls online.

6.2.2 Value Proposition Analysis

In order to understand how we solve the problems and offer value it is important to understand the main features of the product idea: Our specially designed wireless sensors gives the possibility to, no matter where you are, measure and visualize humidity, temperature, soil moisture and light intensity - all vital parameters which tells if he plants are thriving or hurting. With the sensors and accompanied software solution we help the gardener arrives at the plants when they need it. Combining this with intelligent route optimization and customer integration, the users of our product can hopefully make great savings on labor- and transport costs while also being sure, that their plants are green and well. We believe that the suggested solution offers a number of different value propositions, some being more valuable than others to our customer [57] and they have been ranked to some degree according to the value they propose to our customers.

6.2.3 Cost reduction

In the eyes of our customers this is the most important way we create value. The reduced costs would come from optimizing the maintenance routines of the service gardeners to be based on facts and not on guesses about when plants needs to be serviced. Also optimizing routes and customer distribution for the driving service gardeners could prove a valuable time saver. It is imperative to understand that operating in a low margin industry with very high labor costs every percent reduction in labor costs has a significant positive impact on the company's profit. Furthermore online information about plant health will hopefully result in less dead plants and hence less costs to replace these. Also the visualization of which plants need attention and when, might enable the company to see possibilities to optimize which plants they sell to customers and where they place them. For instance they might realize that at one specific customer it is always the same plant that requires watering first because of its position in the sun, requiring the gardener to service the customer more regularly because of that one plant. Now the company has the possibility to make an informed choice to ask their customer if they can move that plant somewhere else or maybe replace it with a type of plant that needs less water, so that it is more in "sync" with the rest of the plants.

Hypotheses (VP - cost reduction): Online access to sensor data (humidity, temperature, lux and soil moisture) can help our customers reduce amount labor needed to service their customers.

MVP to test Hypotheses (VP - cost reduction): Earlier we confirmed in collaboration with Decoplant that they could schedule watering based on the provided measurements. Now we need to see if this can actually be converted into optimized maintenance routines and reduced hours of labor. I suggest doing this by structuring an experiment around deploying a number of sensors with some of Decoplant's low risk customers. And then use the insights Decoplant gain to get a better understanding of how the implementation of the system in their business could reduce labor costs. I will also suggest taking offset in a single one of Decoplant's customers, and together with Decoplant going over and mapping their current routines, hours and costs related to this customer, in order to create a picture of the financial situation on a micro scale. Hopefully this can lead to better understanding what Decoplant and we should look for in order to test the hypothesis.

6.2.4 Risk reduction

The office greening service provider usually has a contractual agreement to keep the plants live and well. This is especially important when considering the product category of large expensive trees and the living walls. Especially the living walls not being well produce a substantial economic risk to the service provider. Some of these walls has many thousand plants and replacing them can cost more than hundred thousand DKK.

Hypotheses (VP - risk reduction): The data provided by the sensors through the software to our customer will reduce the risk of their plants dying, because they get intelligence to take appropriate action in time.

MVP to test Hypotheses (VP - risk reduction): This could be tested in the same time as we test 'cost reduction'. It would entail sensors being appropriately installed on living walls and confirm that the living walls can't be kept living by use of the sensor data. However this hypothesis has already been somewhat tested during the trials on living walls at Decoplant HQ.

6.2.5 Marketing

This was a value proposition we had not initially been aware off and it appeared to be very important to Decoplant. The ability to visually, through an app show potential new customers, building contractors and old customers that you know how the plants are doing (visualized by graphs and data) and that you serve many other customers (visualized by the customer map), ensured credibility and works as a marketing powerful tool.

Hypotheses (VP - Marketing): The product can serve as a strong marketing tool towards our customers.

MVP to test Hypotheses (VP - Marketing): I will argue that this hypothesis has been established to some extent. It was our customer who proposed the idea, they have already displayed the system at a conference and reported successfully that 'customers love the tech stuff!'. Decoplant also had layout made ready to print pictures of our product in their marketing material, which they distribute to all their customers.

6.3 Channels

6.3.1 Pivots in Channels

The amount of pivoting we have done in channels is very limited. This is not because we got it right the first time, but because we have not yet put much effort into it. We started thinking that we would sell directly, then realizing what a huge work it would be we pivoted towards having some sales partner. Now the hypothesis is to start out with direct sales and then later looking at the possibility for using a potential sales partner.

6.3.2 Channel Analysis

Our customer can be reached through a series of different physical distribution channels. Each having weaknesses and strengths. Generally there are two types: Direct and indirect. In the direct channels we sell directly to our customers through a website, phone call our own shop. In the indirect channel we sell to external intermediaries who then, in one-way or the other sells the product to end-users.

Deciding on a sales channel is hard. Steve Blank recommends that until the startup has completed customer validation process it should choose to focus on a single channel to avoid overreaching efforts on different channels with limited knowledge of customers and buying patterns [19]. Examining existing buying patterns for similar products and product categories can give insight into the customers preferred channels [19]. Not being able to find any direct competitors to our product in our customer segment I looked at two cases which has similarities in their offerings as our.

BigBelly is a company providing their customers, who are companies and organizations, with information about when to empty trash cans. They do this by using sensors, which can tell if the trash cans needs emptying, or not. This way service routine for the people who empty trashcans can be optimized. I will argue that their value proposition is much like ours just targeted at another niche. BigBelly are selling through a provider called Waste Zero who bundles BigBelly's offerings as part of 'reduce waste in your organization'-programs.

IC-meters also share similarities to Spiio. They build Internet connected sensors for measuring indoor environment through parameters such as CO2, noise and temperature. Their end users are building management in companies, schools and other larger

organizations who are responsible for daily operation of office buildings and the like. IC-Meter sells their products through a number of (Value Added Resellers) VARs and independent sales reps in industries such as building consulting and contracting, indoor climate consulting and building energy consulting.

Initially because we already have an established relations we will probably start selling directly to Decoplant also to establish a 'proof of concept' as quickly as possible. From here we can continue selling directly to select customers by contacting identified potential customers directly before doing this however we should consider how this can impact our relationship to Decoplant. Since we are operating in a market with few customers compared to consumer market we can reach most of the national actors with a limited sales force. Selling directly leaves us with great oversight and control of the sales process and with a sales force which is dedicated towards our company's product [33]. Insights in relation to price and complexity issues of selling the product might be gained from selling directly, making us better suited to understand how to sell our product (selecting channels). When starting to engage international markets, such as rest of Europe, it might be beneficial to suit up with Independent sales rep or another kind of sales partner who has feeling with the national markets and who can handle after sales services [38].

Hypotheses (CH - direct sales): Initially we can reach and sell to customers through direct sales.

Experiment 1 to test (CH - direct sales): Directly contacting potential customers in order to sell and get reactions - are they interested in buying? Contact customers both nationally and internationally.

Experiment 2 to Hypotheses (CH - direct sales): Selling directly also entails handling after sales services. Discuss with Decoplant what they would require of after sales support. Investigate other similar products and see what their offerings are. From the findings estimate what it will take for us to deliver these services. Is it something we can handle?

Hypotheses (CH - sales through intermediary): We can use Decoplant as intermediary to sell our products and handle parts of the after sales service.

Experiment test Hypotheses (CH - sales through intermediary): Discuss the situation with Decoplant; find out if they are interested, how they could see the partnership, what is their role, what is Spiio's role? Does this seem like a suitable model?

6.4 Customer Relationships

6.4.1 Pivots in Customer Relationships

Our customer relationship hypothesis got updated when we found literature differentiating between how to do B2C and B2B customer relationships. The findings from literature resonated with what we had experienced with Decoplant and what we knew from ourselves as consumers so we pivoted away from an idea of lining out a general same for all customer relationship model [19] to realizing that a B2B 1-on-1 individually tailored approach could be more beneficial [71].

6.4.2 Customer Relationships Analysis

Customer relationships are how the company and the customer interaction will be within the product life cycle. 'Customer development' suggests a get, keep and grow tactic for managing customer relations [31].

Get: is about creating demand and drive customers into the company's sales channels by creating awareness and interests through i.e. cold sales, Google-adword or other media.

Keep: *is* all about getting customers to stick with your products. Can for example be through loyalty programs, product updates and quality service.

Grow: make the customers you have already 'better' customers who add more value to the company. This can be achieved through selling them more of what they have already bought and new products. Also getting them to refer your product to new customers is very valuable. Strategies and tactics should be developed for all three; Get, Keep and Grow. Spiio has not yet found time to develop these tactics, so I have outlined strategies for doing so.

Get customer tactics is all about finding out how to acquire customers in a cost effective and repeatable way. This process can be managed by doing relatively cheap, small in scale 'customer-acquisition experiments', to get an idea about what works well and what less so.

To test effect of cold call sales an experiment could be “Call 50 potential customers and try to sell the product” and see how many customers took the bait. Another example could be to create a small Google ad words campaign, trying to drive customers to a sales website, again noting how many took the bait. Running this type of experiments on a range of different marketing and acquisition channels will enable the startup to estimate a cost for customer acquisition through each channel [19]. When doing this, it is important to realize that there is a distinct difference between B2C and B2B customers. Companies selling to B2C will likely have allot more customers than companies selling B2B. Therefor B2C companies can often rely on statistical analysis of its customers to figure out what is going on. For companies selling to B2B it can be much harder to generalize in this way, and B2B should put more effort into considering their customers individually. When selling to consumers, businesses are dealing with an individual decision making-unit. This is not the case when dealing B2B where it is likely that many different individuals will have influence on the decision making [71]. Therefore when selling B2B Spiio should not only focus on the relationship with the overall organization's (customers) but to a high extent also with individuals inside the organizations. The amount of purchases a B2B customer is capable of can range from very little to huge amounts of money. Therefor looking at direct number of customers has little meaning without also looking at how much the size of the customer and deeply Spiio can penetrate the customer [71].

Keep customers It is often expensive to acquire customers, therefore this is about finding out how to keep these costly acquired customers and sell more to them. A key conception in keeping customers is to actually deliver what was promised. This spans from the customer liking the product or service itself through support and complaint-handling, delivery, billing and product upgrades [19]. A B2B company will typically have less but larger customers. This creates a need, but also enables, for catering to customer specific need, values and expectations. Each of the customers will likely have different needs, finding out what these needs are and how to cater to them by treating customers as individuals can make a huge difference in keeping customers. Sales cycles with B2B customers can often be long with long gaps between purchases. An often effective way of keeping B2B customers is to contact, serve, educate and help customers during times between sales, i.e. through ‘customer check-in calls’ [71]. When dealing with B2B customers the **Grow Customer** and ‘keep customer’ often overlaps. For instance helping B2B customers solve problems by for example helping

with marketing efforts or developing customer specific designed content or helpful guidance, can help grow the customer's business and thus their potential as buyers. A good relations with customers and just the fact that they are using your product serves as a ‘referral’ and blue stamp in the market which can lead to getting new customers [38] [37]. With Decoplant we have a nice case of a single B2B customer from whom we can learn their specific needs and how we keep them and grow them, but also on who we can try out different tactics such as in-between purchase management, strengthening our relations with influencers within their organization and creating custom content, for instance to their marketing campaigns.

6.5 Revenue Streams and Cost Structure

6.5.1 Pivots in Revenue Streams and Cost Structure

Before we switched focus to delivering high volume cheaper sensors and where focusing on lower volume sensors and control unit for living walls we considered charging a large initial cost for each product delivered and a substantial service fee. After changing focus we realized that selling cheap but then in large volume, with low enough fees so that it makes sense to put on smaller plants seemed to be a better revenue model. Also we now have a stand-alone sensor unit for a single plant or section of a living wall, this way our revenue from a large living wall will also scale accordingly because it will need multiple sensors. When going from our former product to the new we had to reduce our manufacturing costs substantially. We did this by building our own cheap, less accurate, sensor module, where we before was relying on analog ‘dumb’-sensors from Canada which each in itself costs more than our entire hardware solution does now.

6.5.2 Revenue Streams Analysis

Basically revenue and pricing asks a few questions in order to figure out whether the business is worth doing or not:

- How many can we sell?
- How is the revenue model and what is the price?
- Is this a sustainable business scenario worth doing?

I will try to analyze each of the questions in order to create a set of guidelines for how Spiio should proceed, in order to understand if the business idea provides an economically feasible business scenario.

How many can we sell? Answering this requires finding a market size and a market share we can expect. From Denmark we know the size of the market for indoor office greening and who the actors are. For international markets however we have not yet found any solid numbers on this. We also need to know the volume of purchases customers can do and what the costs of sales (channels) ar. A suggestion could be to start by evolving the Danish market hypothesis and then proceed to an international market hypothesis when we have gathered better Intel on the size of these and who the actors are and their needs. This relates to some of the to-do work proposed in the 'Channels' section, such as finding proper channel and channel costs of sales, which is important to subtract in order to gain a proper picture of the situation.

How is the revenue model and what is the price? Part of answering this question is figuring out costs related to the physical product itself, such as bill of materials (BOM), assembly, packaging, shipping, field failure returns and more. Also total cost of operation, such as server costs, software development and maintenance etc. is important when considering how much to charge. Another part of pricing relates to the pricing model when selling the product. Such a model will typically consider the value the product delivers, competitive prices and manufacturing costs. A good result can come from understanding competitive pricing. For a product service such as the one Spiio is delivering currently the competition is what companies such as Decoplant already do: evaluate plant health by sending a person directly to the source. So understanding pricing here entails getting a good understanding of the cost structure in the industry and the value these gardeners bring. There are many different models of pricing such as *Value Pricing, Competitive Pricing, Volume Pricing, Portfolio Pricing, The razor/razor blade model, Subscription, Leasing, Product-based pricing etc.* [19]. Based on advice from our mentor team and DGIH, and previous discussions with Decoplant Spiio has so far mostly been looking at subscription models or leasing based model which provides constant earnings over time and provides possibility for scalable revenue stream. In order to get some numbers on what we can charge and how it affects volume of sales etc. we should get in dialogue with potential customers. When selling

to B2B the total cost of operation (TCO) often has a lot to say when estimating revenue streams and deciding on pricing. Does the company customer need to spend on adopting new equipment to use Spiio's product - maybe all their gardeners needs tablets or smartphones? Will their staff need new training or do they need to hire new competences, some one has to monitor the screens right? Another important aspect to look at when dealing B2B is return on investment (ROI). How fast is it worth it for Decoplant to adopt our product, 2 years or 10 years? Maybe instantaneously if they borrow hardware for free and pay monthly fees in a subscription model, but can Spiio muster the funds to cover the manufacturing the initial products? Arguably ROI has a lot to say when selling B2B to test how the ROI should be for customers is important [71]. Spiio needs to prepare some hypothetical ROI present them to potential customers and evaluate if the ROI seems meaningful, otherwise sales may be difficult [19]. From developing our prototypes and running the needed servers we have a good idea about the costs relating to manufacturing and software maintenance. However we do not yet have a good estimate of how salary costs will scale, so this is also something we should look into.

Is this a sustainable business scenario worth doing? Now start putting the findings from 1. And 2. Together in rough terms and cover is the revenue is adequate to cover costs on the short lane, and how they could look over time. Will there be substantial growth and will it be enough to cover expenses salaries and worth pursuing? How about economics of scale, will the profitability increase, as revenues get bigger? It might be easiest and less confusing for Spiio to start focusing only on the Danish market and maybe Decoplant in specific, to see where this takes us. Then from here Spiio can try to get an idea of the bigger picture by extrapolating up to also include some foreign markets.

6.6 Key Activities and Key Resources

Key resources are aspects typically mission critical to the company's success. They can be categorized into four main groups: 'physical', 'financial', 'human' and 'intellectual property (IP)'. Key resources are coupled to key activities - what are the resources needed to 'conduct' the key activities, and what are key activities needed to ensure key resources? I will try to create a list of categories to create an overview of Spiio's key resources and activities.

6.6.1 Pivot in Key Activities and Key Resources

Until recently we probably saw product development as our key activity. After getting advice from the DTU mentor team and learning about customer development and lean startup principles we have become aware that we do not need to create a 'fully finished product' ready for the market. We just need to create something working well enough to prove our problem solution fit. Realizing this was a major thing for us and created a pivot in our key activities and key resources towards focusing on customer development activities.

6.6.2 Key Activities and Key Resources Analysis

6.6.3 Physical resources

Office space: This is where we meet and work, people could work from home to some extend, but the office space works as a hub for knowledge sharing and building our corporate culture and relationships in the company. It definitely seems critical that we have some sort of office space from where we perform key activities such as product and business development. At the moment we have an office at AAU CPH, we might not be able to keep this after summer. Many government grants and accelerator programs provide office spaces if you are accepted. We have made applications for two such programs: Iværksætter pilotordning (IVP) and Scion Tech Challenge. If accepted by IVP we get access to office facilities and meeting rooms for at least a year. If accepted by Tech Challenge we get at least 4 months of free office space. We have possibility of getting office space at a low rate via DGIH at Risø.

Prototyping equipment: One of our key activities is to create a proof problem-solution fit. 'Applying' our solution idea to real life situations at Decoplant in part does this. In order to do this and to ensure we can react to new inputs we need ability to drive development of the physical part of our product. To do this we need access to simple prototyping equipment. This is breakout boards, soldering equipment, electrical measurement equipment, reference sensors and prototype components. For casing access to 3D printer is also convenient. Without prototype equipment we have to rely on getting other people or companies to do prototyping for us which is both expensive, slow and inflexible compared to having it in-house. Right now we have access to prototype equipment through AAU CPH and the open Fab Labs. However we also own most of the stuff needed ourselves so we could already

prototype independently. Currently we do not have any reasons to expect that our need for additional or more advanced prototype equipment will be substantial in the future.

Car: The car might not be mission critical but it has at times enabled us to get things done a lot more efficient than otherwise. The use of the car very much relates to our customer development. This is especially in relation to meetings with customers and advisors. Currently we are using my car and since I am somewhat reliant on having a car due to my physical disability, which also enables me to get government funding for the purchase, I am pretty confident that we will have my car at our disposal for years to come.

Computers: For everything, product development (coding), research, management, project management, customer contact etc. We are relying on personally owned equipment at the moment, we have assurances and stuff so if they break we get a new, thus we feel pretty sure that we have access to this resource. When we get employees we might have to acquire some company equipment for them to use or agreements where they can use their own equipment.

6.6.4 Financial Resources

Spiio needs money to operate; when we run out of it odds are that we are out of business. Not only does the company need money but the people behind it also need money to eat and live. Basically one of the main goals in lean startup is to preserve money as long as possible until the startup finds a repeatable scalable business model [3]. The idea is to only take in small amounts of money for as long as possible while testing hypotheses and finding a product-market fit. With money come obligations and expectations from the ones who gave it, especially if it is investors or venture capitalists. These types of sources are often less forgiving and open towards business model iteration and pivots, than sources such as friends and family, government grants and early customers [36]. It is important to understand that potentially raising lots of money is not the same as a sustainable business model [3]. Therefor startups should strive to find a product-market fit before 'spending like there is no tomorrow', this entails to raise money after (and not before) having gained substantial evidence to back product-market fit hypothesis. I will try to list the options Spiio has to finance the future work giving a small analysis of each.

SU (Danish Student Grant): Currently our main funding comes from SU. Personally I will stop receiving this at the end of July 2015. Martin can continue to receive it for a year more while he finishes his education, however this will take time away from the company because he will need to study.

Fools, friends and family: This is another 'popular' option for startups in the early phases. Rely on friends and family for cheap loans and charity. As an example of this my uncle has proposed to 'donate' 50k DKK to our company as a helping hand. Martin has borrowed some money from his mom. Currently I can get most of my personal expenses covered by living of the mercy of my girlfriend's income [1].

Angels, venture capital and corporate partners: It is often expensive to take in venture capital or money from angel investors, and in general the later a startup does it, the higher is its equities valued, however the saying "rather get small piece of a large cake than large piece of a small cake" also holds true for startups. The reasons for taking venture capital is to scale like hell and to benefit from the experience and competencies the investors bring to the table. However taking venture money usually also entails agreeing to their business model and taking care of a lot of interests they bring to the table [36]. Therefore getting the timing right and not taking venture money too early is a pitfall startups should avoid [1].

Government grants: can be very valuable source for funding often with low or no direct power in regards to decision making in the Startup, leaving the startup with room to navigate, iterate and pivot as it is learning. A grant from 'iværksætterpilot' would ensure personal funding for both Martin and I and a third person for a year, and on top of that a one time injection of 3x35k DKK. The 'Tech Challenge' would not lead to direct funding, but if the company makes it to the finals there is good hopes of getting an investor. Venture Cup is a small grant of 25k DKK, potentially 250k DKK to a single applicant who 'wins'. 'Makedsmodnings fonden' is direct injection of cash often several millions DKK. This can be used to hire in competences and pay salaries.

Ad-hoc web programming sales and possibly hardware: We can take in individual jobs in either programing a web app or building simple hardware prototypes for private people and companies. We have no experience in delivering these kinds of services so it can be risky to

us because we would know how much to charge and how long it will take for us to finish a job.

Part time job: Working besides building the startup is an obvious possibility and again the obvious drawback is that the time working for someone else is subtracted from company time.

Early sales to customers: This option is also very interesting and recommended as part of the customer development process and lean startup [26] [3]. We have done this before; we did a sale to Decoplant, which funded our development process for a period. Last time we did it, it caused us a lot of trouble because of poorly managed and mismatched expectations between Decoplant and us in regards to what they actually paid for and what we should deliver. To do this a clear, fair and common understanding of what is being paid for at what is being delivered must be established.

Crowd funding: Has become increasingly popular means for startups to raise money and validate customer demand. Running a successful crowd funding campaign requires a lot of work and most of the successful projects have actually already raised venture capital before launching the campaign. Running a successful campaign usually entails creating a community around the product, which often entails a product aimed at consumers and not B2B customers [72]. Therefore I do not consider this a very valid option for funding our project.

6.6.5 Human Resources

Advisors and mentors: Through the government program DTU Scion Mentor Match we got an advisory board consisting of five advisors with experience in entrepreneurship and managing companies. So far it is my firm belief that the advice we have gotten from this mentor team has been of great value to us and helped us steer in a better direction. I also believe that the network these people 'bring to the table' could prove to be of great value to Spiio. For the time being we are ensured access to some advisors as long as the Mentor Match program continues, however mentors who are truly interested in our project are more effective than mentors who are there because of 'duty' [44]. Based on this I believe Spiio should strive to maintain an active and good relationship to the mentor team.

Employees: Up until now we have only been two people in Spiio and we have worked as Swiss army knifes trying to handle everything from product and business development to sales, support and accounting. If Spiio successfully finds a repeatable and saleable business model more employees will be needed in the future. Many of the competences needed require high technical skills and as such Denmark in general and Copenhagen area in particular seems an ok area to be due to the generally high level of education. Currently we are not in a situation where we can pay people with money, which is usually the way employees are maintained. Right now we can offer equity, possible future pay and more soft values such as 'being part of a team working on an interesting project'.

Product development: The product itself is key component in the problem solution fit and market fit. Spiio is focusing on IOT solutions. The primary skills to drive the technical development of such products are programming (firmware, backend and frontend), hardware (low power electronics), manufacturing insights and contacts, design competences (UX, user centered). It is very common that programming resources of frontend and backend becomes some of the most resource intensive (in terms of manpower) in tech startups [1]. And so is the case for Spiio and current our advances in the technical development seems to be most constrained by our programming resources. A neat way to reduce the amount of programmers needed and develop a more useable product is to couple it with a UX design process - It takes a lot longer to program something and find out that it is wrong, than it does to hand draw a sketch and find out UI is wrong [73]. Currently we have two software engineers and one design engineer who are going to join us for a month of trial during the summer 2015.

Business development: Our advisors tell us that we need a CBS-kind-of-guy (Copenhagen school of business) to help us create strategy, do project management, pricing, set up an organization geared for sales, doing business modeling and such. I agree with this. Currently our technical development has been favored, probably due to the engineering background of Spiio's founders. While we are searching for a suited and interested candidate to join us to do business development I plan on leaving the technical development pretty much and start focusing more on business development. We have found an intern studying his masters in global business engineering who will be joining us during the summer and early fall writing a report on business development of Spiio. Hopefully this can fill some gaps in terms of competences until we find a lasting solution.

Sales and support: At first this can be handled internally, Martin has five years of fulltime experience in B2B sales, selling product service solutions for TDC. The initial support will be carried out internally, since we want to gain insights from this process, which can help product- and business model development and yield understanding in regards to our customer relationship [3]. Later support and sales needs to be rethought and it will also be largely dependent on the type of sales channels adopted and cost structures.

Others: these we are not sure of yet, but most companies have them: HR representatives, accountants, lawyers, marketing and more. Right now we handle accounting ourselves and for the limited need we have had of lawyer and accounting counseling we have relied on favors from personal network and pro bono work. Access to these competences has not yet seemed as a constraint to Spiio, but as things move forward and we learn more about Spiio's situation, it should be taken more carefully into consideration what exactly these needs are and how to best acquire the needed competences.

6.6.6 *Intellectual Property resources*

In short IP is what stops others from using what we have developed. Figure 19 shows different types of IP protection.

Type of IP	What is Protectable	Examples
Trademark	Branding (i.e. Nike swoosh)	marks, logos, slogans
Copyright	Creative, authored works; expressions (not ideas)	software, songs, movies, website content
Trade Secrets	Secrets with economic value (i.e. the Coke recipe)	non-public technology customer lists, formula
Contract, NDA	As defined in the contract	technology, business information
Patent	Inventions	new technology

Figure 19 - Types of intellectual property (IP)

The nature of the developed products in Spiio is probably not patentable by European standards, nor can we claim meaningful copyrights. Spiio could try to protect core technologies such as: hardware design and source code and business processes as specific

know-how and customer information, through contracts and NDAs with employees and other relevant actors and a trademark which can protect branding.

6.7 Key Partnerships

6.7.1 Pivots in Key Partnerships

We pivoted a bit back and forth between having Decoplant as a key partner. Through advise from mentors and realizations form literature we are currently seeing them as a critical partner in doing customer development and 'serving' as an early evangelist, and through this role we also see them as a key component in finding investors or funding. We pivoted away from It2go as a key partner for our software and we also pivoted away from relying on 'Vegetronix' to supply moisture sensors to us, when we changed to a high volume product.

6.7.2 Key Partnerships Analysis

The key partners are necessary or highly valuable to the startup. They provide stuff, services or competencies which Spiio either does not have or we would prefer others to handle. There are different types of partnerships. *Strategic Alliances* such as sales partners or companies who provide product training. Generally this type of relationship is noncompetitive, and the strategic alliances can reduce the number of things the startup needs to provide or know about. *Join new business development* could be HP selling software with their computers made by others, or it could be Decoplant selling Spiio equipment with their plants and living walls to others. *Key supplier relations* are right in the center of delivering what's promised to customers. For Spiio these are suppliers who provide parts for hardware or Amazon who provides the servers Spiio is using. If Amazon decides to shut down the servers, Spiio's products will not work until an alternative provider is found. Below I listed our current key partners in a table. Some areas which will be relevant in the future are not covered, many of these are related to product fulfillment partners such as sales, support, casing manufacturing and assembly, shipping and packaging, storage, insurance and investors.

Partner name	What they provide	What we provide
Decoplant	First customer, credibility to our brand, market and customer insights.	Solution to their problems (see value proposition)
Digi Key, Mouser and more	Parts for manufacturing	Money
ITEAD Studio, Circuit Hub	Manufacturing and assembly of electronics	Money
Amazon servers	servers	Money
AUTH 0	IT security infrastructure	Money
Electric Imp	Firmware infrastructure	Money

Figure 20 - Key partners

When Spiio is further in the customer development process we should revisit our key partners and find out hot to establish beneficial relationships where we need them, and lay out strategies for how to solidify already established relations.

6.8 Summary - Business Model Analysis findings

6.8.1 Customer Segments - summary

We need to verify that that sizeable amount of customers exist for our product. This entails contacting Danish and foreign indoor office greening companies to find out if they experience they problems that our solution is addressing and if they are interested in having a solution to solve the problem.

6.8.2 Value Proposition - summary

We need to test if our product actually is a problem solution fit and thus delivers the value proposition we claim to deliver. Most central to this is finding out whether or not cost reduction can be made using our product.

6.8.3 Channels - summary

Start out by exploring the direct sales channels. Use this as a means to also gain direct information on pricing and customer preferences. Seek insight into how the product should

be sold to foreign markets and explore possibility of using Decoplant or some other intermediary to handle sales and after sales service.

6.8.4 Customer Relationships - summary

Our get customer strategy will be direct sales supported by having a strong reference in our products is being used by Decoplant. There are a lot fever B2B customers than B2C but at the same time they can spend a lot more. Keeping and growing these large B2B customers is important. Our hypothesis is that this is best done through offering individually tailored customer relations. Spiio should start practicing this on Decoplant.

6.8.5 Streams and Cost Structure - summary

Spiio needs to figure out how much we can sell. This can in part be covered by the activities proposed in to test the channels hypothesis so Spiio should start with this.

Spiio should strive to achieve a better understanding of our cost structure. This entails making rough calculations pulling the best numbers and guesses we have. Furthermore total cost of ownership and ROI are important considerations when selling B2B, which is why Spiio should make estimates for these also.

When Spiio has achieved better knowledge about how much can be sold and how the pricing model will be, estimates should be made to evaluate whether or not the business concept seems worth pursuing or not.

6.8.6 Key Activities and Key Resources - summary

Findings physical resources: Spiio needs to find a secure a suited office space. In regards to computers we need to investigate the possibilities for people to use their own personal laptops when doing work for Spiio. There might be issues here regarding security and intellectual property, which leaves us no choice but to buy equipment for new employees.

Findings financing resources: There is a lot of maybe possible financing options, and some are definitely more desirable than others. But due to the nature of many of these options, such as grants and investors they are embedded with a high uncertainty - it's about getting through a needle's eye “will we be chosen?”. If we do not receive adequate government grants or

investor funding then we will have to run on the less desirable options such as loans and part time jobs.

Findings human resources: Spiio should maintain an active and stable relationship to the mentor team. Human resources needed in the foreseeable future should be identified, as a step towards avoiding the lack of them inhibiting for growth [19]. We need to ensure contractual agreements in regards to intellectual property rights and align expectations to ensure good collaboration with future employees. Spiio should be looking to enhance its competences especially in regards to business development. Currently Spiio can offer equity, possible future pay and more soft values such as 'being part of a team working on an interesting project'. Finding sustainable ways of paying or otherwise maintaining employees should be of high priority to Spiio in the near future.

Findings IP resources: Currently it does not seem like we have many ways of protecting our IP in European legislation. Intellectual property creates value for the company and competitors who 'steal the idea' and seize the market can make a business model obsolete. Therefor Spiio should start looking into if there are meaningful ways we can protect IP and if other aspects such as know-how, big data acquisition or superior business models can help ensure us against being overrun by competition.

6.8.7 Key Partnerships - summary

Spiio should be aware of the need to keep stable relationships with the key partners. Some relationships are unlikely to be stabilized, such as relationship to component suppliers and Amazon Servers. Currently the more vulnerable partnership is to Decoplant.

7 Analysis - Customer Development Process

This is the third and last overall analysis chapter. Based on the findings in the business model analysis this chapter briefly analyze where Spiio is in the customer development process. This is followed by suggestions of how Spiio should proceed towards next step in the model.

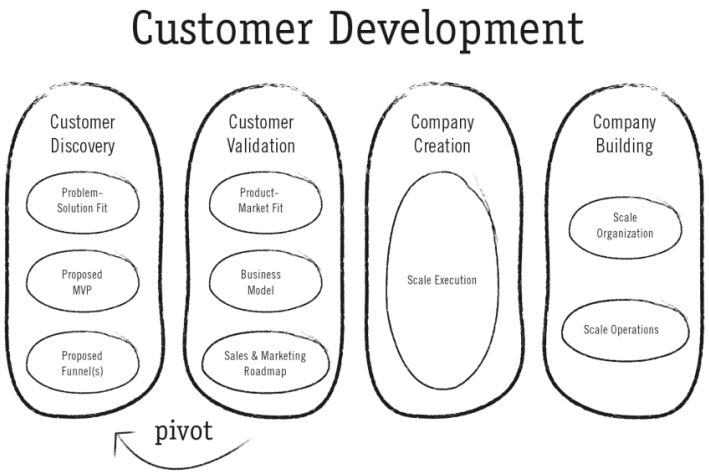

Figure 21 - Customer Development process Model

7.1 Where is Spiio in 'Customer Development'?

In the pre-analysis we found that before a Startup can move out of customer discovery and into customer validation the following should be accounted for [19]

1. A deep understanding of customers problems and needs
2. A value proposition which answers to these problems and needs
3. Identified that there exist a considerable amount of customers for the product
4. Revenue from the business model can be profitable

1) The many interview and meetings with Decoplant, their participation in the development of the problem solution and the use of the functioning prototypes as part of the daily watering routine in Decoplant HQ leaves us at Spiio with a feeling that we have a good understanding of our customers problems and needs.

2) We have met great interest and enthusiasm on behalf of Decoplant in regards to the value proposition we offer. Recently when we changed from focusing on living walls only to also focusing on smaller plants this has changed the value proposition slightly but it still solves the same verified problem: Not knowing how plants are doing leads to inefficiency and ultimately increased costs.

3) On the issue whether or not a sizeable volume of customers exists for our product we are somewhat uncertain. We have numbers on the total industry size of 'indoor office greening', we have identified the most prominent Danish players on the market and we know that indoor office greening is a worldwide industry. We assume that the problem we address with our product is also valid for at least the other Danish actors, but since we only talked to Decoplant, we have not verified this yet.

4) When we were focusing on living walls we had obtained a pretty good idea about what Decoplant would pay for the product. Now since we changed to also covering a new product segment, the smaller plants, we need to obtain more knowledge in regards to what they will pay in this segment.

5) We have not made certain that our problem-solution fit deliver profitable business.

From the above it is clear that the findings from the business model analysis revealed that we still have some untested hypothesis and some unanswered questions which relates to the customer discovery process before we are ready to fully enter the 'customer validation process' and start working on verifying and building a sales roadmap.

7.2 How to move on?

Before moving to customer validation Spiio needs to get solid information about our problem-solution fit. Effort should be put into evaluating whether or not the business idea can provide a profitable business. Technical development of the product seems is further in the process than the understanding of market, channels, revenues and costs. Our mentor team also noted this, and suggested that we should not focus on developing a finished product now, as long as what we have is good enough to test if a problem solution fit is achieved, and that it created value for our customers. Investors partners and the like will now want to see other parts of the business model verified, and that as long as it is shown to be technically

possible creating a ‘finished product’ is just a matter of stacking money on the gas handle. Therefore I will suggest that less emphasis is put on developing the technical solution and more on developing and testing hypotheses relating to the market, such as pricing, channels, customer relations and market size. This can help secure funding and understand in the business idea is worth pursuing.

8 Conclusion

The project started with a review of traditional linear new product development models. The goal was to construct a critical assessment of how suited this type of framework was for driving innovation in startups. The review revealed a mismatch between several of the main assumptions in these models and what actually seems to be driving innovation in new product development. An argument evolved around the model's failure to account for the great uncertainties inherent in many innovation processes. Another point of critique concerned the linear models failure to adequately consider the socio-technical context the innovation would be inserted in; which could result in an innovation nobody wanted. It was also found that seeking to optimize towards certain static metrics is in the DNA of many companies and that the nature of these metrics results in the company being fine tuned for execution of known business models. However due to the uncertain nature of innovation these static metrics are rarely leading towards successful product innovation. During the review differences between startups and companies were pointed out and it was argued that while companies are familiar to executing known business model startups are searching for a repeatable scalable business model to execute. All this led to finding that using the traditional product development model would likely inhibit innovation in startups rather than support it. This encouraged reviewing management concepts directly targeted at innovation in startups. In this part of the review key elements from a number of popular startup management frameworks was identified. In the review it was found that these frameworks had implemented methods to account for the uncertainties familiar to innovation. Finding that the startup frameworks seemed promising they were reviewed using findings from Science, Technology and Sociology studies. This showed a good alignment between what is argued by STS to be important aspects for driving successful innovation and what was proposed in the startup literature. The review revealed that the startup frameworks did not provide extensive considerations and methods for considering and manipulation relevant actor-network configurations. In regards to this suggestions were made to enhance the startup frameworks by using methods from STS. Finally the review concluded that through critical assessment key managerial method and concepts for driving product innovation in a startup such as Spiio had been identified.

The second part of the report started out by examining some accelerator and mentor programs, which could be interesting for Spiio. This was done based on findings from the literature review pointing to the importance of extending the knowledge and resource base of the startup through advisors and accelerator programs. A number of suited programs were identified and applications was written and sent off. To increase the chances of being accepted into the different programs we utilized leanings STS and put an effort towards establishing relevant spokespersons for our applications. After the chapter about accelerators and mentors an informed analysis was made concerning Spiio's first customer and software provider. A misalignment in the actor network around Spiio was identified. Using theories from the literature review an analysis was made establishing the importance of the customer as an 'early adopter. Resulting from a new configuration of the network was proposed to align interests and create stability. This configuration entitled inclusion of the customer and exclusion of the software provider. A strategy for establishing the new configuration was first formulated and subsequently executed. Seemingly the execution was successful and the new stable configuration was achieved.

In the last part of the report a business model analysis was made using methods and frameworks from the startup literature. This resulted in identification of a series of hypotheses that needs testing. Experiments to test the hypothesis was discussed using theory but the analysis did not achieve finding pass-fail tests for each hypothesis as it is encouraged in the startup literature. Instead more general guidelines and qualitative research tasks was defined to test the hypotheses. The business model analysis revealed that a number of areas fundamental to evaluating whether or not there is profitable business case worth doing needs to be further investigated. The finding from the business model analysis was used to analyze where in the 'customer development process' Spiio was. It was found that due to inadequate knowledge about market potential and problem solution fit Spiio was in 'customer discovery' phase. The analysis concluded that the technical development of the product had advanced enough to test core hypothesis relating to problem-solution fit. Resulting form this it was suggested that in near future more emphasis should be on developing and researching other aspects of the business model such as market analysis, pricing, channels and customer relation's hypothesis.

9 Personal Reflections on The Process

This for month master's project period, which started in February 2015 and ended in June same year has been an exciting period. Working on my startup alongside finishing what could very well be my last school assignment ever has been a special time to me. The subject i choose for this thesis was based on me wanting to align the thesis work with building my company - killing two birds with one stone right? This choice led me into unfamiliar theoretical territories and it proved a great challenge to dive into the 'field' of startup literature, but it has also been a dive that felt meaningful and from which I have learned a lot. For that opportunity I am thankful.

Generally when writing a report such as this, which is dealing with a complicated issue, I believe that sticking to the mantra "say a lot about a little" usually yields the better result. Saying a lot about a little helps structure a path thru a nice coherent argument. However my experience from this project is that building a startup does not require 'knowing a lot about a little', but rather 'knowing just enough about a lot'. In this way i cannot help to think that in my attempt to strike to birds with one stone also made writing a good report harder. Nevertheless, in life priorities has to be made and this time it fell out in favor of Spiio and trying to build my own company has been a dream of mine since I was a little boy, so I do not regret this choice.

During the report writing when spending tons of time going through theories to find quotes and references, constructing elaborate arguments, deciding on header titles etc. it has felt almost paradoxical in regards to the lean philosophy around which the report itself was centered. This being said in hindsight it is clear to me that had I submerged myself deeper into the theories earlier in the process, some of the decisions made in regards to Spiio would probably have been done otherwise.

Finally I hope that you enjoyed the read. It is time for me to 'get out the building. So my last words in this report will be a quote from Benjamin Franklin writing a letter about his innovations in electricity - maybe he was trying to be lean about his time too? *"I have already made this paper too long, for which I must crave pardon, not having now time to make it shorter.*

10 REFERENCES

1. Renee DiResta, Brady Forrest, R. V. (2015) The Hardware Startup: Building Your Product, Business and Brand. , .
2. Callon, M. (1986) Some elements of a sociology of translation: domestication of the scallops and the fishermen of St Brieuc Bay. *London, Routledge: Power, action, and belief : a new sociology of knowledge?* , 196-223.
3. Ries, E. (2011) The lean startup: how today's entrepreneurs use continues innovation to create radically successful businesses.. , .
4. Akrich, M., Callon, M., & Latour, B. (2002) THE KEY TO SUCCESS IN INNOVATION* PART I: THE KEY TO SUCESS IN INNOVATIONTHE ART OF INTERESSEMENT. *International Journal of Innovation Management* 6, 187-206.
5. Blank, S. (2013) Why the Lean Start-up Changes Everything. *Harvard Business Review* , .
6. Kelley, T. & Littman, J. (2001) The art of innovation: lessons in creativity from IDEO, America's leading design firm.. *New York: Cyrrency/Doubleday* , .
7. Lew, A. A. (2011) Defining and redefining conceptual frameworks for social science field research. , .
8. Jones, J. C. (1992) Design Methods. , .
9. Pickering, C. & Byrne, J. (2014) The benefits of publishing systematic quantitative literature reviews for phd candidates and other early career researchers. Higher Education Research and Development.. *Higher Education Research & Development* 33, 534-548.
10. Bates, M. J. (1989) The design of browsing and berrypicking techniques for the online search interface. *Online Information Review* 13, 407-424.
11. Kvale, S. (2007) Doing Interviews. , .
12. Preece, J., Rogers, Y., & Sharp, H. (2002) Interaction design: beyond human computer. , .
13. Kitzinger, J. (1995) Qualitative research. Introducing focus groups. *Bmj* 311, 299-302.
14. Carlile, P. R. (2002) A Pragmatic View of Knowledge and Boundaries: Boundary Objects in New Product Development. *Organization Science* 13, 442-455.
15. Buxton, B. (2007) Sketching User Experiences: Getting the Design Right and the Right Design: Getting the Design Right and the Right Design. , .
16. Cooper, R. G. (1990) Stage-gate systems: A new tool for managing new products. *Business Horizons* 33, 44-54.

17. Claus, C. & Yoshinaka, Y. (2007) Staging socio-technical spaces: translating across boundaries in design. *Journal of Design Research* 6, 61-78.

18. Blank, S. () Why Companies are Not Startups. , .

19. Blank, S. & Dorf, B. (2012) The Startup Owner's Manual: The Step-By-Step Guide for Building a Great Company. , .

20. Bijker, W. E. (1995) Bicycles, Bakelites and Bulbs: Toward a Theory of Sociotechnical Change. , .

21. Pavitt, K. (2005) Innovation processes. *in J. Fagerberg, D.C. Mowery and R.R. Nelson (Eds) Oxford Handbook of Innovation* , 86-114.

22. Markides, C. (2006) Disruptive Innovation: In Need of Better Theory. *Journal of Product Innovation Management* 23, 19-25.

23. Chesbrough, H. (2004) MANAGING OPEN INNOVATION. *Research Technology Management* 47, 23-26.

24. Pinch, T. J. & Bijker, W. E. (1984) The social construction of facts and artifacts: or how the sociology of science and the sociology of technology might benefit each other. *Social Studies of Science* 14, 399-441.

25. Fowler, M. & Higsmith, J. (2001) The Agile Manifesto. , .

26. Cooper, B. & Vlaskovits, P. (2010) The Entrepreneurs Guide to Customer Development: A cheat sheet to The Four Steps to the Epiphany. , .

27. Henry Chesbrough, Wim Vanhaverbeke, J. W. (2015) New Frontiers in Open Innovation. , .

28. James P. Womack, Daniel T. Jones, D. R. & Carpenter, D. S. (1990) The Machine That Changed the World. , .

29. Jones, J. W. D. (2003) Lean Thinking: Banish Your Waste and Create Wealth in Your Corporation. , .

30. Chesbrough, H. () Why Internal Ventures are Different from External Startups. , .

31. Blank, S. G. (2006) The Four Steps to the Epiphany. , .

32. Maurya, A. (2012) Running Lean: Iterate from Plan A to a Plan That Works. , .

33. Osterwalder, A. & Pigneur, Y. (2010) Business Model Generation: A Handbook for Visionaries, Game Changer and Challengers. , .

34. Blank, S. () Why Build, Measure, Learn -- isn't just throwing things against the wall to see if they work. , .

35. Mueller, R. M. & Thoring, K. (2012) Design Thinking vs. Lean Startup: A Comparison of Two User-driven innovation strategies. *International Design Management Conference* , .

36. Blank, S. () Fund Raising is a Means Not an End. , .

37. Moore, G. A. (1992) Crossing the Chasm: Marketing and Selling Technology Products to Mainstream Customers. , .

38. Burgel, O. & Murray, G. C. (2000) The International Market Entry Choices of Start-Up Companies in High-Technology Industries. *Journal of International Marketing* 8, 33-62.

39. Brüderl, J. & Schüssler, R. (1990) Organizational Mortality: The Liabilities of Newness and Adolescence. *Administrative Science Quarterly* 35, 530-547.

40. Lindell, M. & Karagozoglu, N. (1997) Global Strategies of US and Scandinavian R&D Intensive Small- and Medium Sized Companies. *European Management Journal* 15, 92-100.

41. Murray, G. C. (1996) A Synthesis of Six Exploratory, European Case Studies of Sucessfully-Exited, Venture Capital Financed, New Technology Based Firms. *Entrepreneurship Theory and Practice* 20, 44-60.

42. Cavusgil, S. T. & Zou, S. (1994) Marketing Strategy-Performance Relationship: An Investigation of the Empirical Links in Export Markets. *Journal of Marketing* 58, 1-21.

43. Hutt, M. D. & Speh, T. W. (1992) Business Marketing Management. , .

44. Sullivan, R. (2000) Entrepreneurial learning and mentoring. *International Journal of Entrepreneurial Behavior \& Research* 6, 160-175.

45. Buchanan, R. (1992) Wicked Problems in Design Thinking. *The MIT Press* 8, 5-21.

46. Rittel, H. W. J. (1972) On the planning crisis: Systems analysis of the first and second generations.. *Bredriftsokonomen* 8, 390-396.

47. Martin, R. (2009) The design of business: Why design thinking is the next competitive advantage. , .

48. Plattner, H., Meinel, C., & Leifer, L. (2015) Design Thinking Research: Building Innovators (understanding innovation). , .

49. Beckman, S. L. & Barry, M. (2007) Innovation as a Learning Process: Embedding Design Thinking. 50, .

50. Buchenau, M. & Suri, J. F. (2000) Eperience prototyping. *Proceedings of the 3rd conferenceon Designing interactive systems: processes, practices, methods and techniques* , 424-433.

51. Coyette, A., Kieffer, S., & Vanderdonkt, J. (2007) Multi-fidelity Prototyping of User Interfaces. *Lecture notes in Computer Science* 4662, .

52. Kelley, T. & Littman, J. (2005) The Ten Faces of Innovation: IDEO's strategies for beating the devil's advocate & driving creativity throughout your organization. , .

53. og Hanne Lindegaard og Tanja Rosenqvist, U. J. (2011) Engaging Actors in CO-designing Heterogeneus Innovations. *International Conference on Engineering Design* , .

54. Khurana, A. & Rosenthal, S. (1997) Integrating the fuzzy front end of new product development. *Sloan management reivew* , .

55. Hussain, S., Sanders, E. B. N., & Steinert, M. (2012) Participatory Design with Marginalized People in Developing Countries: Challenges and Opportunities Experienced in a Field Study in Cambodia. *International Journal of Design* 6, 91-109.

56. Blank, S. () Driving Corporate Innovation: Design Thinking vs. Customer Development. , .

57. Brown, T. (2009) Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation. , .

58. Callon, M. & Latour, B. (1981) Unscrewing the big Leiathan: how actors macro-structure reality and how sociologists help them to do so.. *Advances in social Theory and Methodology: Toward an Integration of Micro-and-Macro sociologies* , 132-164.

59. Akrich, M. & Latour, B. (1992) A summary of a convenient vocabulary for the semiotics of humand and nonhuman assemblies. *Shaping technology/building society* , 259-264.

60. Brandt, E., Messeter, J., & Binder, T. (2008) Formatting design dialogues - games and participation. *CoDesign: International Journal of CoCreation in Design* 4, 51-64.

61. Jensen, T. E. (2012) Intervention by Invitation: New Concerns and New Versions of the User in Intervention by Invitation: New Concerns and New Versions of the User in STS. *Science Studies* Vol 25, 13-36.

62. von Hippel, E. (1994) The Sources of Innocation. , .

63. Lilien, G. L., Morrison, P. D., Searls, K., Sonnack, M., & von Hippel, E. (2002) Performance Assessment of the Lead User Idea-Generation Process for New Product Development. *Management Science* 48, 1042-1059.

64. Callon, M. (1990) Techno-economic network and irreversibility. *The Sociological Review* 38, 132-161.

65. Law, J. (1992) Notes on the Theory of the Actor-Network: Ordering, Strategy and Heterogeneity. *Systems Practice* 5, 379-.

66. Kamp, A. (2000) Breaking Up Old Marriages: The Political Process of Change and Continuity at Work. *Technology Analysis & Strategic Management* 12, 75-90.

67. Dal, M. G. (2015) ChirpNora: Digital Interaction With Plants. , .

68. Donaldson, T. & Preston, L. E. (1993) The Stakeholder Theory of the Corporation: Concepts, Evidence, and Implications. *Conference on Stakeholder Theory at the University of Toronto* , .

69. Poulsen, T. (2015) Appendix - call to brancheforening for office greening in denmark. , .

70. Birdwhistell, R. (1970) Kincesics and context: Essay on body motion communication. , .

71. Peppers, D. & Rogers, M. (2001) One to One B2B: Customer Development Strategies for the Business-to-business World. , .

72. Ebersweiler, C. & Joffe, B. () 8 Things About Hardware Crowd funding we Learned From 20 Campaigns. , .

73. Nielsen, J. (2000) Designing Web Usability: The Practice of Simplicity. , .

ADDIN bibliography{startup-2,SampleTemplate.doc}

11 Appendixes

All appendixes can be accessed online by going to:
https://dl.dropboxusercontent.com/u/2119565/Appendix.zip

Appendix 1- mentormatch application

Appendix 2 - IVS application

Appendix 3 - VentureCup application

Appendix 4 - TECH Challenge ansøgning

Appendix 5 - Mentor team meating 1

Appendix 6 - Mentor team meating 2

Appendix 7 - Meating with Steen Donner

Appendix 8 - Mentor meating with Allan d. 18-5

Appendix 9 - Meeting with DECOPLANT

Appendix 10 - Jydsk plante service interview

Appendix 11 - hardware 3d render

Appendix 12 - call to industry union for office greening in Denmark

Appendix 13 - Hardware schematics