Aalborg University – Entrepreneurial Engineering MSc.

Growth strategies for a knowledge based start-up.

Master's Thesis Project.

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STUDENT REPORT

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SYNOPSIS:

The following document is my Master's Thesis project about the company CreateItREAL.
The document contains a detailed analysis of the current state of company as well as a proposal for its future.

[Zoltan Tamas Vajda]

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By signing this document, each member of the group confirms participation on equal terms in the process of writing the project. Thus, each member of the group is responsible for the all contents in the project.

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Part 1: Create it real

Introduction

For the last 9 months I have been part of a team working on a **start-up** called **CreateItREAL**. This company was originally founded in **2009** by Jeremie Pierre Gay, with the goal to put a **3D Printer on every desk** by solving the technological issues that currently hinder adoption.

The main area of interest of this venture is a subset of 3D Printers called **Fused Filament Fabrication** printers or FFF printers for short. FFF printers use a small stream of molten plastic to form three dimensional objects layer by layer and contour by contour. FFF was chosen as a first target, because compared to other rapid prototyping methods it offers a number of advantages. The objects made using this method are fairly strong and usable, close to the quality and durability of injection moulded parts meaning it is also usable for small scale production runs. Practically any thermoplastic from abs to nylon to even polymers enriched with additives like metal dust and wood. It is also them most widespread and most mature out of all the additive manufacturing technologies.

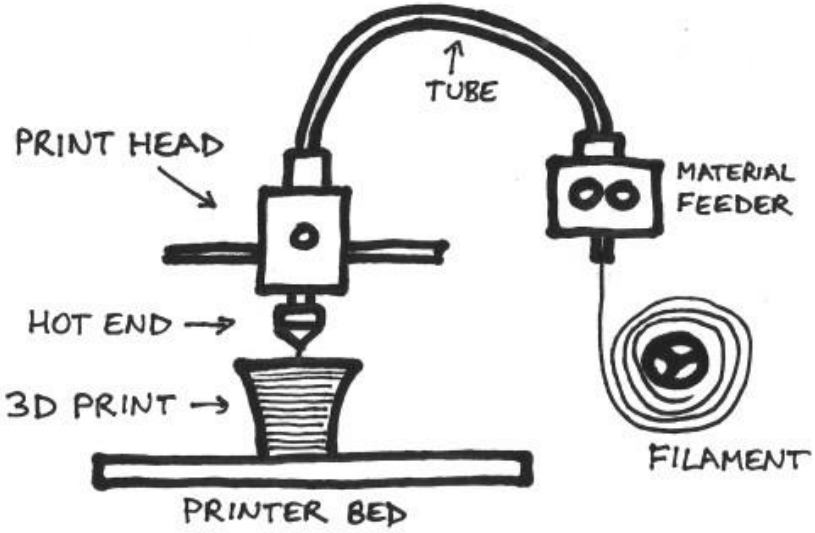


Figure 1. A Fused Filament Fabrication printer

Since the expiration of key patents in 2009 on FFF printers the 3D Printing industry went through a revolution thanks to the huge success of open source Fused Filament Fabrication printers called **RepRaps**.

Figure 2. A typical open source (RepRap) printer.

These machines essentially created the desktop 3D Printer market. Before the RepRaps 3D Printers were expensive toys made for the engineering departments of large corporations. Additive manufacturing was considered a tool for prototyping and essentially another step in the production chain.

The first open source printers however had something different in mind. They wanted to create a tool that could sit on everyone's desk, providing the means for everyone to own their own mini factory.

The popularity of these machines lead to the original big players abandoning the low cost, desktop printer market to focus on enterprise users.

This meant the market was split into **two** highly **different segments**: high quality, expensive and large industrial printers and the open source do-it-yourself, printers (RepRaps) aimed at enthusiasts.

On one side the original two, **Stratasys** and **3D Systems** focused on, repeatability, precision and reliability building sophisticated and expensive machines to cater for enterprise users. On the other hand, we had the **open source community** working on developing printers that could be easily built at home by enthusiast with easy to source parts. The focus on their **Do-It-Yourself** approach lead to making compromises to be able to use off the shelf parts instead of having to develop and manufacture industry specific solutions.

Riding on the **success** of **cheap** open source **printers** more and more companies entered the desktop printing market. These companies want to offer a higher quality printers and a better user experience (pre-assembled and configured printers with support and warranty) at a premium price aimed at mainstream home and professional users.

Figure 3. Pirate3d's Buccaneer, a preassembled high quality printer

Without the **will**, **resources** and **know-how** needed to develop their own platform most of these companies ended up **using** the already **existing open source electronics** and software with all its drawbacks (lack support, bad optimization for high volume production) to power their machines. This lead to interesting cases like multi thousand euro “industrial grade” machines being driven by cheap 100 euro off the shelf electronic kits.

This is where CreateItREAL comes into play with its **dedicated software** and **electronics platform** designed from scratch specifically with 3D Printing in mind. Tackling industry specific issues with industry specific solutions instead of a one size fits all approach provides a competitive edge in areas like speed and noise.

With the current state of the art technology **printing** an object can take anything from a couple of **hours** to **days**. This hinders the adoption amongst mainstream users who are used to printing pictures in a matter of seconds on their conventional printers. At the current state of the technology printers are also noise consume quite a lot of electricity and have a relatively high failure to success rate. If a print takes 10 hours to finish but has to be restarted 3 times then the actual fabrication time turns into days and the noise of the machine makes it highly unlikely that anyone would want to run it overnight or even for multiple days in a small apartment. Reducing the print time to an hour would eliminate most of these issues and could be an important step to wider adoption.

This was exactly what CreateItREAL is getting really close to achieve.

During the past 6 years the company, which first only consisted of Jeremie himself, but now have **7 permanent members** and a varying number of interns, worked parallel to the other players in the market on developing its own 3D Printing platform ripe with new innovations like the world’s first **dedicated** 3D Printing **Real Time Processor**.

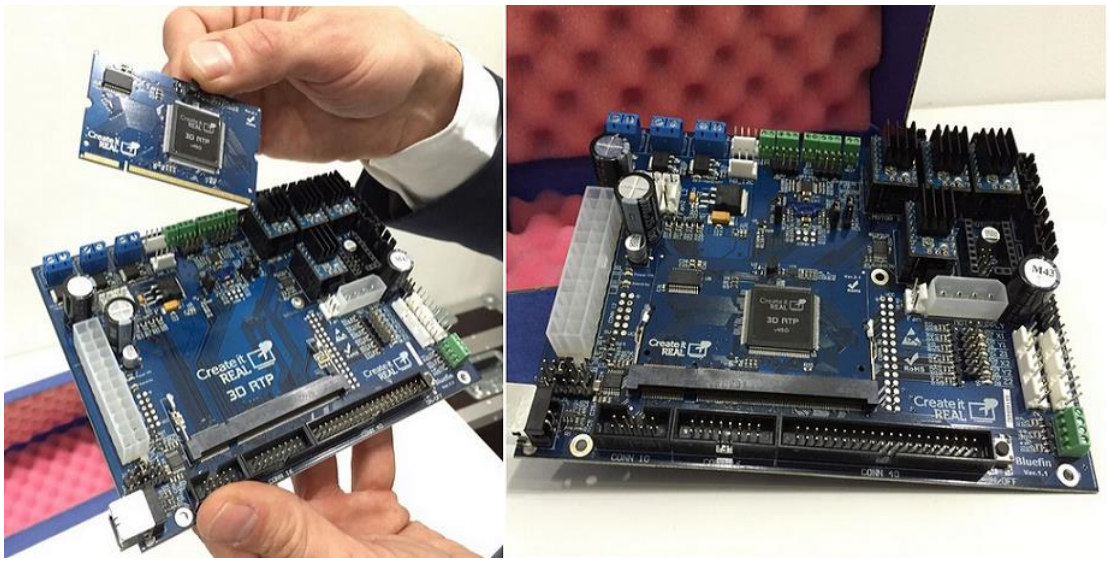


Figure 4. CreateItREAL's electronics platform.

Being the **first company** to offer a dedicated **3D Printing platform** solution for the **low** to **midrange** segment gives the company a competitive **business advantage** next to the technological lead.

CreateItREAL is also **unique** in a way that it did not use this technology to release its own printer but chose to **collaborate** and make it available to anyone willing to pay for it, turning potential **competitors** into **customers**.

In the beginning of the development was mostly **funded by** research **grants** and participating in **EU** and government **projects** and the focus was more on the technology and less on the business, but as the technology matured it attracted attention, which meant the arrival of the first partners.

The company now has **two partners** the Italian Dynamo3D and the Polish company Aye-aye labs. These companies were specifically chosen from a pool of others for two reasons. First they are both very strong on the same thing: making a lot of noise with eye-catching product design. The second reason is that they both target different market segments.

Dynamo3D with their printer the **D3D One EVO** (often dubbed the "Ferrari of 3D printers") is marketed towards enthusiast with the focus on speed easy serviceability and high quality parts.

Aye-aye labs' all-metal **Hotrod Henry** gathered a lot of attention with its vintage looks and high build quality. This printer is mostly aimed at professionals, like designers and architects both individuals and small studios.

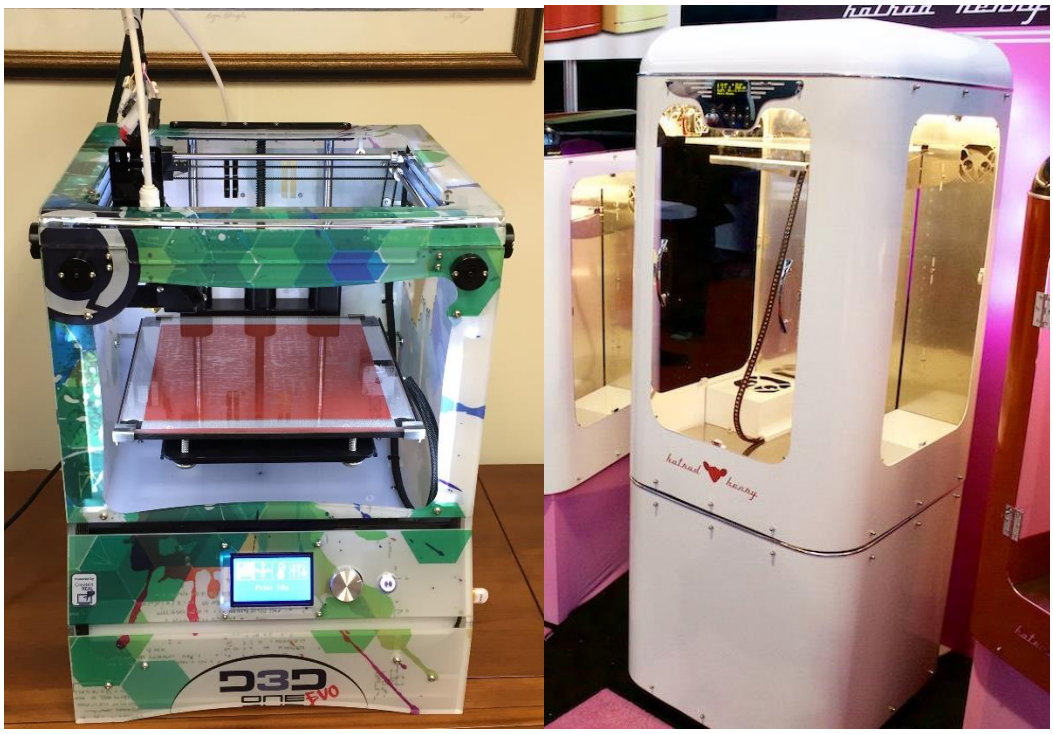


Figure 5. D3D One Evo (left) and the Aye-aye labs' Hot Rod Henry (right)

Problem formulation

CreateItREAL has been up until this point run based on intuition and experience, mostly by engineers without a formal business education. This makes it a very interesting case. The goal for this project is to first analyse the company to see where this style of management has lead the company so far. In the second part we'll develop a new strategy for the company using the things we've learned from the analysis. Right now the company is in a very interesting point in its lifecycle facing significant growth in the coming months. The way the transition from a start-up a company in this period is handled can make or break the company. For it to be able to handle it smoothly it needs an explicit and actionable business model. This is where the present paper comes into play.

First of all, this case gives me an opportunity to use the tools I've learned on a topic I'm intricately familiar with.

On the other hand, it is also to serve the role of a play book for the company to come back to during this important transition period, by giving a business perspective to a company run by engineers.

Analysis of the company:

To be able to rethink and rebuild the company we first need to know the current state it is in. In this part we'll try to get an idea of how the company operates right now, where it is headed in the near future.

One way to tackle this is by looking at where the company is it in its start-up lifecycle.

The **Organizational Life Cycle Model** [1] developed by Larry E. Greiner in 1972 divides the development of a start-up into 4 stages. **Entrepreneurial**, **Collectivity**, **Formalization** and **Elaboration Stage**. The change between each of these stages is always inspired by a crisis when the current structure and organisation of the company proves to be inadequate to handle the growth it experiences.

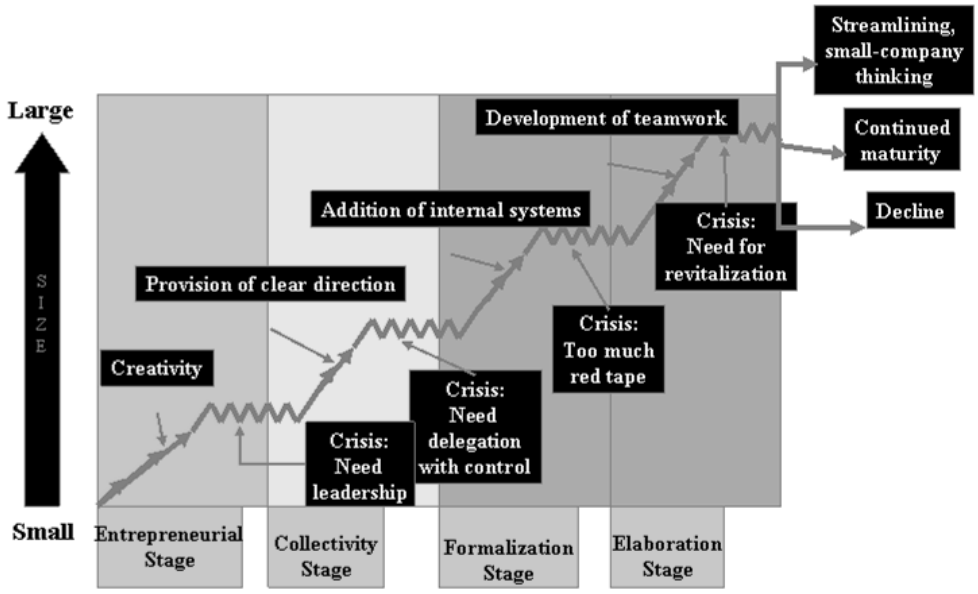


Figure 6. Organizational Life Cycle Model

The **Entrepreneurial stage** is about trying to find a good idea and a matching business model. Companies at this stage are usually one man shows, or operated solely by a handful of cofounders and this lack of manpower is what leads to the first crisis: the need for manpower.

In the **Collectivity stage** the founders alone cannot handle the development workload so more and more people need to get involved. These newcomers are no longer personally invested in the company, but are usually paid employees. The atmosphere however stays informal, with vaguely defined roles and a hands-off approach to management, as the thrill of pursuing the vision together creates a strong commitment and motivation in everyone involved. As the volume of sales, the number of employees and the amount of work starts to pile up the second crisis appears in the form of need for more stability and structure. This is the time when middle management, full time accountants and lawyers, dedicated sales, marketing and customer support departments get introduced. This is called the **Formalisation stage**.

If done incorrectly and in a rush this change leads to an overcompensation and introduces lots of bureaucracy and red tape killing the innovative mindset that lead to company to be successful in the first place. This leads to the **Elaboration stage** which is about finding the right balance of structure and innovation. It usually means Flattening out the structure and shortening the chain of command by empowering lower-level management.

CreateItREAL is currently in its collectivity stage. There is only a handful of people involved, the tone is informal and everyone is their own manager. But it is also at the end of its collectivity stage, heading into the crisis of need for stability and structure. With the release of its first products later this year the company is about to face its biggest growth ever.

If this transition is handled incorrectly it can lead to two things. Without change in the structure and without well-defined roles and consistent management it can lead to headlessness, with everyone trying to do quick firefighting and solving immediate issues and losing sight of the bigger picture. On the other hand, the introduction of too much change, high levels of overcompensation can overstretch the budget by requiring more manpower and can also lead to a decrease in innovation capabilities as described by the organisation lifecycle model.

Product lifecycle

Instead of focusing on the company and the people behind it the Product Lifecycle model looks at finances and adoption rate of the main product of the company. To determine where the company is in its lifecycle. [2]

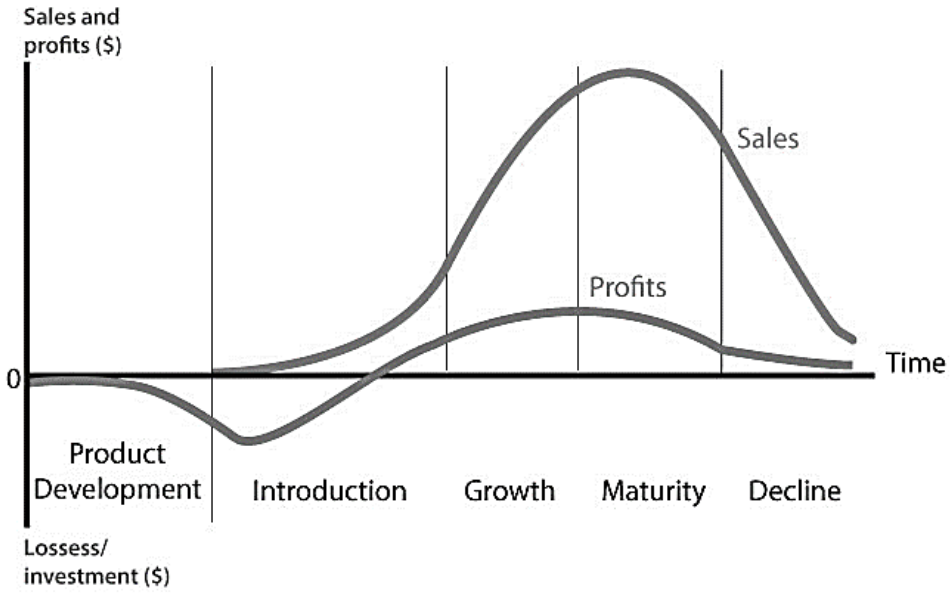


Figure 7. Product Lifecycle model

This model divides the development of a company into 5 different stages. In the **Development** phase all the work is put into creating a product. In this phase the company usually lacks revenue which leads to negative cash flow and high investment needs. In the **Introduction** phase the company releases its first product which finally brings a source of income and much needed positive cash flow. The introduction phase is usually followed by a stage of rapid **growth**, which slows down as the product reaches **maturity**. This period is then followed by a **decline** of sales as the product is slowly superseded by newer technologies.

This model puts CreateItREAL on the Border of Development and Introduction phase also known as **Valley of death**. [3]

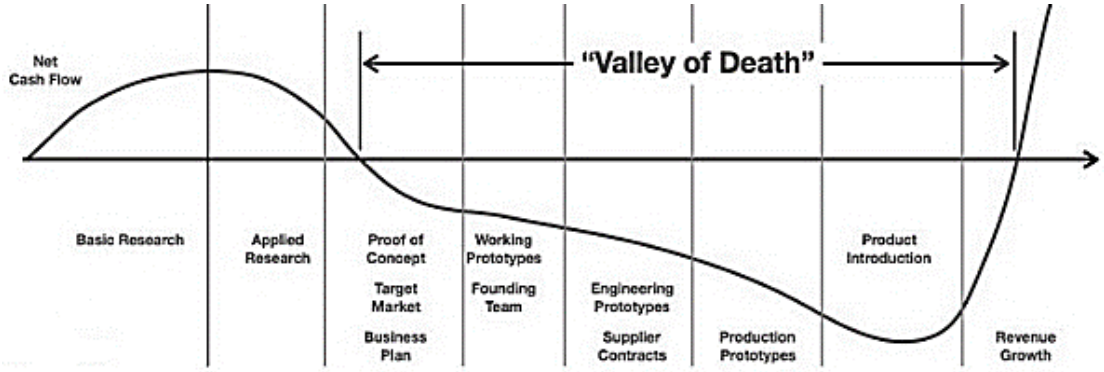


Figure 8. The "Valley of death".

This zone is characterised by two main things. The first is negative cash flow, the second is the fact that some 90% of all ventures never make it further than this (hence the name).

This is thus an important stage of development for any start-up as this is step that separates successful companies from ideas that never quite made it. Managing the transition from a development project funded by grants but with negative cash flow into a company funded entirely by the revenue from selling products is just as important as getting through the valley. As the product releases and the volume start to scale up, sales, marketing and management gains more and more importance over engineering. How this initial growth after crossing the chasm is managed can determine the growth rate and future potential of the company.

Business Model Canvas

The next amazing tool to map businesses is the Business Model Canvas by Alexander Osterwalder [4]. The business model canvas analyses a company by breaking it down to its main activities and arranging them into a chart to visualize how they interact and link together. It gives an easy way to describe and analyse a company's business model.

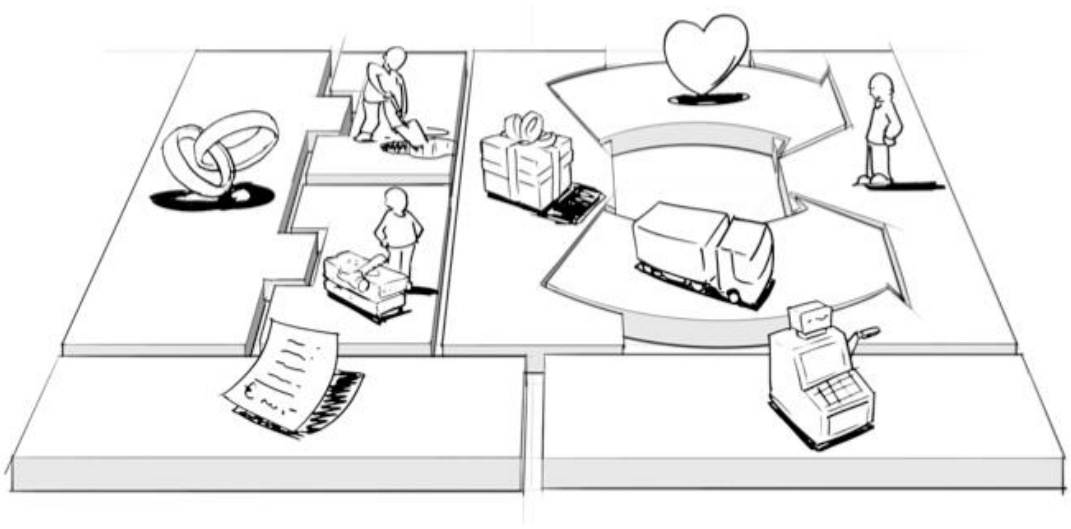


Figure 9. The Business Model Canvas.

In the canvas the main parts of the company's business model are separated into 3+1 main category:

- On the centre of it all there is the value proposition (the +1)
- On the left there is the infrastructure, consisting of all the resources, activities and partners needed to achieve said proposition.
- The right contains the customer segments, channels and relationships, describing the company's relationship with its customers
- On the bottom there are the finances both revenue and cost structure.

Let's look at the individual fields for the case of CreateItREAL.

1. Infrastructure

Main Activities

The company's main activity is Research and Development. Next to the continuous development of the main software and electronics platform the company takes part in high risk, moon-shot projects both internally (mostly done as part of internships and final projects in cooperation with AAU) and in cooperation with outside partners as part of EU and local projects and research grants.

Aside from R&D daily activities include marketing and sales operations, negotiations with partners and participating in trade shows and exhibits.

Key Resources

The main and pretty much only resource is the talented people behind it and their knowledge. Next to this there are also the patents and other forms of intellectual property owned by the company.

Partners

Currently the company's most important partners are the local and European research institutes and Aalborg University. Other important partners are the suppliers of the electronics used in the main product of the company.

2. Customers segments, channels and relationships

CreateItREAL's main customers are companies who try to enter the 3D Printing market with their own printers, who want to stand out from the rest of the competition by not using the same open source software and electronics as everyone does, but lack the resources and know-how to develop their own platform.

The company has a very close and direct relationship with all of its customers. It means working together on solving problems and adding new features on a daily basis. The same can be said about the sales channels. All of the partners go through a series of first informal then formal personal meetings before the contract is signed. Most of the potential customers come from meeting them personally in trade shows and exhibitions.

3. Cost and Revenue Structure

Up until recently the company was funded purely by participating in EU and government projects as part of a R&D group.

Like every start-up CreateItREAL is struggling with cash-flow too. This is to change in the near future as the first partners start to release their first products. As the volume of sales scale up royalties after each machine sold will likely become the main source of revenue.

The cost structure of the company is fairly typical too, with the highest expense being salaries for the employees. Other costs include daily operation and infrastructure costs (shipping, electricity, internet access, software licencing, websites etc…) and marketing costs (travel costs, attending trade shows and exhibitions), and ordering parts and intermediary products for the electronics platform

+1 Value proposition

According to its website the company's main product is the (…)

> *"(…) unique and flexible technology platform that will enable you to quickly launch a proprietary and state of the art 3D printer on the market with minimum technology development risks."*

In general, the analysis paints the picture of a typical start-up built by engineers around an impressive piece of technology. Balancing on the edge of the valley of death facing some serious potential growth this venture is ready for a transition from a start-up into a company. Even though it was built by engineers out of love for a technology it's biggest asset is not the not the amazing industry leading printing speeds or the unique printing platform. And even though the company is right now facing the valley of death the biggest challenge will not be getting out of it, but handling what's after.

Part 2: Developing a Strategy

While the analysis in the first part painted a picture of a fairly typical technology start-up it also highlighted some potential issues that arise from the way the company was built and managed up to this point.

One of the main challenge comes from the fact that the current lasses-faire type management. As the number of partners signed and machines sold increases along with the workload, there will be more need for manpower and higher levels of specialisation and clearer boundaries of responsibility.

The second potential challenge is the transition from a technology for the technologies sake (or for "capturing attention" sake) to a business first, customers first type of organisation. As the main product gets released for the first time to a wider audience the first reviews whether positive or negative, the first real user feedback and the first real need for customer support will flow in. Making sure that the company is able to handle it in a correct and timely manner will be key. The product has been designed by engineer for engineers trying to appeal to manufacturers and journalists which worked so far, but this does not mean that it will work when it gets into the hands of the first real customers.

The company is also about to face some potential backlash, resentment and ridiculing from competitors and the media. As with any new breakthrough innovation in technology, old well established players in the field will always find a way to downplay its importance or make potential customers believe that it is just a hoax. This is especially true if you happen to be a proprietary technology provider in a market so dominated by meritocratic open source development. It's easy to find flaws in numbers and it's easy to ridicule a new and ambitious technology but it is hard to do the same with a clear and concise message, a vision of a better world, a goal of making lives easier. Establishing and effectively communicating such value proposition is key in handling this situation.

Step 1. Revised core value proposition

Stable core value proposition and strong brand is important to manage to handle what's next. A well-defined core business model gives the agility the company needs to tackle any potential issue both inside and outside the company, and allows it to stay on target.

The Golden Circle [5] is a tool that was originally developed by Simon Sinek, to show how leaders inspire action by communicating differently from other people. It is also widely used to explain and create business models and core value propositions. It is essentially three concentric circles representing three levels of communication behind every message.

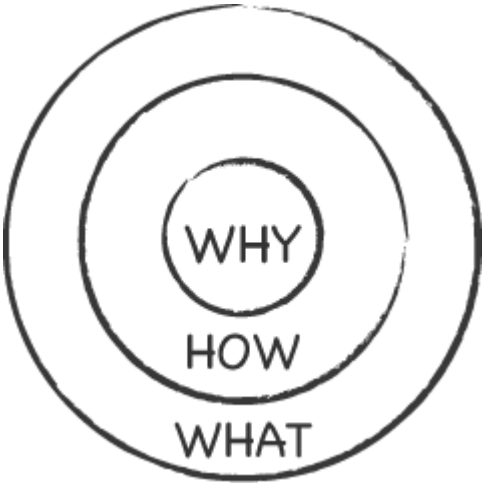
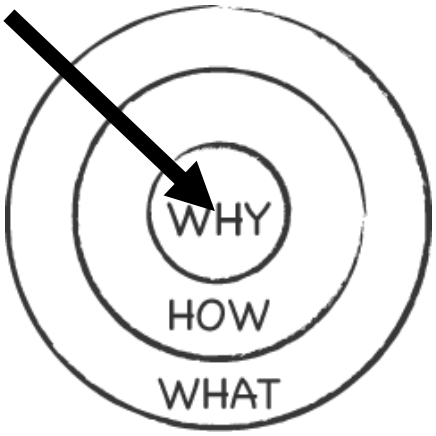


Figure 10. Why? How? What?

Most of the companies when trying to define what they do take the logical and intuitive path and define it from the outside-in, going from simple and visible to more complex and less tangible. A classical company would build its value proposition this way. In the case of CreateItREAL it would look something like this:



What (do we do?): We make electronics and software that enables fast printing

How (do we monetize it?): By selling it to companies lacking know-how to develop their own platform

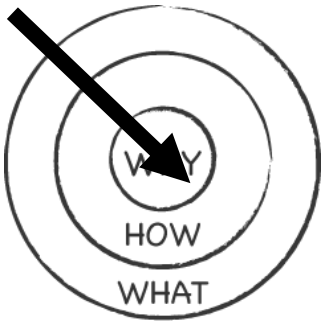
Why (do we do what we do?): To ensure growth and revenue for the company.

This value proposition places the 3D printer manufacturer as the customer with the company's main activity being developing better and better, or more specifically faster and faster, electronics and software. While technically true at the current state of the company, message is not appealing and makes the business model stiff and inflexible.

Should there ever be any disruption in the market, like the competition catching up on speed, or new and completely different ways of additive manufacturing surface and make the current technology obsolete, would leave the team with a number of now bankrupt partner companies and scratching its head thinking "What are we supposed to do now?".

If we look at some of the most successful companies of the last decades there is something common in all of them. They communicate differently.

One such example would be Google. If we were to use the three circles for Google's business model going outside in, we would end up something like this:



What (do we do?): Developing search engines.

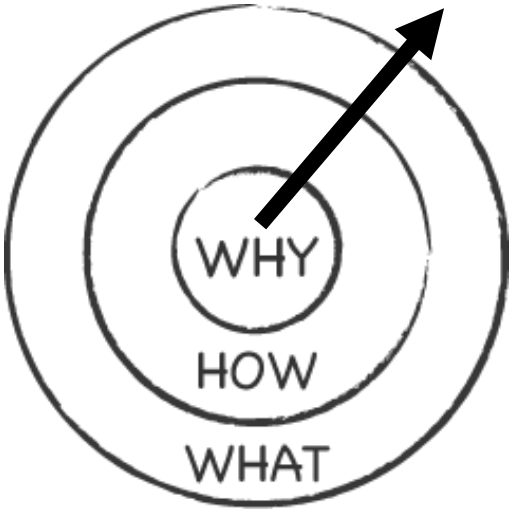
How (do we monetize it?): By showing advertisements and selling the data we collect.

Why (do we do this?): To ensure growth and revenue for the company.

This might seem correct on the first sight but this is not the case in real life. In reality Google's mission statement says it's goal is:

"to organize the world's information and make it universally accessible and useful"

The reason behind this is that just like many other successful companies they start with the **why**. Reverse the order and start from the inside out we will end up with something that is much more appealing, sympathetic much more believable and actionable:



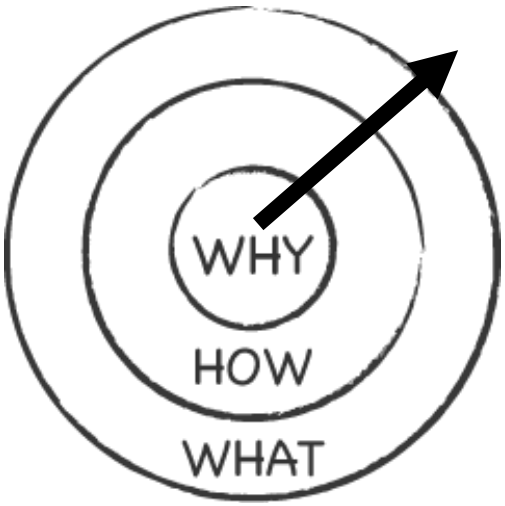
Why (do we do what we do?): To make the world a better and more equal place with the help of technology.

How (do we achieve this?): By developing new ways of making information universally accessible and useful.

What (are the products we develop?): Search engines, Super computers, Mobile phone operating systems etc…

Structuring the core business model this way enabled the company to be more flexible. Instead of being reliant on the internet and being only a search engine developer, following the why-how-what strategy Google ended up being a much more, diversifying into other industries like mobile operating systems, artificial intelligence, robots, super computers, big data, advertising and marketing made google a more robust more tangible company, allowing it to successfully weather economic recessions, changes in internet usage and entrance of competitors.

So how does this apply to CreateItREAL? The company on a daily basis is very much run on an "outside-in" management. This is partly because the organisational problems foreshadowed in the analysis is already taking its toll with everyone getting lost in small details and extinguishing fires before the big launch. It is also partly because the outside in approach is much more appealing to an engineer's mind. A revised core business model for CreateItREAL now with the correct inside out logic would look something like this:



Why do we do what we do? We want to introduce the world to the amazing technology of 3D Printing, make people use it, like it, love it, because we believe it would make everyone's life more fulfilling.

How do we achieve this? By providing an amazing printing experience to the masses through helping our partners make great printers using our technology and know-how.

What is it that we provide? We provide a full platform of matching mechanics, electronics and software that was specifically designed to solve the biggest issues that hinder the adoption of 3D Printers.

Apart from sounding a lot nicer and believable it also turns the company's message towards other players on the market from:

> *"We're here to steal your market and disrupt your open source business with our fast, proprietary printers."*

to:

> *"We are here to help 3D Printing get to the masses and to turn it into something that makes everyone's life better by using our technology and knowhow to help anyone willing to work with us."*

In a market that is already sceptical of patents and proprietary solutions from new entrants this reduces lot of the friction and resentment from not only the competition but also the main evangelists and opinion leaders of the industry.

Apart from this intangible change the new proposition also has some very practical implications. First of all, it changes the mission of the company from "Bringing technology to companies" to "Bringing technology to people". This might sound like a small change but it is actually quite different. It changes the role of the 3D printer manufacturers from being a customer to being a channel we use to access our end users.

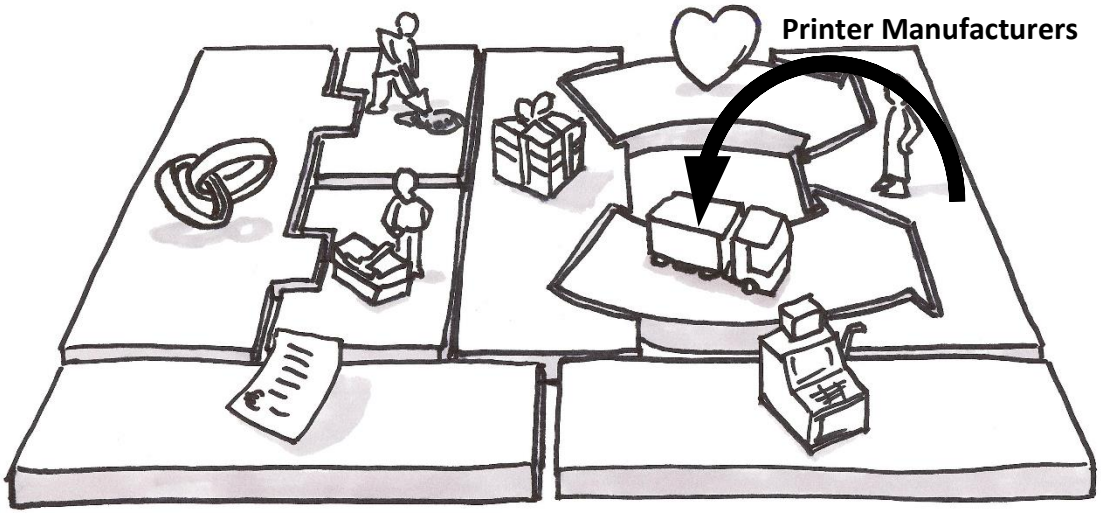


Figure 11. A Change in the business model.

The partners are no longer the only one to keep satisfied and to have a say in what features get implemented but the end users. In the end if we keep the users happy as a by-product our partners will be happy too and that in turn means having access to an important sales and communication channels towards our end-users.

Another important implication is the role of technology for the sake of technology.

Currently the platform is developed to be faster, to be better, to be more precise, but these are technological and engineering achievements and they do not mean a lot on their own. They might be important printer manufacturers who are looking for a buzzword to stand out of the crowd, but an end user is indifferent weather or not it was the amazing speeds or clever software that got them to their object being printed.

What they do care about is the object being printed and what will they use it for. To them all that technology we cherish and proud of is just part of a magical noisy box that stands between them and the object they desire.

Technology might get you the first sale and the attention from the media, but providing that technology in an easily accessible package that makes the lets the users feel empowered, instead of frightened gets you the second and third and fourth one.

This value proposition also frees up CreateItREAL to look into other complementing technologies or creating use cases for 3D printing.

This transition from technology for the sake of technology into technology for the sake of user delight (which in turn means for the sake of business) might be the hard for a company that built its image around engineering and prides itself (rightfully) in its technologically advanced product. In **Step 3** will talk about organisational changes to facilitate this transformation.

Step 2. Positioning and Marketing

The newly defined value proposition brings with it a new marketing and positioning strategy. If we look at the manufacturers as a channel for selling our technology to end users that means that CreateItREAL is no longer a B2B(2C) company, that can hide behind its partners but a B2C one with an interesting value chain, meaning it is exposed directly to the end user's "wrath". There is not really any way to circumvent it as some part of the offering (namely the software bundled with our electronics package) is very much user facing, since it is pretty much the only way any user can interact with the printer. Whether we like it or not CreateItREAL is at least partly a B2C company and it needs to act like it is one.

The theory describing potential marketing choices in a situation like this is called push-pull marketing. [2] It says that each company that is selling its product through a distributor has two ways of affecting the market in order to capture more attention and sell more product.

One way is to achieve more sales is to push forward in the value chain by convincing distributors and resellers to promote our products and "**push**" it to customers.

The second way is to create a **"pull"** from the market side, by building up demand on the market for our product that will force the distributors and resellers to partner with us in order to not lose customers.

Both of these strategies have their use and place and both have pros and cons. The most successful companies use a combination of the two to capture as much attention as possible.

In the case of CreateItREAL this strategy means having two faces of the company, two marketing strategies with two different touch points.

On the **push** side we have the 3D printing manufacturer, who look for the technology that can give them a competitive edge and make them stand out from the crowd. Towards them the main touch point is the electronics providing fast and quite prints, giving them the much wanted advantage, while the main forum for interaction are trade shows and exhibitions.

On the **pull** side we have the end users, the people buying the printers. They look for a cool brand to identify with, a seamless printing experience and interesting new features. The main touch point on this side is the software which is the platform's most obviously user facing part.

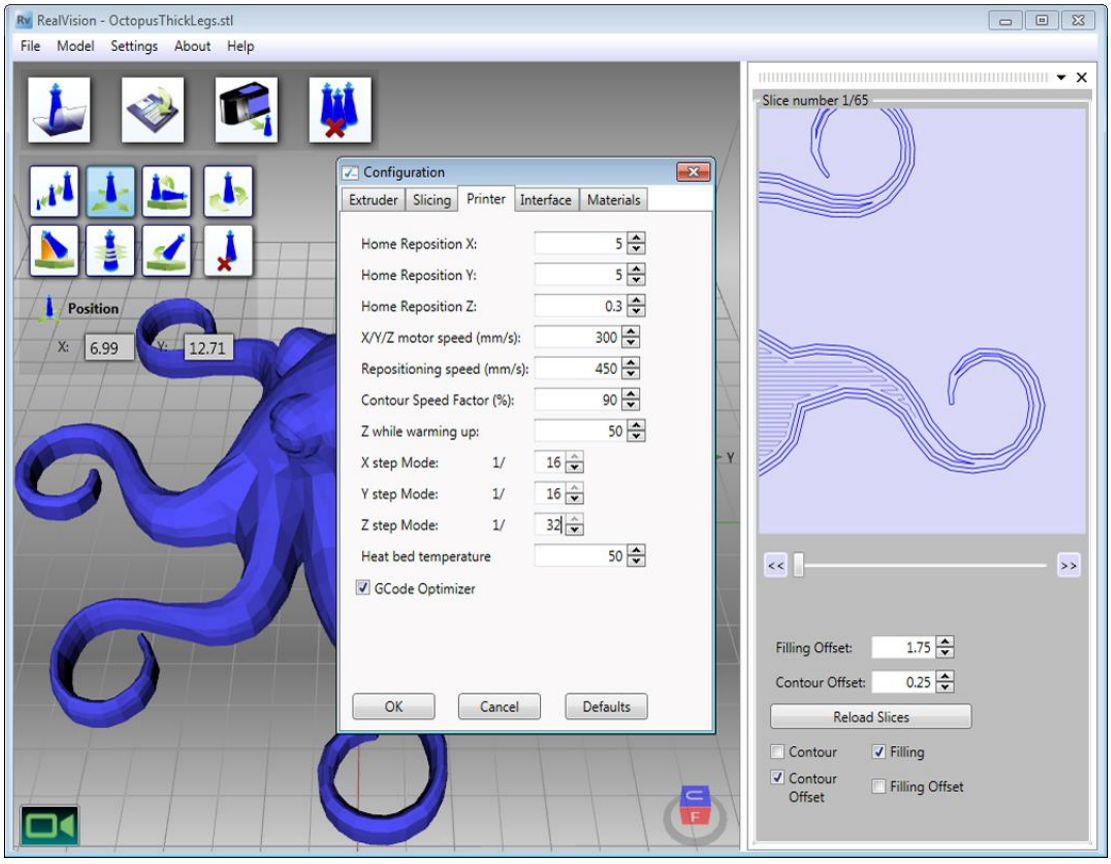


Figure 12. RealVision, CreateItREAL window towards its users.

Push marketing works for getting the first partners on board, which in turns give us access to the end users, but a transition to **pull** marketing has to be made once we have reached enough users. Focusing solely on **push** marketing, trying to please partners, makes the company vulnerable and dependent on its partners and puts it in a bad bargaining position. It also makes the business model more fragile as it leads to less loyal customers and distributors (the printer manufacturers) who are more willing to switch to alternatives.

Pull marketing, requires that we've already reached enough users to be able to effectively market ourselves. Using the software as our main touch point we can create demand for our products by providing unique features and a better user experience than the competition. A great software and brand recognition leads to loyal users spreading the news, creating **demand** for our platform.

Another way to create **demand** on the **pull** side is by coming up with new use cases and **complementary products** and **services** (like 3D scanning or photography) for 3D Printing and tying them into our platform. Coming up with a unique use case that is only available on printers equipped with our platform create more demand from customers wanting to use it putting a **pressure on the manufacturers** to work with us.

Apart from correct use of push-pull marketing strategies another important thing to look out for is expectation management.

In an environment that is as sceptical to new innovations (especially if they don't come from open source projects) as the 3D Printing community, backlash, resentment and ridiculing of any unrealistic claim is to be expected from competitors and opinion leaders. The initial release needs to be handled with reasonable claims, consistent communication. With the first partners secured and signed there is no longer a need to impress with technology. It is better to exceed expectations than to fall short. Printing fast should be the icing on the cake not the cake itself.

It is also important to avoid getting boxed in and marked as a **one-hit-wonder**, by having a continuous and **consistent flow** of new features and **innovations** apart from speed improvements. One way to achieve this is to focus on a different issue with each new partner. Tackle speed with one partner, tackle another one with the next. We'll talk more about partners and how to handle them in **step 4**.

Step 3. Organisational changes

During the analysis of the company we've already found that the transition from the collectivity stage to the formalisation stage usually brings the need of establishing more stability and structure inside the company, but we've also concluded that this step needs to be implemented correctly to keep up the innovation potential of the company.

The shift from working on technology for the sake of technology towards working on creating a satisfied and loyal customer base by using the technology to provide a seamless experience necessitates the introduction of design thinking and customer based innovation into the development process as an integral part. Up until this point there was very little user involvement in the development process with most of usability testing done in house by the same engineer who wrote the code. This means that the software (which we already established as one of the most important windows towards the outside world) is one of the weakest points in the offering.

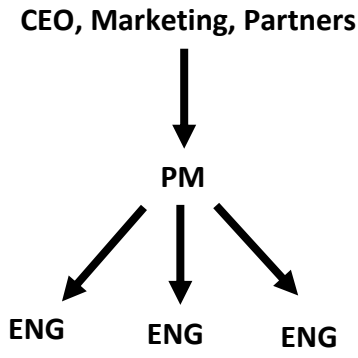
In order to fix this a large effort needs to be done in terms of redesigning the software in a more user centric fashion.

Considering the engineering background of most of the team you cannot expect for everyone to be a design and management expert overnight, which leads us to the importance of introducing layer of **middle management** into the organisation.

In order to introduce design based innovation to the company mentality and develop better products, the company need to rethink the way product development is managed.

What the we need is a new project management structure that is more in line with the revised value proposition and business model. One which helps promoting the same why-how-what structure we established in **step 1** by **making the core value proposition part of the development process.**

The "**Why**" level of thinking comes from the CEO and the head of marketing in forms of long term strategy, potential features to be implemented, technologies to pursue. This is then on the "**How**" level turned in to actual tangible and technologically feasible features to be added to the platform by a Product manager. The "**What**" level of the structure is managed by the engineers themselves, making decisions on what technologies to use, in which way to implement it.

<table>
<tr><td>Why?
+Market insight, Strategy</td><td rowspan="3"> 
</td></tr>
<tr><td>How? – Features
+User Feedback and Design Thinking</td></tr>
<tr><td>What? – Software and Electronics
+Technology and Creativity</td></tr>
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This introduces **two new** crucial **points** to the way development is handled currently.

The first is **letting the engineers deal engineering** and managers deal with user and business needs, **freeing** the engineers from making decisions they are not comfortable with and taking the responsibility of making product management and user experience design decisions, like which features to implement and how from the them to let them focus on the technical implementation

The second is creating a new role in the form of a **product manager**.

The role of the product manager is **facilitating** the **communication** between individuals inside the company. Taking business and marketing **strategy** from a higher level and **ideas** and improvements from the lower levels turning them into **features** to be added to the platform, then breaking it into smaller bite size chunks for implementation and handing it over to the correct engineer with detailed instruction on the design and business implementation but leaving technical decisions up to the engineer. This essentially creates a **buffer** and shields the engineers from having to deal with business and users. It also has the added benefit of having all the **changes** and **decisions** in the project go **through** a **common node** instead of decisions being made independently by multiple persons making the product easier to oversee and manage, with the added benefit of a more consistent user experience.

Adding a project manager would also lower the amount of **time wasted** on internal **communication**. If someone has an idea to implement but needs the help of another engineer to do it, in the current way they both need to break their workflow (potentially involving others too) to be able to explain and discuss the new idea. With a product manager in place he could assume the role of the technology broker, collect the ideas, store them, then process and bundle them together with more, similar ideas, then break down the technical discussion into smaller easy to answer questions that he can quickly discuss with both engineers on their own, then present the pre-developed simplified proposal in a clear, potentially written form at the right place and time to, the engineer who will implement it. This saves resources, shortens development times and leads to a more unified and consistent product.

This management style also known as **heavyweight team structure** [6] as proposed by Wheelwright and Clark is known to be the most efficient when it comes to managing platform and breakthrough projects.

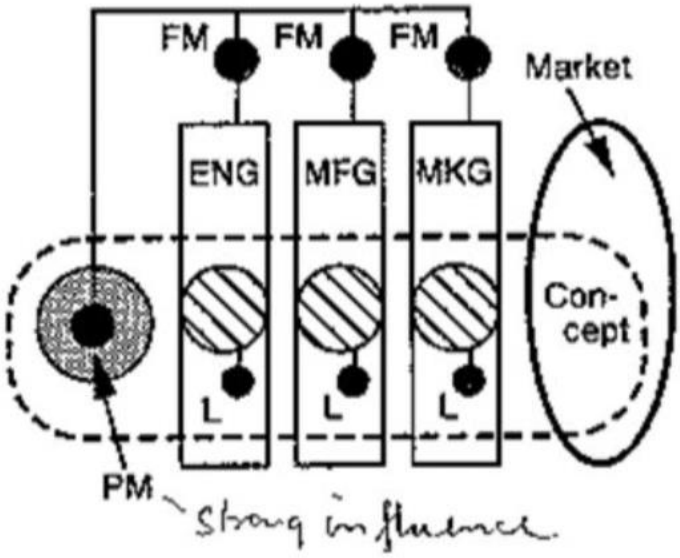

Figure 13. Heavyweight Team Structure

Having a **well-defined structure** in the early stage can **help with scaling** on the long run and can save the need for later restructuring as defined in the organizational lifecycle.

Since this is a relatively big change, **managing** the **transition** is crucial. Some might welcome the lowered responsibility but some so might see it as being left out or being reduced in importance. It is important to state clearly the project manager's role in this is not supervision or "being the boss" but more of **facilitation**, being a secretary of ideas. To an engineer if not explained correctly the addition of a middle man in the process might sound like a loss of efficiency (which it is not). Explaining the reason for the change and its advantages, discussing how it will affect everyone's workflow and clearly defining what is everyone's role in the process is important.

Step 4. Partner Relation and Growth strategy

In order to **avoid conflict** of interest between partners CreateItREAL needs to continue with its current strategy of **segmenting** the 3D Printing market in to smaller independent parts. To avoid one partner creating competition to another one a carefully chosen selection of first partners are needed that focus on these segments.

This could be companies focusing on different geographical markets like China, Europe, US, or companies focusing on different user segments like architects, designers, enthusiast, home users, enterprises, SMEs, small printers, large printers.

The problem with this strategy however is **scalability**. There is a limited number of ways to segment a market and the number of possible non-conflicting partners will **saturate** very soon, putting a **cap** on the **potential growth** of the company.

One way to solve this is to take a slightly different approach. Instead of segmenting the market into as small chunks as possible and choosing a partner for each it is better to identify the main segments that are **meaningfully different** in their needs for different features. One way to do it would be segmenting based on customer type:

- Home users
- Professionals, design and engineering studios
- Small and medium size businesses
- Large enterprises
- Schools and public sector.

When this is done the next step is to identify a potential partner for each sector to serve as a **beachhead**, or a **pilot** for setting foot in that segment. When choosing these partners, the main factor should be how well they are already **embedded** in that specific area. Choosing a partner that already has close connection to possible customers makes it easier to get first-hand information on the **needs** of that specific sector, which in turn leads to a better **product-market fit**.

These partners would get the chance to have a close relationship with a lot of **influence** in the **development** of the product for that specific segment, but they are also to share the **cost of** development of the **new features** required by that segment by paying a higher percentage based **royalty** and also accepting **longer time to market**. In return they would get **exclusivity** in their respective markets for a set amount of time.

Once the exclusivity expires the door would be open to new companies "**followers**" hopefully convinced by the success of the "pilot" partner to enter into another **"lower tier" of partnership**. This would essentially mean they would get a **lower price** paying a fixed price per unit, **lower time to market** and an already well developed and **bug-free** non-beta **product**. On the other hand, this partnership would guarantee **them no direct say** in product development and **no exclusivity**.

Using this strategy would allow to potentially **cover the whole** 3D Printing **market** while still **avoiding** unnecessary **competition** between the first few most important partners. The high tier partners would also provide a way to **subsidise development** costs, while the lower tier partners would help in getting the volume necessary to keep a **positive cash flow**.

In terms of positioning CreateItREAL needs to keep up its reputation as **trusted third party** and centre for innovation and R&D. Offering **continuous innovation** on the technology and guarantee to staying ahead of competition is still the company's most appealing proposition towards potential partners. But apart from the technology there are **other advantages** of CreateItREAL that is worth potentially **exploiting**.

One of them is **uniqueness**. Being a partner of CreateItREAL should feel like being part of an exclusive club versus the endless other faceless open source printer clones. As this "club" (hopefully) continues to produce more and more success stories the more appealing it will become.

There is also a very strong **Us vs. Them** angle to be exploited. One of the reasons open source electronics and software are so popular is that they provide a way for everyone to enter the market and compete with large companies. The same is true for CreateItREAL on a higher level. As the number of features grow the platform could help partners reach higher and higher end markets turning the company as the sling that lets David you pick up a fight with the Goliaths. This essentially says that we are not another big business here to make profit, but we are here to help small guys like you fight those big players like 3DSystems and Stratasys.

Another currently unexploited positioning advantage over open source solutions is **solid legal background**. Open source projects have always been a legal grey zone and is no different in the 3D Printing market. A study [7] from Sculpteo shows that one of the **biggest concern** in the enterprise sector about the adoption of 3D printers are **legal issues**. Having a clear consistent policy on both patents and copyright laws can be appealing to a lot of companies afraid to use open source software, hardware and electronics for legal reasons.

Step 5. Funding

As for all start-ups this size CreateItREAL has **three choices** for funding: Investors, Banks or going self-funded.

Getting a cash injection from a **business angel** is the usual choice and it is for a reason, being associated with a business angel has its benefits, like giving access to a **larger network** and getting **free business consulting**. A reasonably sized cash injection could also help by giving **more room** for manoeuvring and could provide a **safety net** and **time** to **take a step back** and implement the recommendations of this paper.

The company also have a chance to continue with **self-funded** development. With two partners signed and more coming the sales volume should be enough in a couple of months to provide a **positive cash** flow and accommodate a **modest growth**. In general, going self-funded is always the most appealing, but it comes with caveats. Without the safety net there **is less room for error** and having to work to be able to pay rent also means that there is **less will** and **time** to **implement** the crucial **organisational changes**. Going self-funded also means slower product development, which could allow **competitors** to **catch up** easier.

On the other hand, going for an investor right now to address a **temporary cash flow issue** might not be the best idea as an **investment** might be better used **later**, for **expanding** the number of partners rather than subsidising the development costs of the first ones. Having a positive cash flow and a product on the market will also give the company a lot **higher valuation** and make it a potential case for **venture capital**.

Good in-between and very possible solution would be to go to **banks** for investments, with **two signed partners** a **sound business plan** and a soon to be **steady cash flow**, the case of CreateItREAL is a **prime target** for a small **bank loan**. This would give most of the benefits of an investor sourced cash injection while keeping the independence of the company.

Part 3. Conclusions and Reflections

Having worked as part of the team, being involved in the day to day struggles of running a start-up, writing this project gave me an opportunity to step back and reflect on the things we do in the company on a daily basis.

Analysing the problems we face daily with an objective head with the help of the theories learned in the past two years to find the root of the problem and come up with a solution to make sure it never happens again turned out to be a really interesting journey.

One of the biggest findings for me was the importance of proper management even at such a small scale. When faced with hardships people tend to get obsessed with the present, trying to solve the small problems, forgetting about the bigger picture. The role of management in a start-up is to make sure this happens as little as possible.

Because start-ups at the end of the day are just an organization formed to search for a repeatable and scalable business model. And organizations are just a group of people working together on single cause, and forgetting this cause make the organization break.

Working on this paper also gave me a chance to take a second to look into the future of the company I'm working on building, instead of being obsessed with the present, and I have to say, the future (assuming the road there is managed correctly) will be bright.

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