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Open Design Consulting

How to capitalise on and adapt to open source practices for tangible products

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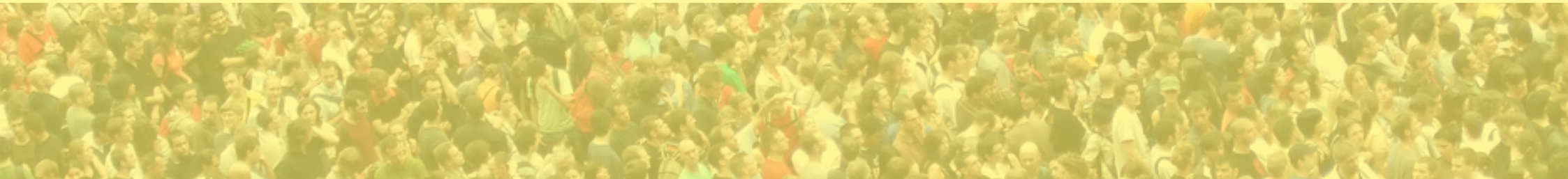
OPEN DESIGN CONSULTING

How to capitalise on and adapt to open source
practices for tangible products

Abstract

The objective of this study is to set up some foundational theory and practices for the conceptualisation of open source practices for tangible products, or the so-called Open Design. This is a novel and emerging approach derived from the well-known open source software movement. A clear definition of the practice has been lacking as well as identification of an archetypal business model of current practices. Furthermore no explanation or step-by-step process has been accessible on how companies could use open design and obtain a sustainable business despite opening up the product development process.

Four open design companies were chosen as cases for the study to identify their characteristics and activities. One case; Arduino, received a special focus, as the authors had the opportunity to work with one of its founders. Empirical material was gathered through face-to-face interviews and Skype conferences, while internet resources were used extensively. With literature on open design being scarce, some knowledge and experience was drawn from the 'brother' paradigm; open source software, especially in relation to motivational factors, management and business aspects.

This has lead to a clear definition and archetypal business model for open design, in addition to the Open Design Process, which demonstrates the key elements that have been identified and how they come into play in the process. These are *platform, community, development, business* and *drive*. A 6-Step Guide to open design is then introduced which starts by identifying the company's current situation (As-Is), both externally and internally, for thereafter to translate it into a To-Be scenario in terms of open design business opportunities. Emphasis is laid on the different possibilities of revenue streams that may influence other dimensions of the company's business model.

The authors see the 6-Step Guide as a consultancy framework for companies to walk through when considering open design. It should provide them with a well-rounded scenario of opportunities and challenges and prepare them for the next steps of implementing open design strategies.

Keywords: *Open Source Development, Open Design, Co-Creation, Platforms, Business Models.*

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Foreword

Right now, being open is no longer an added value. Either you are open or you are out! The internet has changed the game, we're be coming self-producers with access to information and possibility to learn whatever, whenever, wherever.

Addressing open design with somewhat of a business approach is a good way to open up the discussion for those who have not yet understood its fundamental importance, and explain its economical possibilities within the future scenario of technological and social development.

Sharing success stories, cases where people created new opportunities for themselves using open technologies and methods, is an invitation for anyone – also businesses – to embrace a change in their core values, to improve through knowledge creation and sharing their observations with others. It wouldn't surprise me if they earned a little more on that journey.

David Cuartielles, California, 2012

Jorge Bernal

Preface

Had we not stumbled into our former professor; Thomas J. Howard, at the Produktudviklingsdagen (Product Development Conference at The Technical University of Denmark) a cold winter day in January 2012, our journey into the exciting domain of open design would not have begun. We are thankful for having had the opportunity of exploring this field and we hope that our contribution will be helpful for further research – theoretically as well as in practice. It will be exciting to follow future exploration and evolution within the area and see how established companies as well as start-ups will exploit these practices.

Acknowledgements

About the Project

This is a master thesis project titled *Open Design Consulting*, conducted at The Technical University of Denmark, Department of Management Engineering. The project was carried out by two Icelandic students: Gudrun Adalsteinsdottir and Asta S. Fjeldsted, under the supervision of Thomas J. Howard and Tim McAloone, during the spring semester of 2012. A paper under the name *Open Source Development of Tangible Products* was published in August 2012 in relation to the students' participation in the NordDesign Conference* in Aalborg, August 2012. The paper serves as an introduction to open design and a summary of the project at the time it was handed in (see Appendix X).

Our main goal with this report is to shed light on the emerging practice of adapting open source development practices to physical product development, or so called open design, and present suggestions on how to go about it in order to sustain a profitable and viable business.

It is our intention to present this in a visual, attractive and accessible form in order to evoke interest and curiosity amongst readers, whom we see primarily as researchers and managers of companies looking for new ways in product and service development in order enhance their competitive advantage. Start-ups may benefit from reading this report as well for them to broaden their perspective on business development. Mostly, this report should enhance understanding of what open design is all about.

The name Open Design Consulting relates to the authors wish to establish a consultancy service on open design, with this research as the first step toward that goal.
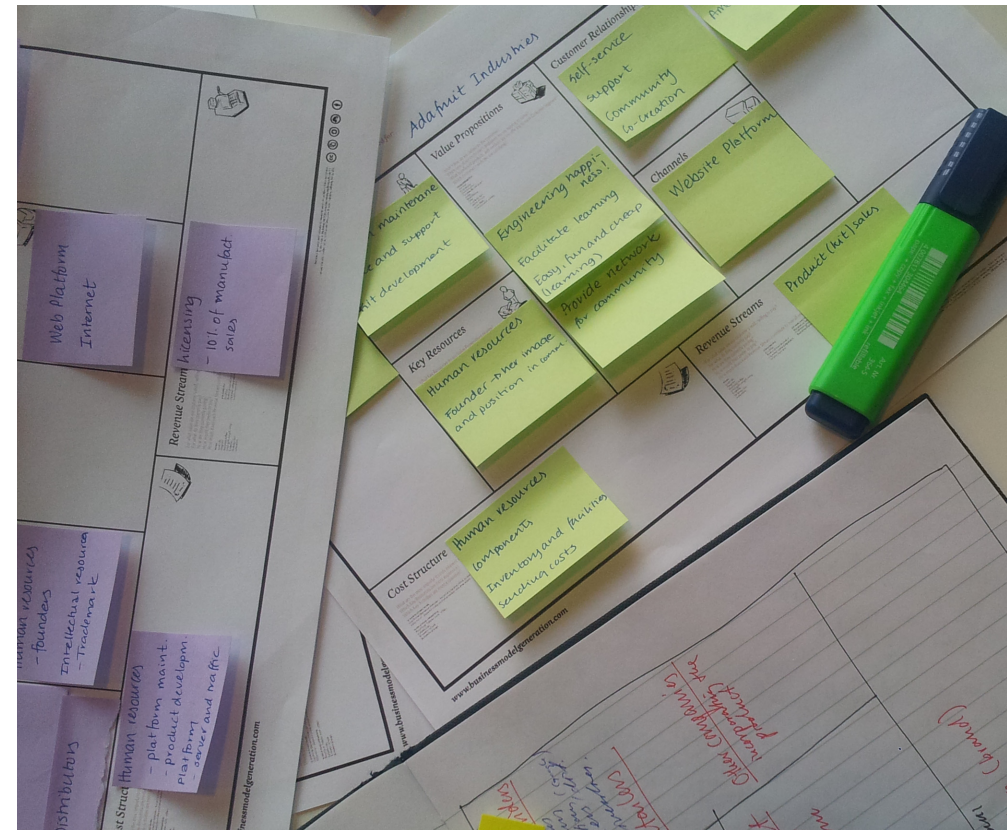
Introduction

Product- and service development is bound to be revolutionized within the globally networked information society we live in today. The disruptive nature of the Internet has radically lowered the barrier for collaborative participation enabling a rediscovery of the natural, human and social mode of creative endeavour (van Abel et al., 2010). Digital tools and media are enabling and facilitating personal learning, creation, sharing and transformation of information on a massive scale.

Leaders of development companies are realizing the benefit that community-based development can have on their businesses. The real-time communication and transparency that rule within the open source communities are exactly what internal development teams need in order tobecome more agile and meet the increasing demand for delivering high quality products with reduced development cycles.

Open source software (OSS) has proven to be a billion dollar business, with a vast number of communities contributing to its development, and with prominent companies, such as IBM and Linux, being able to capitalise on the potentials it brings (Fitzgerald, 2006). In light of the success which OSS has had it has been increasingly tempting to apply open source to the development of tangible products or so called open design (Balka et al., 2009a).

Business leaders have on the other hand been more reluctant towards open source practices in relation to tangible product development as research, case studies and flagship stories have been of scarce supply (Balka et al., 2009a). Ownership, IP rights and other proprietary aspects have been of concern as well as the potential complexity which open design poses, requiring physical production as opposed to source codes being compilable in a matter of minutes.

To this date a clear definition for open design has not been established. Furthermore there is a lack of open design methodology and literature which currently forms a barrier to the use of this practice. This inspired the authors to address the topic of open design, in order to give an overview of its dimensions and possibilities in generating new business opportunities. Introducing case examples of companies that have managed to reap benefits from the open design approach show that the pace of innovation, level of quality and speed of development is considerably improved. The low cost and reliability of a community based development show that open source practices can just as well be applied to tangible products.

The objective of this project is to develop and determine a clear definition of open design and map its process, in addition to creating an open design method, which will provide organisations with a step-by-step process to generate viable open design strategies. Furthermore, the research is conducted with a business perspective allowing for considerations in regards to business models and financial viability with an additional objective of identifying an archetypal business model within open design. Because of the dearth of prior research a broad approach is deliberately pursued in order to offer a foundation for future research.

The project is structured as follows:

- Firstly some background knowledge is provided for newcomers to the scenario of open source development for definitions and theories to be presented thereafter.

- Secondly the research methodology is described, followed by an in depth introduction of four case studies, which should demonstrate an example of open design in practice.

- Thirdly our Open Design Process is presented which explains the characteristics of open design and activities that companies need to cover in order to 'make it work' and develop a successful open design business.

- The fourth part explains how to run a profitable open design business by looking into 9 different segments of the identified Open Design Archetypal Business Model, with a special emphasis being laid on revenue streams.

- Then a 6-Step Guide is laid out for companies considering open design to map their current situation (As-Is) and how to translate it into a To-Be open design business strategy.

- Finally the 6-Step Guide is tested with one of the cases.

Problem Definition

To suggest the use of open design as a viable alternative for product development a fundamental understanding of what it entails and requires is needed. Additionally, a method for establishing development strategies for incorporating this practice is of dire need. This challenge leads to the problem statement of this study:

How can companies adapt to open design so that it allows them to

sustain a profitable and viable business?

To provide an answer to this we have identified the following sub-questions:

1. Is open design ever suitable for for-profit business creation?

2. What are the main characteristics of open design?

3. Is there an existing archetypal business model for open design?

4. Can the process of adapting to open design be systematised?

5. Can such a systemised process be shown to lead to viable output?

These are ambitious goals but it is our hope that our suggestions will contribute to a deeper understanding of open design and inspire researchers and others interested to further explore this exciting approach to product development.

Background Knowledge

As mentioned earlier, open source development is not new to the scene of software development. However, within tangible product development this is an emergent practice and has so far mostly been applied to electrical and hardware products*. In this research differentiation is made between tangible and intangible development, where the well-known term OSS presents intangible products while Open Design represents tangible products (see Figure 1). Some products may clearly entail both elements (hardware and software) such as Arduino and RepRap, an open source electronic prototyping platform and an open source 3D printer, respectively.
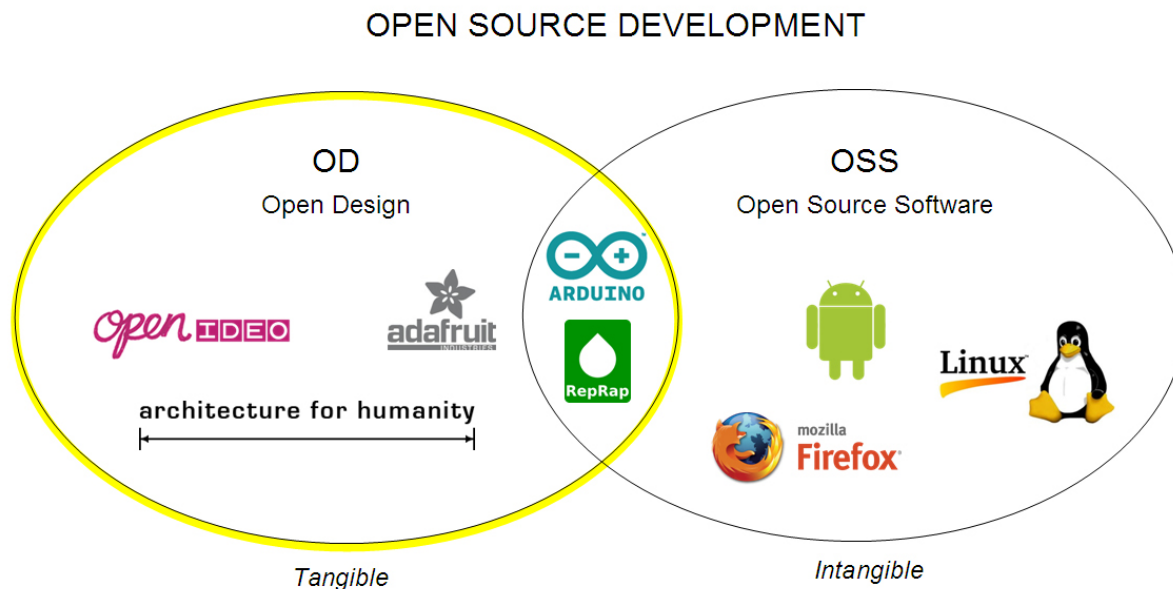
Figure 1: The demarcation of the analysis concerns Open Design highlighted on the left

* In case the reader is familiar with the term Open Source Hardware (OSHW) which has been defined as *a thing – a physical artifact, either electrical or mechanical – whose design information is available to, and usable by, the public in a way that allows anyone to make, modify, distribute, and use that thing.* We have chosen to incorporate that term under open design as we see hardware as a tangible object.

The independent researcher Peter Troxler (van Abel et al., 2010) defines open design as a practice that borrows its operating principles from open source software and applies them in the domain of design. He describes it as a peer-oriented form of production, which makes production tools, methods and experience accessible to everybody as a common infrastructure, giving people options for controlling their productivity.

Professor Michel Avital (van Abel et al., 2010), states that open design signifies open-access digital blueprints that can be adapted at will to meet situational requirements, and can subsequently be used by consumers to fabricate products on demand by commercial, off-the-shelf production methods. The open design model diminishes the traditional vertical value chain that is formed by designer-manufacturer-distributor-consumer relationships and offers an alternative, open web of direct links between designers and consumers. The resulting short-spanned, transient and non-hierarchical relationships forge dynamic and flexible arrays of design blueprints that are not only user-centred but also user-driven.

It is perhaps Avital's definition that captures the essence of open design so clearly; the change of relationship between stakeholders with a new proposed value chain that is characterised by co-creation and continuous communication. This furthermore encourages an examination of the supply chain that is affected by the physicality of the product; increasing the complexity level of the chain compared to a simple compilation of a software source code at no cost. With open design, blueprints need to be transformed to a physical medium at a cost to the end user in the form of materials and manufacturing processes/capabilities (Howard et al., 2012).

Open Design Definition

From these considerations it is our opinion that open design as a term covers the development of tangible products that may be merged with intangible products, through accessible and sharable platforms, where motivated communities with common practices share, adopt, produce and further develop innovative solutions, under commonly agreed credits and licensing. Open design being free to anyone can still encompass revenue streams from related services and branding recognition, which enforce new business opportunities.

The Short Story of Open Design

The settings of this analysis require some understanding of the historical evolution of open source development. This chapter introduces the open source scenery, its origin, licensing strategy and commercial successes.

Open Source Software

Open source software (OSS) development projects are Internet-based communities of software developers who voluntarily collaborate to develop software that they or their organizations need. Thousands of these exist today and have become a significant economic and social phenomenon.

(von Hippel and von Krogh, 2003, p. 209)

Much of the software development in the 1960s and 1970s was carried out in academic and corporate laboratories by scientists and engineers. These individuals found it a normal part of their research culture to freely give and exchange software they had written, to modify and build upon each other's software both individually and collaboratively, and to freely give out their modifications in turn. This communal behaviour became a central feature of 'hacker culture' (in communities of open source programmers, 'hacker' is a very positive term that is applied to very talented and dedicated programmers) (von Hippel and von Krogh, 2003).

Couple of decades later, in response to a general trend in the software world towards development of proprietary software packages and the release of software in forms that could not be studied or modified by others, a programmer, named Richard Stallmann, founded the Free Software Foundation in 1985 (Wu and Lin., 2001). His aim was to develop and diffuse a legal mechanism that could preserve free access for all to the software developed by software hackers. This mechanism became the GNU General Public License or sometimes referred to as 'copyleft' – a play on the word copyright, which enables those possessing a copy of free software to use it at no cost and to have the right to study its 'source code', to modify it, and to distribute modified or unmodified versions to others at no cost (GNU, 2012).

The free software idea did not immediately become mainstream and the industry was especially suspicious of it. The term 'free' seemed to have an ominous ring to the ears of business people, which led to the "open source" software movement to be founded. This term is now generally used by scholars to refer to free or open source software (von Hippel and von Krogh, 2003, p. 210).
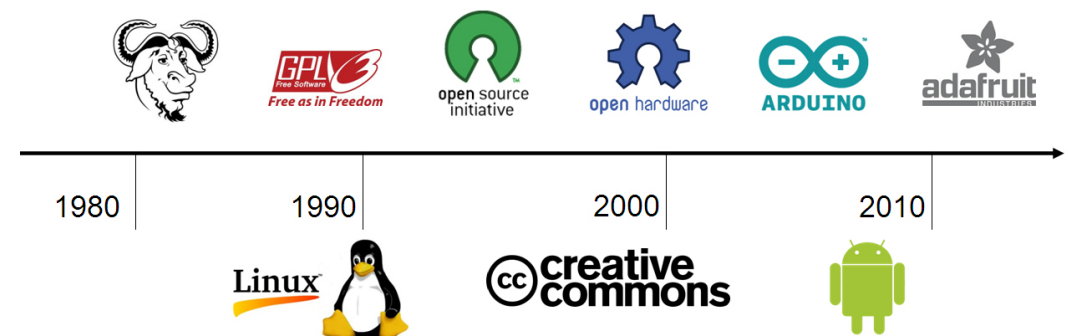
Figure 2: A quick overview of the open source evolution

The open source movement altered the basic nature of the software industry. Fundamental changes occurred to the development process, reward mechanisms, distribution of development work, and business models that govern how profit can be achieved. It has undergone a significant transformation from its free software origins to a more mainstream, commercially viable form (Fitzgerald, 2006).

Today huge corporations such as IBM, Red Hat and Android are running million dollar businesses through open source activities. With this approach they have received massive compensations, substantially increased their popularity as a development platform and expanded the market for complementary products (Fitzgerald, 2006).

The open source mentality might dramatically alter the economic dynamics of a marketplace with the mantra: *"If you can't be the number one product in a sector, then open source it."* (Fitzgerald, 2006. p. 596) Free as in zero cost is replaced by a value-for-money concern (Fitzgerald, 2006), and open source software customers are prepared to pay for a professional service. However large commercial organizations are not always well perceived within the open source community, which might affect the adaptation of the open source practice. The power of community that wishes to protect its own creation should not be underestimated.
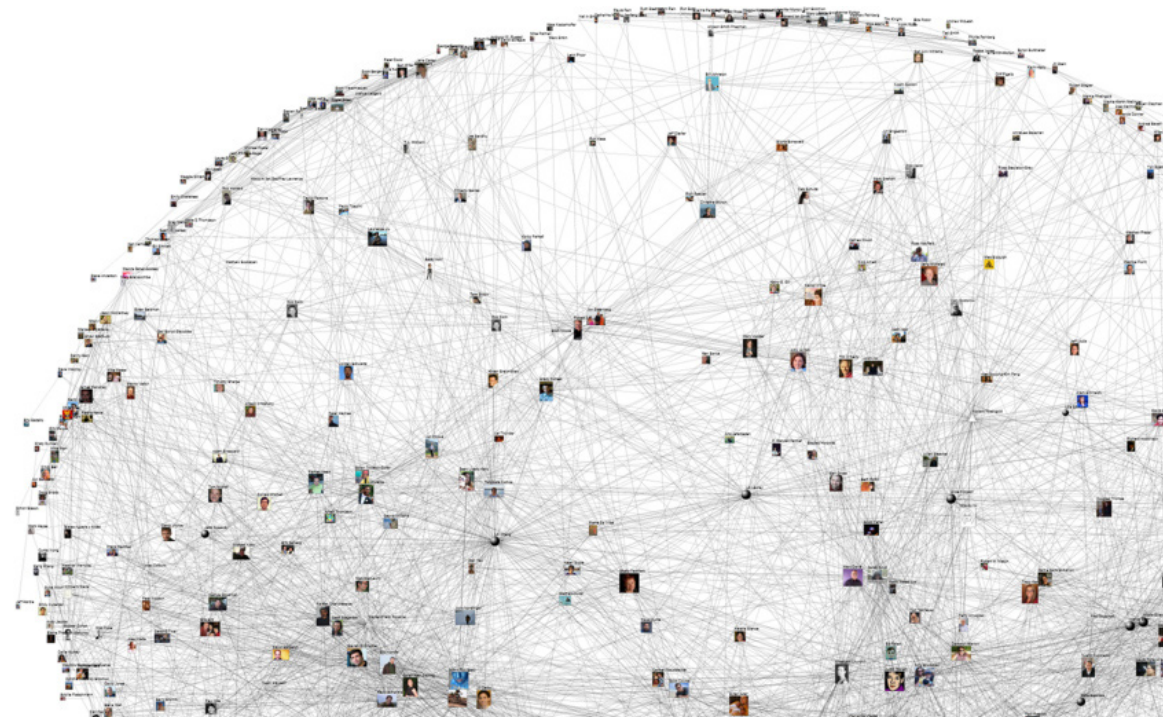
Licensing

When everything is open, shared and accessible, some licensing and legal right questions certainly come up. How can anyone protect his or her idea against being copied and commercialised when everything is open and sharable? This is extremely important in relation to open design which has adopted Creative Commons Licensing:

Although the Internet has provided us with this opportunity of access, our legal and social systems do not always allow for that to be realized. Copyright was created long before the emergence of the Internet, and it can make it challenging to legally perform actions we take for granted on the network: copy, paste, edit source, and post to the Web. The default setting of copyright law requires all of these actions to have explicit permission, granted in advance, whether you're an artist, teacher, scientist, librarian, policymaker, or just a regular user.

(Creative Commons, 2012)

In 2002, the non-profit corporation Creative Commons, took the challenge to create a licensing tool which lets creators make a choice about their copyright: They created a "some rights reserved" approach to copyright.

The licenses differ by several combinations that condition the terms of distribution. The original set of licenses all grant the "baseline rights", such as the right to distribute the copyrighted work worldwide, without changes, at no charge. The details of each of these licenses depend on the version, and comprise a selection of four conditions as can be seen in Figure 3.

The creative commons licenses are being used worldwide by corporations such as Wikipedia, Flickr, Google as well as smaller organisations and emerging firms and individuals (OpenIDEO, Arduino, RepRap, and many more). This will be mentioned later in relation to the case studies of this research.

	Can someone use it commercially?	Can someone create new versions of it?
Attribution	👍	👍
Share Alike	👍	Yup, AND they must license the new work under a Share Alike license.
No Derivatives	👍	👎
Non-Commercial	👎	Yup, AND the new work must be non-commercial, but it can be under any non-commercial license.
Non-Commercial Share Alike	👎	Yup, AND they must license the new work under a Non-Commercial Share Alike license.
Non-Commercial No Derivatives	👎	👎

Figure 3: Overview of Creative Commons Licenses.

Theory

As the topic of open design is a nascent one, finding relevant literature on the subject was a challenge. Some articles and papers on Open Source Hardware (OSHW) have been of good use while literature on Open Source Software (OSS) development has been the backbone of the research, containing valuable information on how open source development within the software world has evolved and matured throughout the years. Experience and challenges from that area have been used and taken into account when analysing the emerging practice of open design. Having a business perspective whilst conducting the research involved analysing literature on business models and other related frameworks which explained the different dimensions companies need to take into consideration to sustain a profitable business. Literature on collaboration and motivations for such activities was examined as well.

The first two sections concern **Open Source** and **Open Design**, introducing existing theories on those topics. The third section is dedicated to **Business Models** and generation thereof. Lastly some evidence of **Open Design Practices** is mentioned to explain some of the reasons and drive that participants have for contributing to open source development.

Open Source

With his article The Transformation of Open Source Software, Fitzgerald (2006), explains how the software phenomenon has metamorphosed into a more mainstream and commercially viable form, which he labels as OSS 2.0. He mentions how companies have taken advantage of open source in terms of its low cost, reliability, and portability across platforms where they are concerned with open standards, stability, high performance and small footprint, supported by a vibrant, responsive development community. This could well be transferred to the world of tangible product development reaping similar benefits and further support the realization that *"transparency increases trust"* (Matusow, 2005 in Fitzgerald, 2006, p. 594).

Fitzgerald touches up on highly debated patent and copyright issues within 'free software' and states that trademarks and brands could become the next IP mechanism. He mentions the *"unbreakable Linux"* slogan as an example, which open design companies in a similar way might achieve with their brand.

What we find highly relevant in this discussion is Fitzgerald's comments on the importance of open source practices in relation to governmental agencies and public administrations, who are mandating that open source be a priority option, even to the extent of requiring formal justification for not choosing an open source solution if one is available. This should ensure that open source becomes even more important in the future and might be the stepping stone for product developers to become a priority option for governmental and public sectors in the future, providing open source solutions for new innovations.

Open Design

Opening up in terms of product development is not new to innovative companies. Pisano and Verganti (2008) state that it is now conventional wisdom that virtually no company should innovate on its own, presenting a matrix of possible collaboration forms, which we found useful in the initial research phase of this study (see Figure 4).

Figure 4: The four ways to collaborate

The matrix gives a good overview of the different forms of collaboration that have emerged throughout the years, going from hierarchical and closed innovation approach (Elite Circle) to a more open and flat community of innovation, i.e. The Innovation Community: *"A network where anybody can propose problems, offer solutions, and decide which solutions to use"* which fits best to the open design approach. This matrix was used in the initial stages of the research as well in a class-workshop at DTU (Appendix VII).

Cook (2008) refers to open design work as Contribution Revolution:

> *The users can be customers, employees, sales prospects – or even people with no previous connection to the company or product. Their contribution can be active (work, expertise, or information) or passive and even unknowing (behavioural data that is gathered automatically during a transaction or an activity), and the system is the method, usually internet-based, by which contributions are aggregated and automatically converted into something useful to others. Although the company retains control of the system and may choose to modify its design, the system converts inputs into useful outputs in real time with little or no intervention by the company. Such a system creates value for a business as a consequence of the value it delivers to users – personalized purchase recommendations, connections between buyers and sellers, new personal or business relationships, lower prices, membership in a community, entertainment, and information of all kinds.*

(Cook, 2008)

Business Models

Shah (2005) states that building a business around freely-revealed user innovations is more straightforward when the product is physical rather than virtual. In the case of physical products, a fraction of users will build their own, but many will prefer the convenience of purchasing a copy. In other words, even if product development by users displaces that of manufacturers, manufacturers can still profit from manufacturing activities and product innovation. Manufacturers may compete against each other for customers based on complementary assets such as brand name, and distribution and production capabilities. Firms may also choose to provide services that go with the product, e.g. in the case of sports equipment, lessons, facilities, or equipment maintenance.

Therefore encompassing free development as in zero cost, there is a value-for-money concern, which customers will be willing to pay for. Having access to free blueprints and product formulas does not necessarily mean that participants will start manufacturing all products by themselves. Customers will be willing to pay for production, support, pre-assembling, delivering, etc. This is what the OSS 2.0 entails (Fitzgerald, 2006).

> *Industry has a poor sense of what people want – indeed, we have a poor sense of what we want. Unlimited selection is revealing truths about what consumers want and how they want to get it in service after service.*
>
> (Anderson, 2004)

What open design companies may achieve is generating a scene for Long Tail (Anderson, 2004) business to flourish. The possibility of customizing and adopting products to the users' need may result in multiple versions of products which cannot all be mass produced. This may therefore support various niche markets which smaller companies and manufacturers around the world can participate in and benefit from. This relates directly to Anderson's explanations of embracing niche markets within the digital marketplace.

Anderson (2004) puts forth a list of Long Tail's rules:

1. First of all, *making everything available* allows users to embrace niches which may never be found or sold in conventional markets. Aggregating dispersed audience across the globe for a production of highly specific objects can result in profitable sales and customer satisfaction; not spending time and money on choosing which variant of a product to release but let the audience choose by themselves.

2. Just as with OSS, there is a benchmark which is to *cut the price in half - now lower it* and let people service themselves, although the psychological value of convenience will result in most people opening their wallets for additional services (such as production, pre-assembling, delivery, etc.)

3. The last but not least is the *help me find it* rule which has proven to be an excellent marketing tool for guiding buyers in their search and purchasing activities. Indicating what other customers have bought or liked and incorporating recommendations to drive demands down the Long Tail, should be highly considered, in order to gather the dispersed audience.

> *"One beneficial aspect that open design has is the fact that it is community and customer driven....so you end up with a product that the customer wants."*
>
> (Snapgear, 2012, Appendix III)

This relates directly to the importance of *network effects* which occur when the value of a product or a service to consumer is contingent on the number of other people using it (Farrell & Saloner, 1985, 1986; Katz & Shapiro, 1986, 1994 in McIntyre & Subramaniam, 2009) which a platform for open design needs to obtain in a positive form in order to attract developers.

Open Design Principles

User groups often form and operate independently of firms. Many groups, however, are open to participation by firms so long as firms support the general goals of the community and abide by the community's rules, norms, and practices.

*(*Shah, 2005)

Openness is a very general philosophical position from which some individuals and organizations operate, often highlighted by a decision-making process recognizing communal management by distributed stakeholders (users/producers/contributors), rather than a centralized authority (owners, experts, boards of directors, etc.) (van Abel et al., 2010).

From a social perspective, openness is a core characteristic of an infrastructure that conveys and reinforces sharing, reciprocity, collaboration, tolerance, equity, justice and freedom.

(van Abel et al., 2010).

Openness pertains to accessibility and is a relative characteristic that refers to the degree to which something is accessible to *view*, *modify* and *use*. The ability to *view* refers to sharing content and the availability of detailed information about the subject matter. The ability to *modify* refers to sharing labour and empowering changes, improvements and extensions of subject matter. The ability to *use* refers to sharing ownership and enabling semi or unrestricted reuse of the subject matter or parts thereof. These are the three fundamental operations that are implied by accessibility (van Abel et al., 2010).

Who are the participants?

A common question in relation to open source activities relates to Glass's (1999, p. 104 in Bonaccorsi & Rossi, 2003) considerations on *"who these crazy people are who want to write, read and even revise all that code without being paid anything for it at all"*. Bonaccorsi & Rossi (2003) explain three types of participants. First of all, there is a large group of individuals who will never contribute to the development but may be capable of using the platform, but only if it is decidedly user-friendly. Second, those who contribute in their spare time and consider the development as a hobby. Their contribution is inevitably limited and clearly insufficient to explain the enormous results achieved by the open source movement. To do so, it is necessary to refer to the third group, formed by the members of the 'hacker culture' – the real heavy contributors who drive and manage the process.

Why do they participate? Why do they work for free?

"I haven't seen any post saying: why aren't we getting paid for what we are doing?"

(Coloplast, 2012, Appendix IV)

There are many motivational factors that can be mentioned in relation to open source contribution. Bonaccorsi & Rossi discuss several of these. They mention intrinsic utility similar to that of a scientific discovery, involving elements other than financial remuneration (Perking, 1999, in Bonaccorsi & Rossi, 2003). Sharing results enables improvement through feedback from peers and to gain recognition and hence prestige for their work. Secondly they mention the intellectual work being regarded as an art form – having an artistic satisfaction associated to solving complex challenges. Thirdly it is the pleasure of creativity, which is being progressively lost in the commercial world, where the nightmare of delivery deadlines is transforming production into an assembly line. As a final note they mention the business side of it, addressing customer satisfaction of filling an unfilled market, of specific products or services that contributors have looked in vain for (Bonaroccorsi & Rossi, 2003).

"I don't consider myself as a hard working person. I have managed to combine my hobby with my work"

(Copenhagen Suborbitals, 2012, Appendix VI)

How to manage the open source projects?

Bonaccorsi & Rossi (2003) explain two factors that shape the lifecycle of successful open source projects: a widely accepted leadership setting the project guidelines and driving the decision process, and an effective co-ordination mechanism among the developers of shared communication protocols. It seems important to understand that core development group of a project (initiators/founders) do not carry out the bulk of the co-ordination effort. In general, no one is forced to perform a particular task but agents choose freely to focus on the problems that they think to best fit their own interest and capabilities. This requires a clear modularization and sets of standards which is a part of the co-ordination mechanism shared by open source developers in order to produce a well-structured flow of contributions (Bonaccorsi & Rossi, 2003).

What are the benefits of being open?

According to T. J. Howard (2012) one of the biggest benefits of open design is its crowd of developers who can also be considered as expert-users. Additionally, this provides the potential of increased customer feedback into the development circle. Open design also seems to create a great deal of media coverage through social networks and also the released design can be expected to have multiple product derivatives where developers customise the design to their needs and creativity.

Free software has shown that it is possible for software to evolve steadily over the years as amendments, and bug fixes are made available from a very large range of contributors. There is no reason why the same should not be true for tangible products.

Open Design Management

Accepted leadership

Providing platform

Attracting the right contributors

Fragmenting tasks

Evaluating ideas

Responsiveness

Effective co-ordination

Why Do People Participate?

Feedback

Prestige

Satisfaction of solving challenges

Acknowledgement

Pleasure of learning

Pleasure of creativity

Answering niche needs

DIY - Do It Youself

Open Design Benefits

Crowd of free developers

'Experts-users'

Increased customer feedback

Rapid and cheap publicity

Media coverage through social networks

Increased product varieties

Who are the users?

Amateurs

Hobbyists

Hackers

Students

etc.

Research Methodology

With scarcity of literature related to open design and lack of fully developed theories for an open design process, a qualitative approach to the research was applied. The objective was to perform a well-designed empirical study with generalizable findings which were relevant and relatable to open design. The following section explains the qualitative research method undertaken and why this approach was believed to contribute beneficially to the study. The process of the research is roughly drawn up for the reader to explain further our approach and results.

Firstly, we needed to gain a deep understanding of the open design scenery, and the on-going discussions and debates of the topic, by going through blogs and presentations shared on the internet. Background material on its forerunner; OSS, and licensing policies was collected along with literature with key words such as *open design, open source, collaborative design* and *co-creation.*

In order to tackle the task of analysing how companies can *adapt open design so that is allows them to sustain a profitable and viable business*, an extensive search was initiated in order to identify open design businesses that could become central cases of the research. The initial criteria were that these cases should be well established (existing for minimum 2 years) and have a sustainable business model with revenue streams of min 1 million USD. It was important as well that these companies were proving themselves in more than one market place. This was chosen as criteria since it assures us of the sustainability of these companies' business models.

Another criterion was that these cases should together demonstrate open design development in a broad perspective, meaning that their products should be as different as possible. A crucial matter was that they all licensed their output under a Creative Commons License. At the same time there was a limitation to how many cases could be chosen, due to the short time given for the project. This resulted in four cases being chosen: two from the hardware and electronic industry (Arduino & Adafruit) and two from the consultancy industry (OpenIDEO & Architecture for Humanity).

Apart from focusing on the four cases other activities were included in order to get a broad understanding of the open design scenario. This involved interviewing experienced OSS businessman and entrepreneur Bob Waldie from Snapgear (Appendix III), initiators and administrators of open design platforms such as InnovationByYou for Coloplast (Appendix IV) as well as DIY* enthusiast Peter Madsen from Copenhagen Suborbitals who invited us to a crowdsourcing event followed by an interview (Appendix VI).

Empirical material was collected in two separate ways. Firstly, semi-structured open-ended interviews were performed with people involved in open design projects and other collaborative activities. The other method was to gain insight and some quantitative evidence through Internet sites, presentations, journals and articles, as well as reviewing online interviews and web talks.

Many interviews were recorded, and some thereafter fully transcribed while others were summarised. Some relevant transcriptions and summaries can be found in the appendix.

We were lucky to get in close contact with David Cuartielles, one of Arduino's founder, who gave an in-depth explanation and information on their business and activities. The first interview was held in the early stage of research phase in order to gain understanding of what open design is all about and how Arduino exploits it (see Appendix I). The second meeting focused more on their business model, future perspectives and challenges, where David managed to give feedback on our final results where he confirmed some important findings.

In order to analyse and attempt to identify characteristics of an open design business model the Business Model Canvas (BMC) by Osterwalder and Pigneur (2010) was used (see Figure 5 p. 25). Their visual approach and clear explanation of what 'blocks' build up a business model, fitted well with our approach to segment the open design activities. Grasping every detail in one page was beneficial to obtain overview of each case (see Figures p. 30, 34, 38 and 42).

* DIY refers to the ethic of self-sufficiency through completing tasks oneself, as opposed to having others who are more experienced or able complete them on one's behalf. Literally meaning "do it yourself," it promotes the idea that an ordinary person can learn to do more than just what he or she may have thought was possible. http://en.wikipedia.org/wiki/DIY_culture

As the revenue streams of these open design cases differed greatly, special emphasis was laid on the *revenue streams* building block. This resulted in a thorough analysis of numerous possible revenue streams, not only explicit to open design practices. An iterative process was used to determine which revenue streams were applicable to op, en design. Twelve revenue streams were then identified and tested by using Arduino as a case.

Our ultimate goal was to create a foundation for starting a consultancy service in the field of open design. A classical consultancy approach was therefore taken, meaning that we created a guide, or a step-by-step process for companies to use when moving from a status quo to a future open design business scenario. This process resulted in two phases of *As-Is* and *To-Be* situations. For the As-Is mapping, classical tools were chosen, such as SWOT (Jones and George, 2003) and Landscape Mapping (Osterwalder and Pigneur, 2010). For the To-Be mapping a model called The Open Design Process was generated, which serves as a tool to help identify elements and activities that need to be in place when it comes to open design. These elements and activities are then related to the BMC's 9 building blocks, resulting in a To-Be open design business model.

Testing the model with Arduino was the final step of the project.
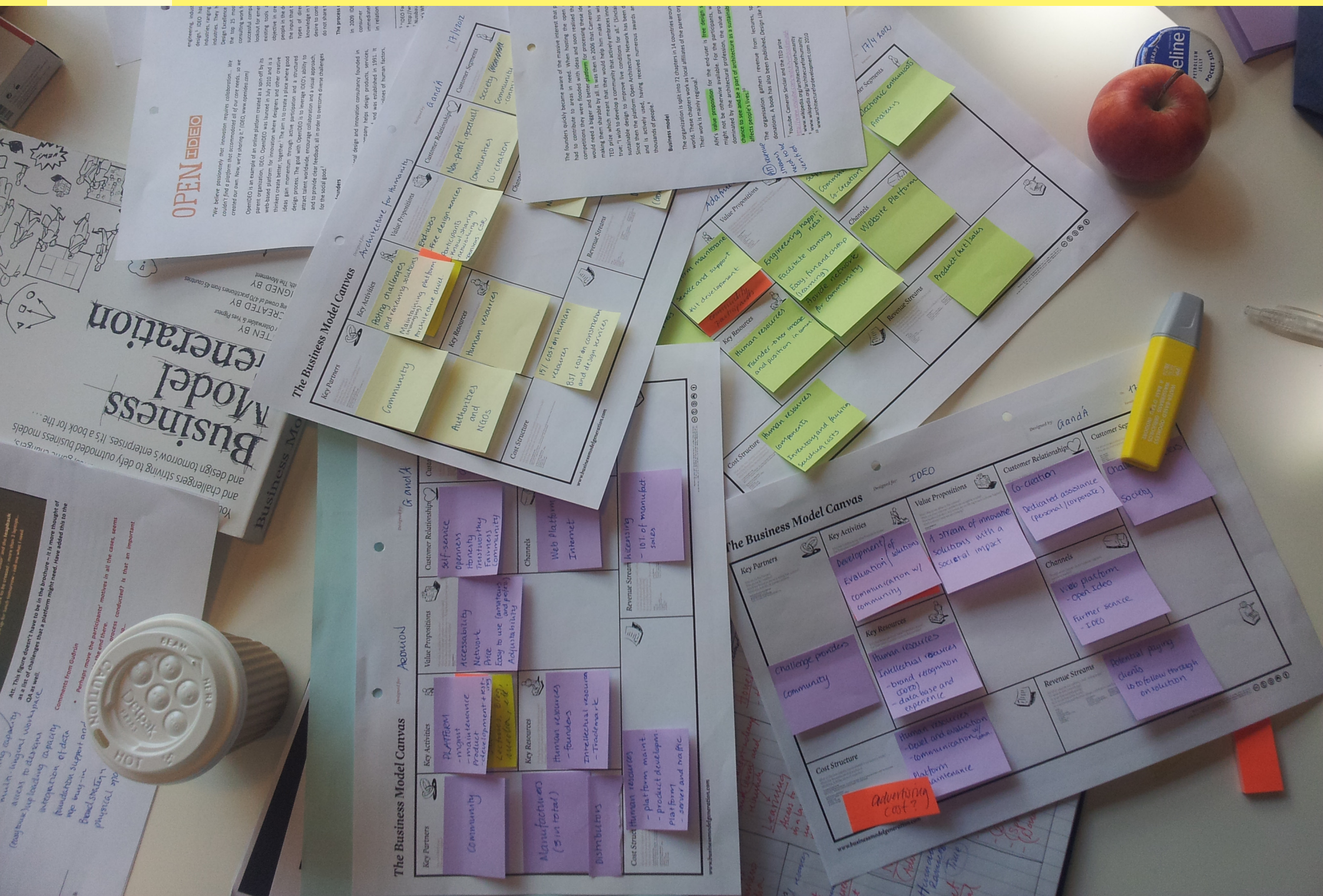
The Business Model Canvas

Designed for:

Designed by:

On: Day / Month / Year

Iteration: No.

Key Partners

Who are our Key Partners?
Who are our key suppliers?
Which Key Resources are we acquiring from partners?
Which Key Activities do partners perform?

MOTIVATIONS FOR PARTNERSHIPS:
Optimization and economy
Reduction of risk and uncertainty
Acquisition of particular resources and activities

Key Activities

What Key Activities do our Value Propositions require?
Our Distribution Channels?
Customer Relationships?
Revenue streams?

CATEGORIES
Production
Problem Solving
Platform/Network

Key Resources

What Key Resources do our Value Propositions require?
Our Distribution Channels? Customer Relationships?
Revenue Streams?

TYPES OF RESOURCES
Physical
Intellectual (brand patents, copyrights, data)
Human
Financial

Value Propositions

What value do we deliver to the customer?
Which one of our customer's problems are we helping to solve?
What bundles of products and services are we offering to each Customer Segment?
Which customer needs are we satisfying?

CHARACTERISTICS
Newness
Performance
Customization
"Getting the Job Done"
Design
Brand/Status
Price
Cost Reduction
Risk Reduction
Accessibility
Convenience/Usability

Customer Relationships

What type of relationship does each of our Customer Segments expect us to establish and maintain with them?
Which ones have we established?
How are they integrated with the rest of our business model?
How costly are they?

EXAMPLES
Personal assistance
Dedicated Personal Assistance
Self-Service
Automated Services
Communities
Co-creation

Channels

Through which Channels do our Customer Segments want to be reached?
How are we reaching them now?
How are our Channels integrated?
Which ones work best?
Which ones are most cost-efficient?
How are we integrating them with customer routines?

CHANNEL PHASES
1. Awareness
   How do we raise awareness about our company's products and services?
2. Evaluation
   How do we help customers evaluate our organization's Value Proposition?
3. Purchase
   How do we allow customers to purchase specific products and services?
4. Delivery
   How do we deliver a Value Proposition to customers?
5. After sales
   How do we provide post-purchase customer support?

Customer Segments

For whom are we creating value?
Who are our most important customers?

Mass Market
Niche Market
Segmented
Diversified
Multi-sided Platform

Cost Structure

What are the most important costs inherent in our business model?
Which Key Resources are most expensive?
Which Key Activities are most expensive?

IS YOUR BUSINESS MORE:
Cost Driven (leanest cost structure, low price value proposition, maximum automation, extensive outsourcing)
Value Driven (focused on value creation, premium value proposition)

SAMPLE CHARACTERISTICS:
Fixed Costs (salaries, rents, utilities)
Variable costs
Economies of scale
Economies of scope

Revenue Streams

For what value are our customers really willing to pay?
For what do they currently pay?
How are they currently paying?
How would they prefer to pay?
How much does each Revenue Stream contribute to overall revenues?

TYPES
Asset sale
Usage fee
Subscription Fees
Lending/Renting/Leasing
Licensing
Brokerage fees
Advertising

FIXED PRICING
List Price
Product feature dependent
Customer segment dependent
Volume dependent

DYNAMIC PRICING
Negotiation (bargaining)
Yield Management
Real-time-Market

Figure 5: The Business Model Canvas (Appendix XIII) which was used to identify and compare the different business models of the open design cases

Successful Open Design Cases

In the following section four different cases are presented that use open design in their product development. The four cases have been chosen based on their different approaches to open design and each represents a different product from the rest. Two of the cases have a product that is both hardware and software related while the other two strive to find solutions to societal problems, which in most cases do not rely on software or hardware. The companies chosen were Architecture for Humanity; a non-profit organisation deploying open source architecture services, OpenIDEO; a spin-off from an established consultancy firm called IDEO, with an open source platform to provide solutions for the greater good, Arduino; an open source circuit board, and Adafruit; an open source hardware distributor and developer.

The purpose of using these cases is to determine their characteristics and business approach in order to gain a better understanding of the necessary elements that need to be in place to allow for successful implementation. At the end of each case a recapitulation is made for their business models in the form of a Business Model Canvas (Osterwalder and Pigneur, 2010).

Arduino, 40Fires, RepRap, Design Smash, Fritzing, Ikea Hackers, Instructables, Open Source Washing Machine, $50 Leg Prothesis, Ponoko, Flickr, Linux, *Adafruit*, Spotify, Open Office, Arduino, VIA, Apache, Make magazine, Daisy, InnoCentive, Alessi, Threadless, TopCoder, *Open IDEO,* Creative Commons, Jamendo, SpinXpress, Quirky, 99Design, Opening Design, Goteo, Safe Creative, System Audio A/S, SpringWise, Jovoto, Crowdspring, Digg, Epinion.com, Podio, *Architecture for humanity*, cmmn open source car, Brewtopia, FreeBeer, Nilfisk

Appendix V

Architecture for Humanity

"Join us in building safer, more sustainable and more innovative structures… that are an on-going testament to the ability of people to come together and envision a better future."

Architecture for Humanity (2012a)

Architecture for Humanity (AfH) is a non-profit design service firm founded in 1999. Their mission statement is to build a more sustainable future through the power of professional design. The organisation brings design, construction and development services to the places where it is most needed. From conception to completion the organisation manages all aspects of the design and construction process. Their clients are community groups, aid organizations, housing developers, government agencies, corporate decisions, and foundations (Architecture for Humanity, 2012a). To foster knowledge sharing and best practices AfH developed the Open Architecture Network. This is a ground-breaking online network that empowers architects, designers, builders and their clients to share architectural plans and drawings. All information available on the network is freely downloadable by all. As of today this network consists of 15,000 registered users that are willing to give their time, effort and expertise to helping those in need. Each year 25,000 people benefit directly from structures designed by the organisation. In addition the organisation offers advocacy, training and outreach programs that affect an additional 60,000 people each year (Architecture for Humanity, 2012b).

Examples of challenges

* Alleviating poverty and providing access to water, sanitation, power and essential services
* Bringing safe shelter to communities prone to disaster
* Rebuilding community and creating neutral spaces for dialogue in post-conflict areas

Founders

AfH was founded by Cameron Sinclair and Kate Stohr in response to the need for immediate long-term shelters for returning refugees in Kosovo. Being extremely driven and passionate about making architecture about sustainability and social responsibility they built up the organisation by hosting a series of open design competitions and then implemented the best solutions, by pairing local communities with design professionals. With this collaboration they were able to develop a pioneering alternative to development and reconstruction in areas of need. In 2005 they adopted an open source model for operations and were the first organization to use Creative Commons licensing system on a physical structure (Architecture for Humanity, 2012c).

The process of going open

The founders quickly became aware of the massive interest that people had in contributing to areas in need. When hosting the open design competitions they were flooded with ideas and soon realised that they would need a bigger and better platform for processing these ideas and making them sharable by all. It was then in 2006 that Cameron received the TED prize which would help him make his wish come true; "I wish to develop a community that actively embraces innovative and sustainable design to improve live conditions for all" (Sinclair, 2007). Since then the platform Open Architecture Network has been developed and is actively used, having received numerous awards and helped thousands of people (Architecture for Humanity, 2012c). The network includes project management, file sharing, a resource database and online collaborative design tools and has the aim of allowing architects, designers, innovators and community leaders to share innovative and sustainable ideas, designs and plans. Participants can view and review designs by others and collaborate with people in other professions. Design projects are managed from concept to implementation with Creative Commons "some rights reserved" licensing for protection of intellectual property rights, shielding them from unwarranted liability (Architecture for Humanity, 2012b).

How AfH works

The platform Open Architecture Network has two distinct manners of co-operation; competitions proposed by Architecture of Humanity and project proposals by members of the community. The competitions are posted on the platform and include challenges such as designing the classroom of the future, and changing military space into civic space. For attracting participants a monetary reward may be granted. These competitions are managed by Architecture for Humanity, from conception to completion.

Members of the community can post their own projects on the platform but in those cases they are responsible for maintaining and administrating the process. To start a project there are simple guidelines to follow and the initiator has administration rights and can grant others varying rights to oversee the process of conceptualization to completion. The motivator for starting these projects is mostly the benefit of gaining access to the knowledge
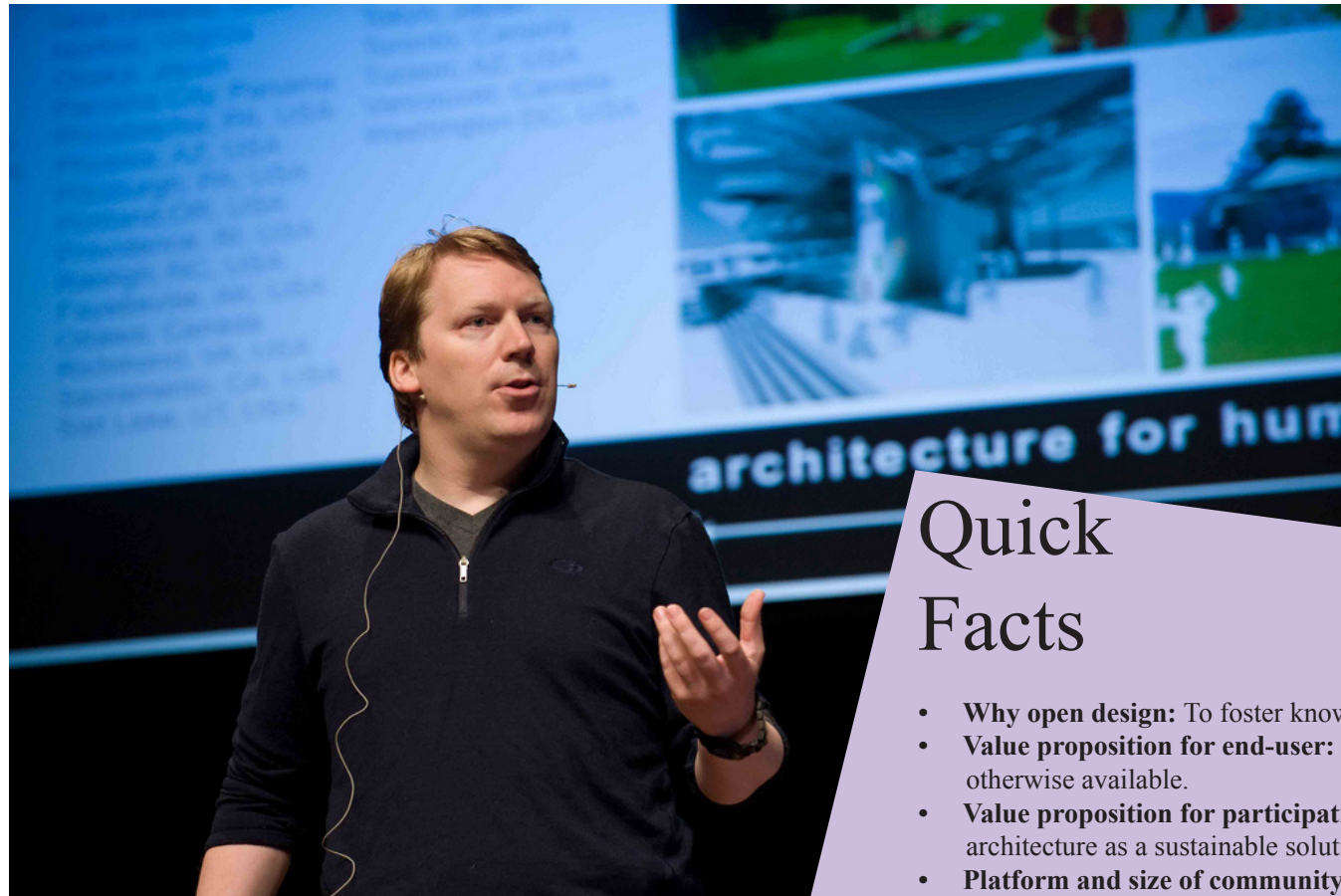
Figure 6 : Cameron Sinclair at a TED lecture 1st March 2007

Quick Facts

- **Why open design:** To foster knowledge sharing and best practices
- **Value proposition for end-user:** Free design services which might not be otherwise available.
- **Value proposition for participation:** The chance to see and be a part of architecture as a sustainable solution that affects people's lives.
- **Platform and size of community:** Open Architecture Network, 15,000 registered users.
- **Community composition:** Architects, designers, builders, engineers, NGOs, etc.
- **Revenue streams:** Donations and sponsorships.

of others. Also, posting the project on a platform such as this makes sure that the project gets attention, visibility and feedback (Architecture for Humanity, 2012b).

Business model
The organization is split into 72 chapters in 14 countries around the world. These chapters work as local affiliates of the parent organization. Their work is mainly regional (Architecture for Humanity, 2012c).

AfH's value proposition for the end-user is free design services which might not be otherwise available. For the participants, who are largely dominated by the architectural profession, the value proposition is the chance to see and be a part of architecture as a sustainable solution that affects people's lives (Week, D., 2012).

The organisation is non-profit and driven by donations and sponsorships. On a side note, seeing that the concept has inspired so many people and gained a great deal of publicity, the founders and in particular Cameron, have been able to gain revenue as public speakers. A book has also been published, *Design Like You Give a Damn: Architectural Responses to Humanitarian Crises.* It is important to mention that to the founders there are other aspects more valuable than revenue streams, namely sustainability and social responsibility. "*It is not enough to look at the environment; culture and society must be a part of the equation*" (Social Enterprises, 2011).

AfH uses 5% of its capital to raise funding and 10% is used in administration costs. This leaves 85% of their capital being solely spent on construction and design services (Architecture for Humanity, 2012a).

5% fundraising outreach

10% administration cost

85% spent on construction and design services

architecture for humanity
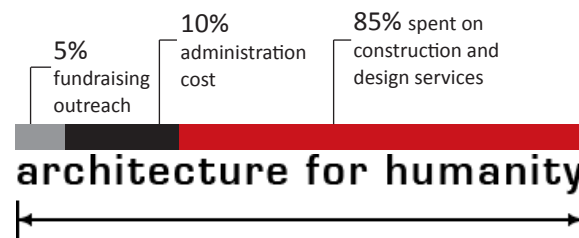
The community
The community of participants contains diverse backgrounds including architects, engineers, planners, NGOs, manufacturers and suppliers. By joining these different actors together a powerful pool of talent is created. The network counts approximately 40,000 people. By having such an extensive network a momentum is created by word of mouth. This raises social awareness and works as a marketing tool. Furthermore, this community is used for raising funds.
But what motivates participants to contribute? The motives seem to be mostly intrinsic. The participants are working pro bono which eliminates monetary compensation. It seems like the participants are more driven by their will to make a difference and to influence people's lives. Also, as importantly, by joining the network they are gaining an access to an extensive resource of knowledge, networking and peer to peer inspiration.

"When your focus is social change and not financial change why wouldn't you want to share that openly?"

Cameron Sinclair, 2008

Architecture for Humanity

The Business Model Canvas

Designed for: Architecture for Humanity
Designed by: Gudrún & Ásta
On: 17/4 2012
Iteration:

Key Partners
Who are our Key Partners?
Who are our key Suppliers?
Which Key Resources are we acquiring from partners?
Which Key Activities do partners perform?

Community

Authorities and NGOs

Key Activities
What Key Activities do our Value Propositions require?

Providing challenges
Reviewing solutions
Platform mgmt/maint.
Solution development
Attracting participants

Key Resources
What Key Resources do our Value Propositions require?
Our Distribution Channels? Customer Relationships?
Revenue Stream?

Human resources

Value Propositions
What value do we deliver to the customer?
Which one of our customer's problems are we helping to solve?
What bundles of products and services are we offering to each Customer Segment?
Which customer needs are we satisfying?

Free design services for end-users

Knowl·sharing+network for participants

CSR for sponsors

Customer Relationships
What type of relationship does each of our Customer

Community

Co-creation

Channels
Through which Channels do our Customer Segments

Web platform

NGOs and authorities

Customer Segments
For whom are we creating value?
Who are our most important customers?

Society (end-users)

Community – participants

Sponsors

Cost Structure
What are the most important costs inherent in our business model?
Which Key Resources are most expensive?
Which Key Activities are most expensive?

15% human resources

85% construction & design services

Revenue Streams
For what value are our customers really willing to pay?
For what do they currently pay?
How are they currently paying?
How would they prefer to pay?
How much does each Revenue Stream contribute to overall revenues?

Sponsorship

Donations

Governmental support

www.businessmodelgeneration.com

OpenIDEO

"We believe passionately that innovation requires collaboration... We couldn't find a platform that accommodated all of our core needs… so we created our own. Now, we're sharing it."

IDEO (2012a)

OpenIDEO is an example of an online platform created as a spin-off by its parent organization, IDEO. It was launched in July 2010 and is a web-based platform for innovation where designers and other creative thinkers *create better, together* (IDEOb, 2012). The aim is to create a place where good ideas gain momentum through active participation and a structured design process. The goal with OpenIDEO is to leverage IDEO's ability to attract talent worldwide, encourage collaboration and a visual approach, and to provide clear feedback; all in order to overcome diverse challenges for the social good (IDEOb, 2012).

Founders
IDEO is an international design and innovation consultancy firm founded in Palo Alto, California. The company helps design products, services, environments, and digital experiences Nussbaum, 2004) and was established in 1991. It currently employs over 550 people in the disciplines of human factors, engineering, industrial design, communication design and interaction design (IDEO, 2012b). IDEO has worked on thousands of projects within various industries, ranging from consumer food and beverage to the automotive industries. They have won more of the BusinessWeek/IDSA Industrial Design Excellence Awards than any other firm. IDEO has been ranked in the top 25 most innovative companies by BusinessWeek and does consulting work for the other 24 companies in the top 25 (Nussbaum, 2006). Being a highly successful company, dedicated to innovation, IDEO is constantly on the lookout for emerging technologies and methods that will complement its existing tools and approach. When starting OpenIDEO, their main objective in creating this platform, was to include a broader range of people in the design process (IDEO, 2012a). This would also work in their benefit since the input that they gain from participants is extensive and comes from all types of directions, allowing them to capture value by using that knowledge in their consulting to paying clients. IDEO is also driven by the desire to contribute to a greater cause and have an impact on others that do not share the same quality of live.

The process of going open
In 2009 IDEO's London team observed that online collaboration and consumer activism were becoming increasingly popular. They started to seek out ways to harness the potential it could hold, especially in relation to social good. The team then set out to establish a global network of creative thinkers who could help IDEO address social issues (IDEO, 2012a). More than 100 ways were considered as means of engaging people in design challenges but IDEO could not find a platform that met all their needs. They therefore decided to create their own; OpenIDEO.com where IDEO is responsible for overseeing the process from start to finish.

How OpenIDEO works
IDEO posts a design problem, most often from a third party, which then moves through three phases of development, namely Inspiration, Concepting, and Evaluation. Users participate and provide feedback every step of the way and receive points for their contribution. This is known as their Design Quotient, or 'DQ'. The input is then evaluated, both in terms of quality and quantity by OpenIDEO participants. This process takes about 10 weeks and at the end of that period a final design is chosen. The winning design may be produced by whoever chooses to do so since the concepts are generated under a Creative Commons licence. That means that they are shareable, remix-able and reusable.
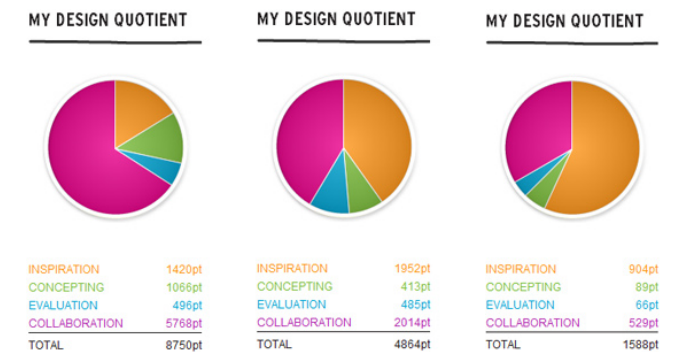
Figure 7: Examples of the participants' Design Quotient

To give an example, the site's first challenge was 'Food Revolution' with British chef Jamie Oliver. His challenge was *"Join me at OpenIDEO.com and share your inspiration and ideas for how we can help educate kids about eating healthy food… [Let's] make a difference once and for all."* In hosting this challenge OpenIDEO supported Oliver in fulfilling his 2010 TED prize wish list. Since then, among other, OpenIDEO has helped non-profit organisation Grey Matters Capital to generate a catalogue of potential low-cost educational tools and services for the developing world. There have also been spin-offs from the OpenIDEO platform, namely

Quick Facts

- **Why open design**: To include a broader range of people in the design process.
- **Value proposition for end-user:** Being able to use a large network to post challenges for resolution free of cost.
- **Value proposition for participation:** The possibility to be involved in the design process of creating societal solutions for the greater good.
- **Platform and size of community:** OpenIDEO, network size depends on each challenge
- **Community composition:** People from all types of backgrounds.
- **Revenue streams:** Sponsorships.

Figure 8: Jamie Oliver during the first OpenIDEO challenge: 'Food Revolution' in 2010

a separate online community for Sony and the World Wildlife Fund. These rely on the same technology and share the same community as OpenIDEO. Additionally, Sony being inspired by OpenIDEO, has for the first time opened up some of its technologies for environmental causes (IDEO, 2012b).

Business model

OpenIDEO is a non-profit organization and mostly runs on support from IDEO in addition to sponsorship from corporations and non-profit organisations. IDEO is responsible for the 10 week evaluation phase of solutions which is done pro bono. However, through OpenIDEO, IDEO is able to draw upon participants' knowledge and recommendations which they capitalize on through their consulting work with paying clientele. The value proposition for the end-user is that OpenIDEO is offering a large network to post challenges for resolution free of cost. The value proposition for participants is mainly the possibility to be involved in the design process of creating societal solutions for the greater good.

The community

The community of participants contains people from all types of backgrounds. According to IDEO the main aspect of the participants' motivation is the inspiration, knowledge and recognition involved in contributing solutions to some of the toughest problems faced by modern society (IDEO, 2012b). Participants receive no monetary rewards for their input and participation is therefore highly driven by intrinsic motivational factors. Additionally, the Design Quotient reward system works as a tool for participants to be recognised for their work. The Design Quotient can be displayed on social network sites such as Facebook and Twitter so it is visible to others what the participant has been contributing. It could also be used in their CV to describe their resolution to both social good and design proficiency (Charles, 2011). These factors also include the desire to contribute to a greater cause and have an impact on others.

OpenIDEO

The Business Model Canvas

Designed for: IDEO / openIDEO
Designed by: Guðrún & Ísta
On: 17/4 2012
Iteration:
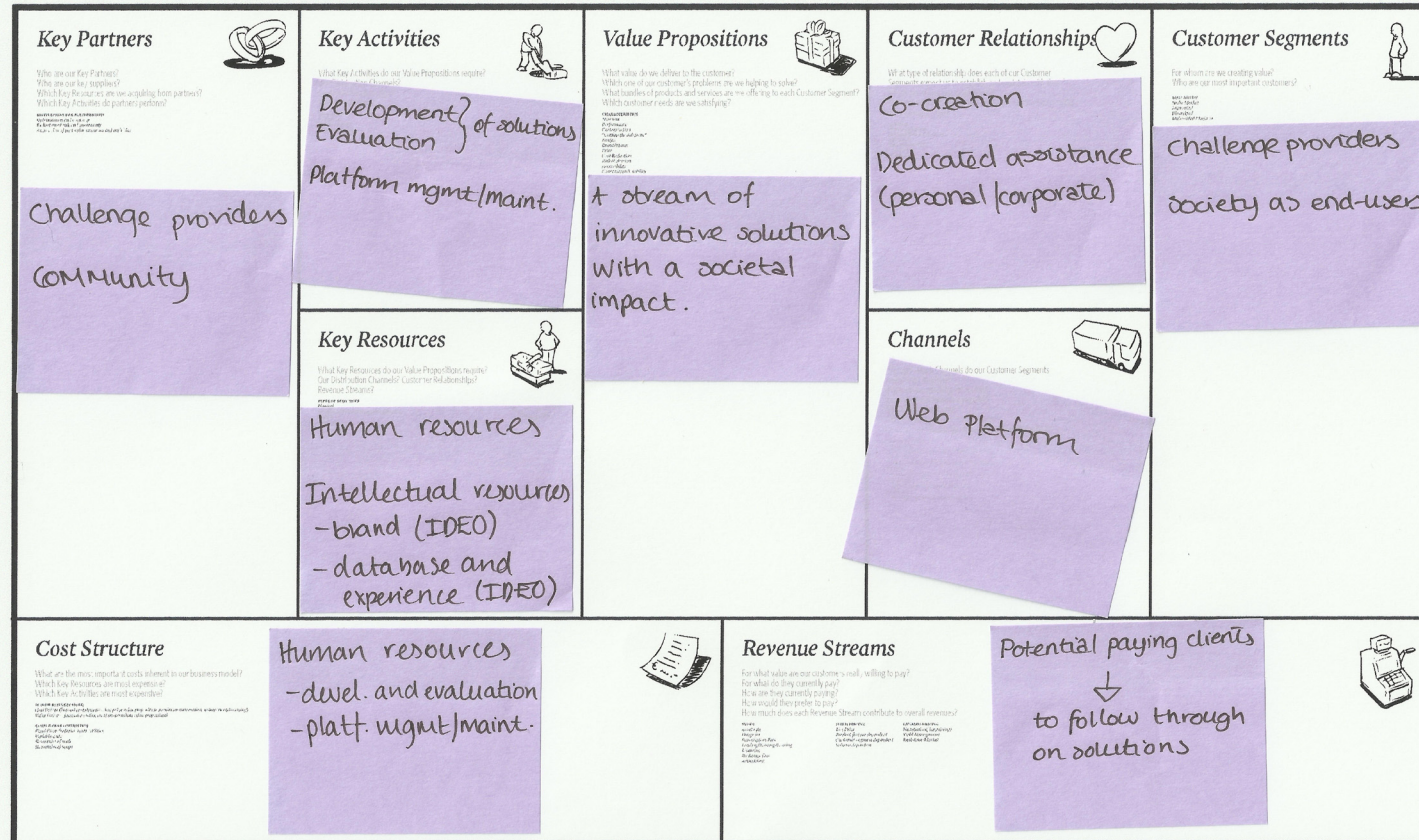
Key Partners

Challenge providers

Community

Key Activities

Development of solutions
Evaluation

Platform mgmt/maint.

Key Resources

Human resources

Intellectual resources
- brand (IDEO)
- database and experience (IDEO)

Value Propositions

A stream of innovative solutions with a societal impact.

Customer Relationships

Co-creation

Dedicated assistance (personal/corporate)

Channels

Web Platform

Customer Segments

challenge providers

society as end-users

Cost Structure

Human resources
- devel. and evaluation
- platf. mgmt/maint.

Revenue Streams

Potential paying clients
↓
to follow through on solutions

Arduino

Arduino is an open-source electronics prototyping platform, based on flexible, easy-to-use hardware and software. It should be easy enough to use for anyone that is interested in creating interactive objects or environments with its users being designers, artists, students and hobbyists, among others (Arduino, 2012a). Arduino's functions are best described in the words of its founders;

"Arduino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lights, motors, and other actuators. The microcontroller on the board is programmed using the Arduino programming language (based on Wiring) and the Arduino development environment (based on Processing). Arduino projects can stand-alone or they can communicate with software running on a computer (e.g. Flash, Processing, MaxMSP)."

(Arduino, 2012a)

Examples of how Arduino can be used:

- An alert on your phone when there's a physical mail in your mailbox
- Your own heart rate monitor for cycling that logs to a memory card
- Switching on or off lights and appliances throughout the home

Arduino provides a platform for its users on their website www.arduino.cc. Among other activities, it serves as a forum where discussion on the use of Arduino takes place and where participants can share their findings and ideas. The platform has approximately 18 million hits each month (Calvo and Alejos, 2010). Arduino received an Honorary Mention in the Digital Communities section of the 2006 Arts Electronica Prix (Arduino, 2012b).

Founders

The team consists of five founding members: Massimo Banzi, David Cuartielles, Tom Igoe, Gianluca Martino, and David Mellis. This team is versatile in its core competencies having teachers, designers, engineers and artists onboard.

The process of going open

The project began in Italy in the year of 2005 with the aim of making *"a device for controlling student-built interaction design projects less expensive than other prototyping systems available at the time"* (Arduino, 2012b). The prototyping systems available at that time were expensive and the team noticed this in particularly when teaching large classes where microcontrollers were needed for projects but only few were available due to costs. The team then set up to create a cheap and user friendly microcontroller. When the first version of the Arduino board was set up, available for people to play around with, it became clear that the target group was much wider then they had originally estimated. There was a target group of people that was not technologically specialized but came from other fields of interests, such as architects, graphic designers and so forth. *"So for people that had no idea about programming [...] our goal was to make it as easy as possible"* (Arduino, 2012, Appendix I).

How Arduino works

Arduino provides its community with a well administrated and informative platform. People can access information on every aspect of the product; introduction to its functions, a description of its environment and troubleshooting. Furthermore the platform provides people with information about local distributors and where the source code and software can be downloaded.

The platform also provides a blog with frequent updates to keep people interested and informed about Arduino and events or functions around it, with anyone allowed to comment. Additionally there is a link to a "playground" where people can access manuals, see instructions on setup and configuration, code library and tutorials, electronic techniques and project ideas.

Finally, the platform provides people with a forum where questions and comments can be posted which is then replied to both by the community and by the administration team at Arduino. This is a highly active forum, with thousands of posts and topics (Arduino, 2012a).

Business model

Arduino is a small company run primarily by its original founders who are located around the world and work and communicate mainly through the Internet. Arduino has no headquarters or physical facilities. Arduino works according to open design principles and uses Creative Commons Attribution Share-Alike license for their hardware and GPL license for their software. However, as Arduino has trademarked their logo and brand, those who wish to produce under their name must pay a licensing fee to Arduino. The microcontrollers

Figure 9: Arduino's open design microcontroller
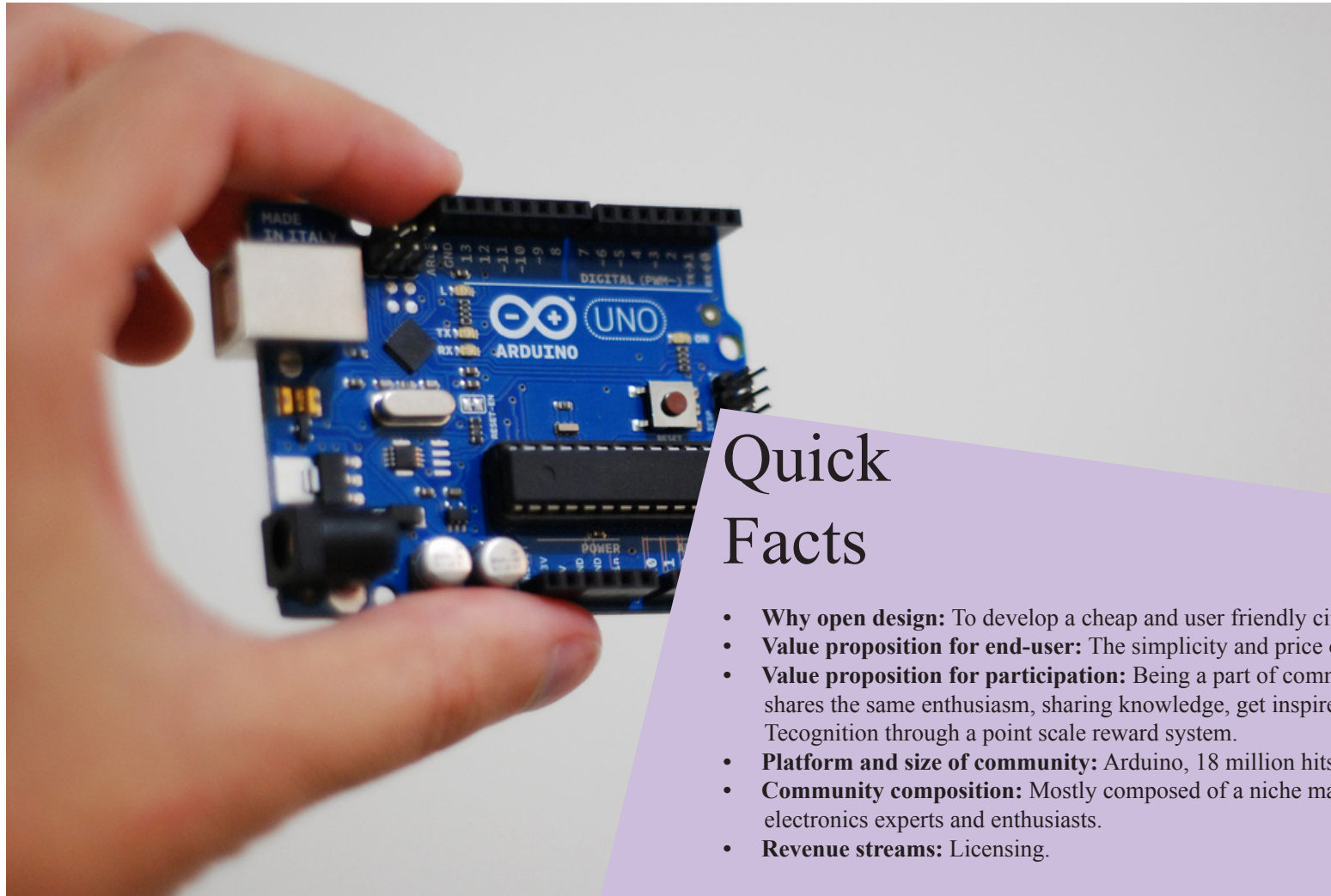
Quick Facts

- **Why open design:** To develop a cheap and user friendly circuit board.
- **Value proposition for end-user:** The simplicity and price of the product.
- **Value proposition for participation:** Being a part of community that shares the same enthusiasm, sharing knowledge, get inspired by others. Tecognition through a point scale reward system.
- **Platform and size of community:** Arduino, 18 million hits per month.
- **Community composition:** Mostly composed of a niche market segment of electronics experts and enthusiasts.
- **Revenue streams:** Licensing.

can be purchased preassembled or built by hand by the user and the software is downloaded for free. Due to Arduino's first mover's advantage and customer recognition of the brand this has proved lucrative with customers associating the brand with quality. As of now, Arduino has three manufacturers using the logo and over a 100 distributors. This business model has accumulated revenue of $1 million plus in the year of 2011 with over 150,000 units sold (Adafruit Industries, 2012).

The value proposition to the end-user is the simplicity and price of Arduino:

"Our approach was, if you can't afford it, build it by yourself."

(Arduino, 2012, Appendix I)

Now people with no prior electronics' knowledge can play around with electronics projects and expand their design to include fun gadgets. This is particularly popular with designers. In regards to price, Arduino is set at $30 dollars compared to other similar products that cost around $100. The value proposition for participants is that they become a part of a community that shares the same enthusiasm and interest in electronics, which allows them to bounce off ideas, receive recognition for their work and become inspired by others. Arduino uses a reward system for their forum. Participants that are highly active move up along a point scale which gives them a certain status within the community – "*people care about the credit*" (Arduino, 2012, Appendix I). A very important factor of the business model, according to the founders (Arduino, 2012, Appendix I), is support. Participants want this support in the form of service for all aspects of the products.

The community

The community is mostly composed of a niche market segment of electronics experts and enthusiasts. Arduino has gained immensely from using the community to further develop the product. This has led to rapid and cheap product development and a huge crowd of free developers. By providing the participants with support in the form of feedback and platform maintenance the response has gone above and beyond anything expected. The user feedback from the forums helps Arduino constantly develop the product in addition to providing access to expertise knowledge. This helps the Arduino founders to become affluent in the society of open source hardware – often being asked to oversee workshops, speak at conferences and consult on projects. Another great benefit has been the publicity they have received:

"You know Arduino hasn't spent a dollar on advertisements in 7 years, not a single dollar. But companies using Arduino spend hundreds of dollars advertising us, because it is for their own benefit."

(Arduino, 2012, Appendix I)

Bloggers and web magazines all over the world continue to publish stories on Arduino.
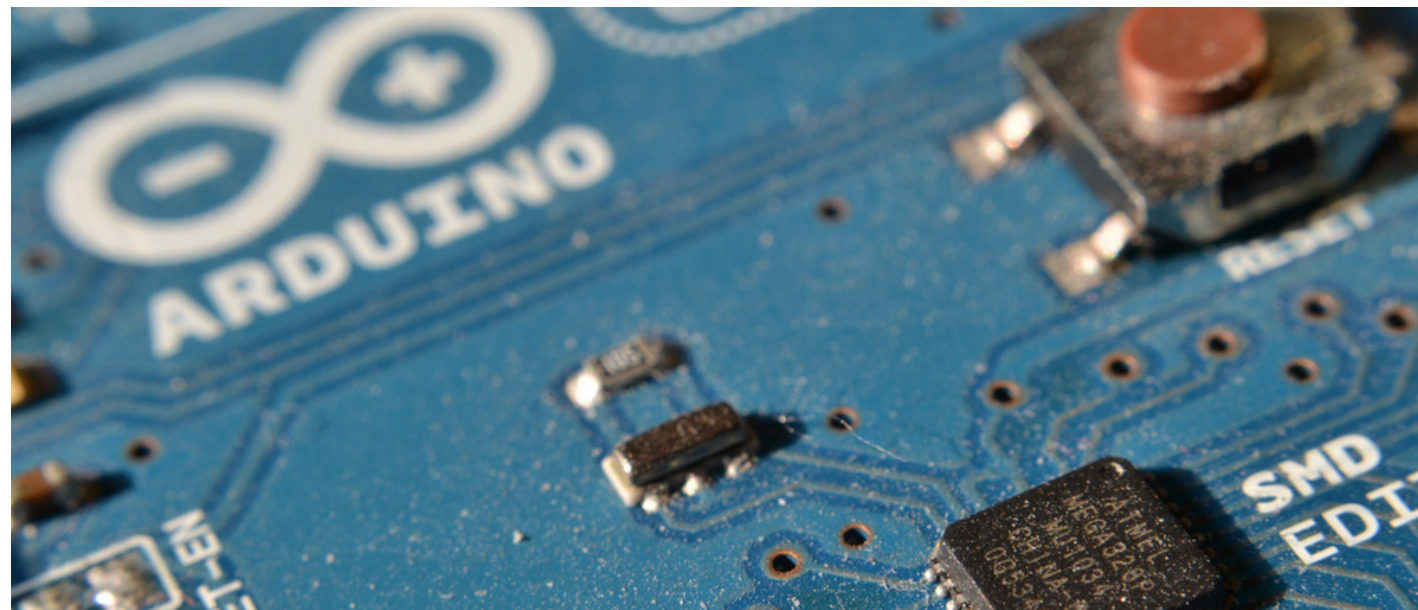
The Business Model Canvas

Designed for: ARDUINO

Designed by: Guðrún Ásta

On: 17/4 2012

Iteration:

Key Partners

Community

Manufacturers
Distributors

Key Activities

Platform mgmt/maint.
Attracting participants
Product development
Side activities
(lectures, blog, consult.)

Key Resources

Human resources

Intellectual resources
- trademark
- user database

Value Propositions

Accessability
Network
Lower Price
Easy to use
Adjustability

Customer Relationships

Self-service
Openness
Honesty
Reciprocity
Community

Channels

Web Platform

Customer Segments

Hobbyists
Computer 'geeks'
Corporations (i.e. Google)
Distributors
Universities

Cost Structure

Human resources
- Platform maint.
- product development

Revenue Streams

Licensing
→ 10% of manuf.
sales
Founders' side revenue
- lectures, workshops

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Adafruit

Adafruit was started in 2005 with the goal *"...to create the best place online for learning electronics and making the best designed products for makers of all ages and skill levels"* (Adafruit Industries, 2012). Since then the company has grown to over 25 employees and is located in the heart of Manhattan. Adafruit offers their customers specialized kits which contain tools, material parts and electronics to make fun and cool gadgets. The making of these gadgets is demonstrated online with all tutorials given away for free. If the customers then want to make the gadgets by themselves they can buy the kit which comprises the material needed –personally selected, tested and approved by Adafruit's founder, Limor Fruit. The company places emphasis on having great prices, the best customer service, support and fast shipping (Adafruit Industries, 2012).

In addition to working as an online store and tutorial source for customers the company's website functions as a platform for users to share their ideas and product findings and become inspired by each other. The forum available for users is extensive and deals with a range of topics, everything from the infamous Arduino board to various projects such as iPhone chargers, remote controls, and other electronics and tools.

Founder

Adafruit Industries was founded by Limor Fried in 2005. She is a MIT trained electronics engineer and was named the "Most influential woman in technology" in 2011 by Fast Company (Fast Company, 2011). Additionally she has won an EFF pioneer award for teaching and sharing electronics and she has been featured in hundreds of publications and media around the world (Adafruit Industries, 2012). She is influential in the open-source hardware community, having participated in the first Open Source Hardware Summit and the drafting of the Open Source Hardware definition (Limor Fried, 2012).

The process of going open

Starting in 2003 Limor carried out a website, www.ladyada.net, where she posted her electronics projects in an open source manner. This meant that anyone could see how she created fun and exciting gadgets or hacked various electronics. The material posted is published under the Creative Commons licence. Soon after she started the website she realised that there was an immense interest from the community of electronics enthusiasts which could lead to a lucrative business opportunity. By giving away the information on how to make gadgets she gathered the crowd - but by selling the components needed in a simple kit available at the same website she would gather revenue. For the user this would make the process of creating gadgets way simpler, since he would not have to find the different components by himself, scattered in different stores. Limor therefore decided to start a company, Adafruit Industries, where she would sell kits and individual components but give tutorials away for free. Adafruit was selected as one of Entrepreneur's "100 Brilliant Companies 2012″ (Entrepreneur, 2012).

How Adafruit works

Adafruit has an ambitious and highly interactive platform for their online community. The platform has a blog that is updated daily on news and events that concern Adafruit and it is divided into various categories such as 3D printing, Arduino and code descriptions. There is also a vast number of tutorials open and free for anyone. In terms of interactive communication between Adafruit and the community, Adafruit offers a forum where customers and others can seek out technical support on topics such as Arduino, electronics and tools. Additionally there is a weekly live video and chatroom which is open for anyone to participate in. In these chats people can ask questions about Adafruit products and functions or follow up on the new and exciting projects that the Adafruit team or participants are working on (Adafruit Industries, 2012).

Business model

For the end-user the value proposition of Adafruit is the online platform which makes learning electronics easy. By being provided with tutorials and assembled kits the end-user is able to approach electronics in a much simpler way than before. Additionally, a forum is provided for those who are particularly interested in electronics, where they can share their ideas and innovations, get feedback and become inspired by others. The value proposition for participants is the knowledge sharing that takes place in the platform's forums and the sense of achievement and recognition by demonstrating to others their capabilities and expertise in electronics.

The company gains revenue from direct product sales and does so through its online store. Whenever a tutorial for a new product is posted the user is able to easily locate a button which displays the kit and the price thereof. It is then up to the user if he wants to purchase the whole

Figure 10: Ladyada or Limor Fried, the founder of Adafruit on the cover of Wired magazine

Quick Facts

- **Why open design:** To create the best place online for learning electronics and making the best designed products for makers of all ages and skill levels.
- **Value proposition for end-user:** The online platform which makes learning electronics easy.
- **Value proposition for participation:** Knowledge sharing and sense of recognition.
- **Platform and size of community:** Not known.
- **Community composition:** Mostly composed of niche market segment of electronic experts and enthusiasts.
- **Revenue streams:** Direct product sales.

kit or customize it according to specific needs. In 2011, Adafruit Industries raised $1 million plus in revenue (Adafruit Industries, 2012).

The community

Limor is a strong believer in the open source community. To her it was obvious that her website, www.ladyada.net, should be open to anyone interested. By doing so she allowed the community to gain from her expertise within electronics, while at the same time she gained from the users' input and recommendations. Her website quickly became noticed within the electronics community and a momentum was created through word of mouth. She did not advertise her website in any way. This then led to her business idea of selling the kits which proved to be a valuable solution to a need within a niche market segment.

Over the next few years we'll continue to release our products and projects as open source hardware, but wew will also add more products that are for more advanced customers. So in addition to having great beginner kits, we'll have more complex and more challenging electronics for the makers who have moved on to the level of their hobby or profession.

Ladyada, 2012
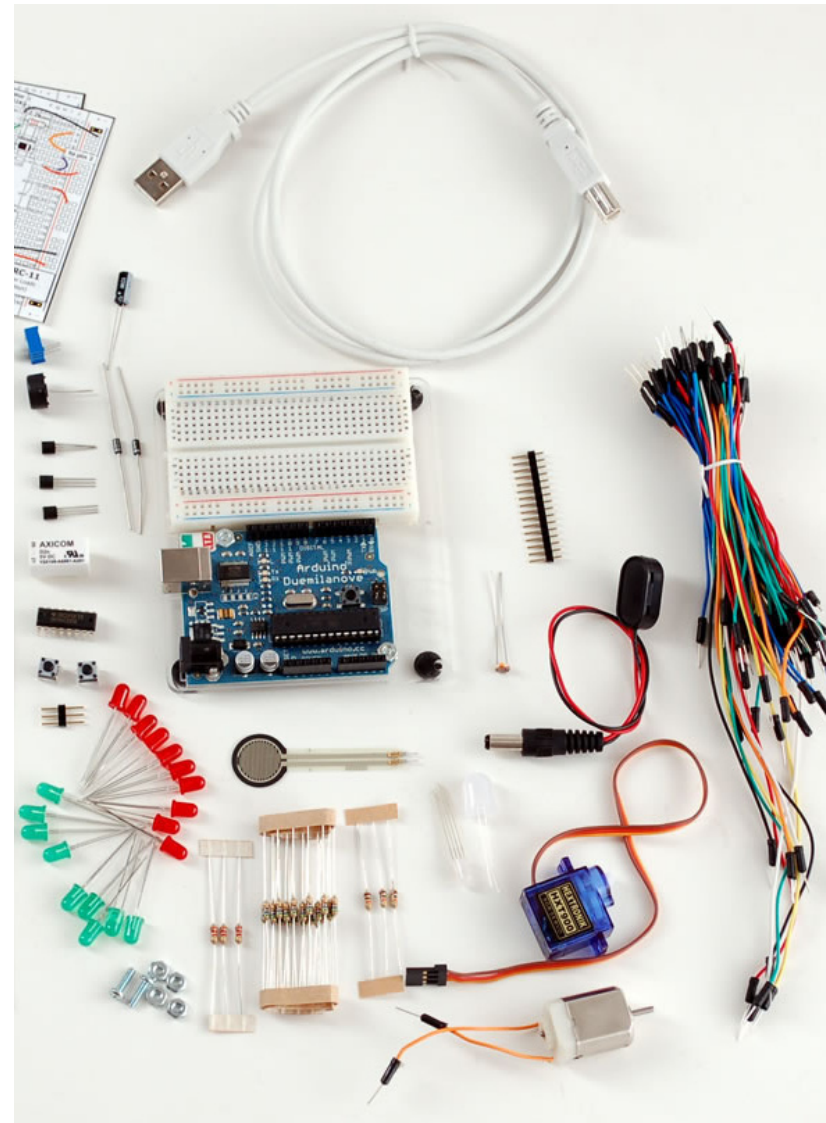
Figure 11: Adafruit 'kit'

Adafruit

The Business Model Canvas

Designed for: Adafruit Industries
Designed by: Guðrún & Ásta
On: 17/4 2012
Iteration:

Key Partners

Who are our Key Partners?
Who are our key suppliers?
Which Key Resources are we acquiring from partners?
Which Key Activities do partners perform?

Suppliers

Community

Key Activities

What Key Activities do our Value Propositions require?
Our Distribution Channels?
Customer Relationships?
Revenue streams?

Platform maintenance

Service and support

Kit development

Attracting participants

Key Resources

What Key Resources do our Value Propositions require?
Our Distribution Channels? Customer Relationships?
Revenue Streams?

Human resources

Founder → her image
and reputation in the
community

Value Propositions

What value do we deliver to the customer?
Which one of our customer's problems are we helping to solve?
What bundles of products and services are we offering to each Customer Segment?
Which customer needs are we satisfying?

Engineering happiness!

Facilitating learning
(easy, fun, cheap)

Providing a network

Customer Relationships

What type of relationship does each of our Customer
Segments expect us to establish and maintain with them?

Self-service

Support

Community

Co-creation

Channels

Through which Channels do our Customer Segments
want to be reached?
How are we reaching them now?
How are our Channels integrated?

Web Platform

Customer Segments

For whom are we creating value?
Who are our most important customers?

Electronics enthusiasts

Hobbyists

Cost Structure

What are the most important costs inherent in our business model?
Which Key Resources are most expensive?
Which Key Activities are most expensive?

Human resources
Components
Sending costs
Inventory and
facilities

Revenue Streams

For what value are our customers really willing to pay?
For what do they currently pay?
How are they currently paying?
How would they prefer to pay?
How much does each Revenue Stream contribute to overall revenues?

Product sales

www.businessmodelgeneration.com

Overview of Cases

Dimensions	Archit. f. Humanity	IDEO	Arduino	Adafruit
Purpose	Social good, sustainability	Social good, branding	Simplification, lowered price	Making electronics fun and easy
Product	Best solution chosen for development	Best solution chosen for development	One product which users can build upon and customise	Various products that can be customised
Structure	Non-profit, medium size	Non-profit, medium size	For profit, small	For profit, small
Founder	Inspiring visionaries	A leading company	Academicians	Influential blogger
Community composition	Highly diverse	Highly diverse	Tech geeks and hobbyists	Tech geeks and hobbyists
Main costs	Managing challenges and solutions	Managing the evaluation process	Maintenance of platform, support, product development	Maintenance of platform, service and support
Revenue streams	Funding and donations	Sponsorships	Licensing	Direct product sales
What attracts the crowd	Intrinsic motivation, recognition, large knowledge pool, networking, the community	Intrinsic motivation, contributing, showing your skills, recognition, the community	Recognition Sharing - reciprocity Empowerment	Recognition, sharing-reciprocity, empowerment
Marketing	Ted Talks, lectures, the community	The community	The community, blogs, lectures workshops, co-branding	The community, blogs, lectures
Market	Can appeal to everyone	Can appeal to everyone	Niche	Niche

Table 1: Overview and comparison of the four cases presented

The Characteristics of
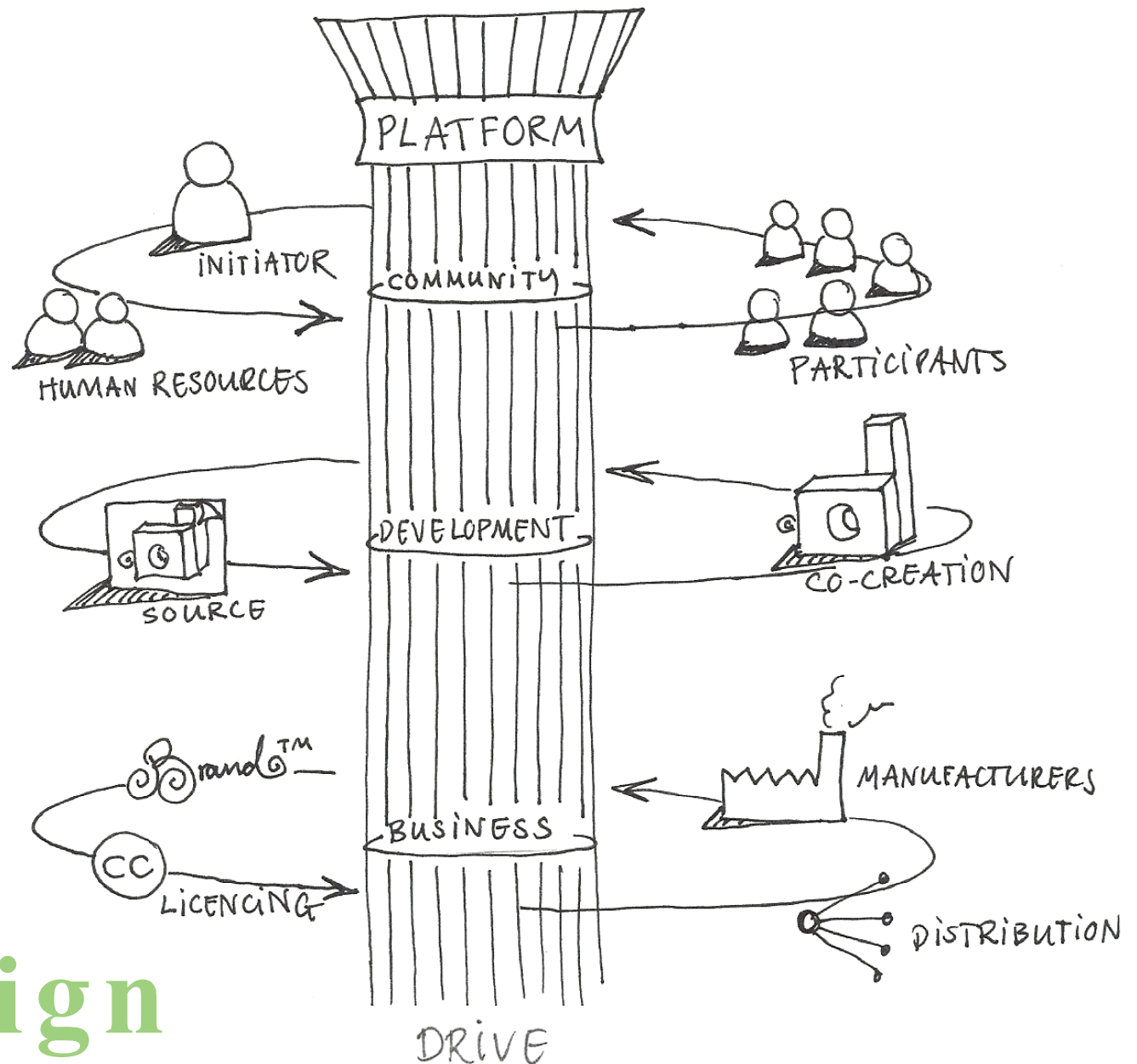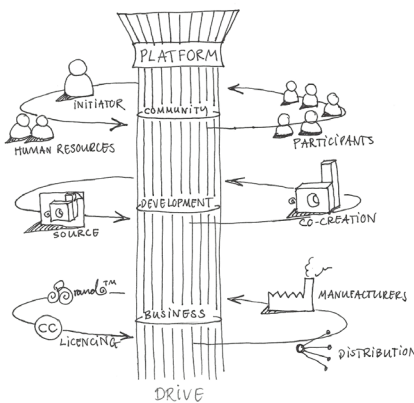
Open Design

The Open Design Process

From the case description the reader should now have gained a good understanding of how open design businesses operate. In order to generalise from these findings and create a model that demonstrates the fundamental aspects of open design and how they are connected, we have developed an Open Design Process Model (see Figure 12, p. 48) which should clearly visualise the process. The core element is the *platform*, through which a network of symbiotic connections is created between stakeholders. The other elements that make up the process and represent the most important dimensions of open design are then *community*, *development*, *business* and *drive*. In the following passage, all five elements are shortly explained.
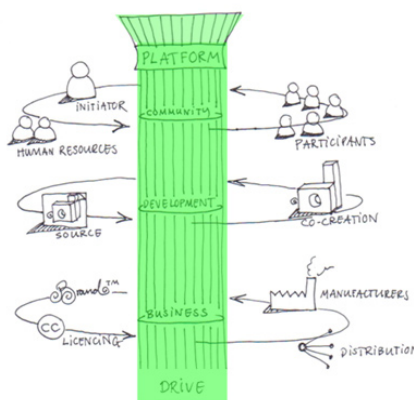
Platform

The core of the open design process is the platform that enables, facilitates and empowers interaction and development between participants through a symbiotic relationship. The platform needs to be accessible and open to anyone while providing self-service and effective coordination mechanisms which enable participants to figure out by themselves where, why and how to use it. In most cases the platform is presented via a website created by the company initiating the open design project. The platform is one of the company's key resources were customer relations are retained and through which channels are created and enabled, either by direct sales or by linking to local distributors and suppliers.
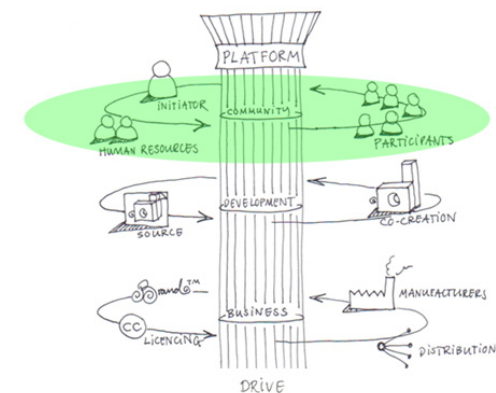
Community

The community is first and foremost made up of the participants who wish to take part in the development of the product and the company's human resources. These parties interact and build on each other's contribution with the common objective of creating an improved product. Together they create a network that is based on values of reciprocity, recognition and a desire to make an impact. The company's key partners are therefore the participants who receive the value proposition of gaining access to sharable knowledge and network without charge while they simultaneously are one of the company's main customer segments, often being the buyers or the end-users of the product outcome. The employees of the company are normally those maintaining the platform and managing it, although in some cases 'super users' of the platforms may become administrators. Whomever in charge these activities require responsiveness, intermediacy and deep understanding of the community and development. Segmentation and delegation of tasks is of great importance to achieve a functional communication platform and reduce the risk of having a costly and time-consuming process.
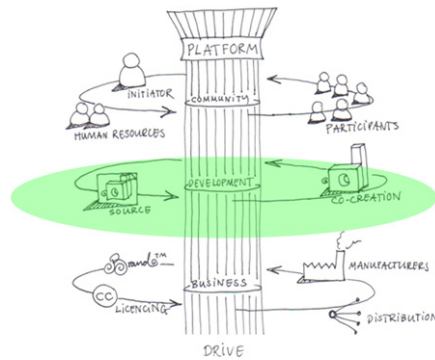
Development

The development of a product starts with the company posting their source on the platform; a 'challenge' or a 'point of reference', to attract participants. This most often includes a product's code, blueprint or something of that nature, which needs to have the potential of being further built upon, allowing multiple variations and customisation, depending on participants' requirements and creativity. This sets the frame for the open design collaboration where contribution is valued through recognition and exposure. Through interactions within the community and continuous development, co-creation takes place, where each participant is self-serviced through forums, tutorials and other information on the platform without any direct contact with the initiators.
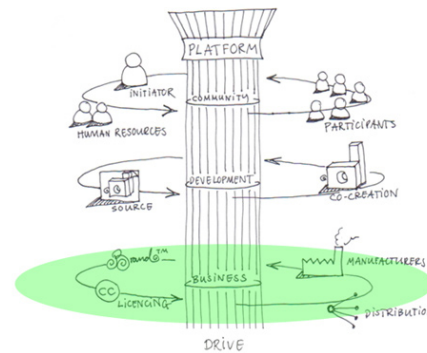
Business

The business aspect related to open design entails the business model needed to make open design a viable and desirable option for companies undertaking product development. As explained later in relation to the Archetypal Business Model the revenue stream can take many forms but what seems to be crucial in all cases is the strength of the company's brand, which may even function as a patent mechanism (Fitzgerald, 2006), thereby presenting one of the company's key resources. The type of license also influences greatly the possibilities of revenue streams, which again affects the company's key partners, who manufacture and distribute the final product outcome.
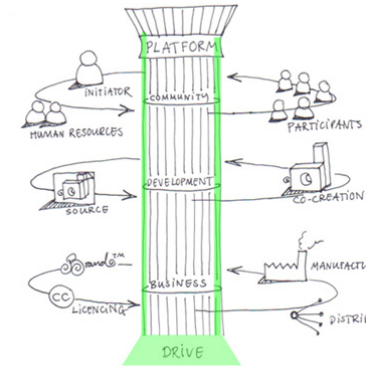
Drive

In order to attract crowds of developers to the platform there needs to be a drive that motivates participation. There needs to be a benchmark of some kind, which can be expressed in acts such as going against monopolistic giants (Linux against Microsoft), reducing cost of products (Arduino) or collaborating for the sake of good cause (OpenIDEO).

Collaborating and co-creating tangible products requires a mentality based on respect, trust and credibility (Fitzgerald, 2006). This cannot be emphasized enough. Furthermore, businesses need to be aware of the power of the crowd and their sensibility towards companies trying to reap benefits from their participation without being true to the open design principles. Therefore, one of the company's key activities is to create the right drive in the community to attract participants. This also plays a vital role in their customer relationship.

It is vital for companies undertaking open design approach to dig deep into the core elements of the open design process model and pinpoint exactly which elements will operate within it. In the following section these elements will be detailed further and related to a Business Model Canvas with the aim of structuring a formal business model for companies to build up on.

Self-service through platform website

Human resources Platform maintenance

Sharing of source, Intellectual prop. Platform maint.

Brand & Trademark, Licensing agreem. Revenue streams

Community of participants, End-users, others in network

Development and co-creation, Accessibility to knowledge, acknowledgement

Business partners, Manufacturers Distributors

Drive for attracting participants, Self-service

Figure 12: The Open Design Process

The Archetypal Business Model

The four cases described earlier represent companies that are successfully using open design to capture value and maintain a prospering business. For each of the cases we have mapped out their Business Model Canvas (see p. 30, 34, 38, 42). By doing so we were able to identify what these cases have in common, and where they differ.

By comparing the four canvases it became clear that the cases, despite offering different products or solutions, had a number of important common characteristics. Placing these on the BMC allowed us to visually demonstrate which key elements are needed for open design business models, i.e. allowing us to create an archetypal business model. This can be seen in Figure 13. The elements placed in the archetypal business model are those that are consistently present in open design. However, various other elements might be added to the building blocks depending on the company. For instance, where a company is located in its supply chain influences what elements should be added to key activities and key partners. Interestingly, one building block was drastically different between the cases, and that was the revenue streams. This gave us the opportunity to play around with this building block and explore various revenue streams which could be viable options for open design.
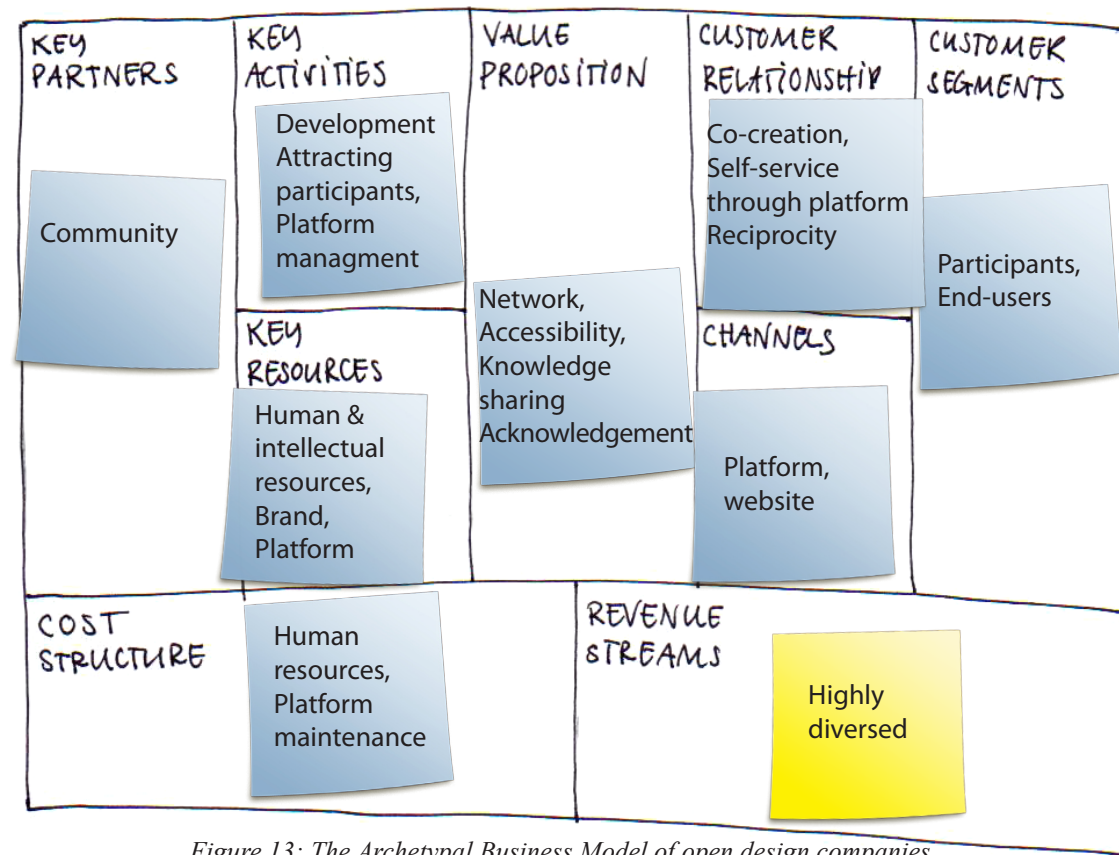
Figure 13: The Archetypal Business Model of open design companies

The 9 segments of the business model canvas can be related directly to the Open Design Process in the following way (see Table 2 and Figure 14):

Open Design Process Model	Business Model Canvas Blocks
Platform	Key Resources, Customer Relationship & Channels
Participants	Key Partners, Value Proposition & Customer Segments
Initiator / HR	Key Resources & Cost Structure
Co - Creation	Value Proposition & Customer Relationship
Source	Key Activity & Key Resources
Manuf. & Distrib.	Key Partners
Brand & Licensing	Key Resources & Revenue Streams
Drive	Key Activity & Customer Relationship

Table 2: A quick overview of which elements relate to the different blocks of the BMC

A visual clarification is made in Figure 14 and represents the relationship between the open design process model and the business model canvas.

Each building block of the BMC represents a complex part of the business model, which must be explored in-depth. To dig further into each building block the next section is dedicated to each part of the BMC and related to the archetypal business model of open design.
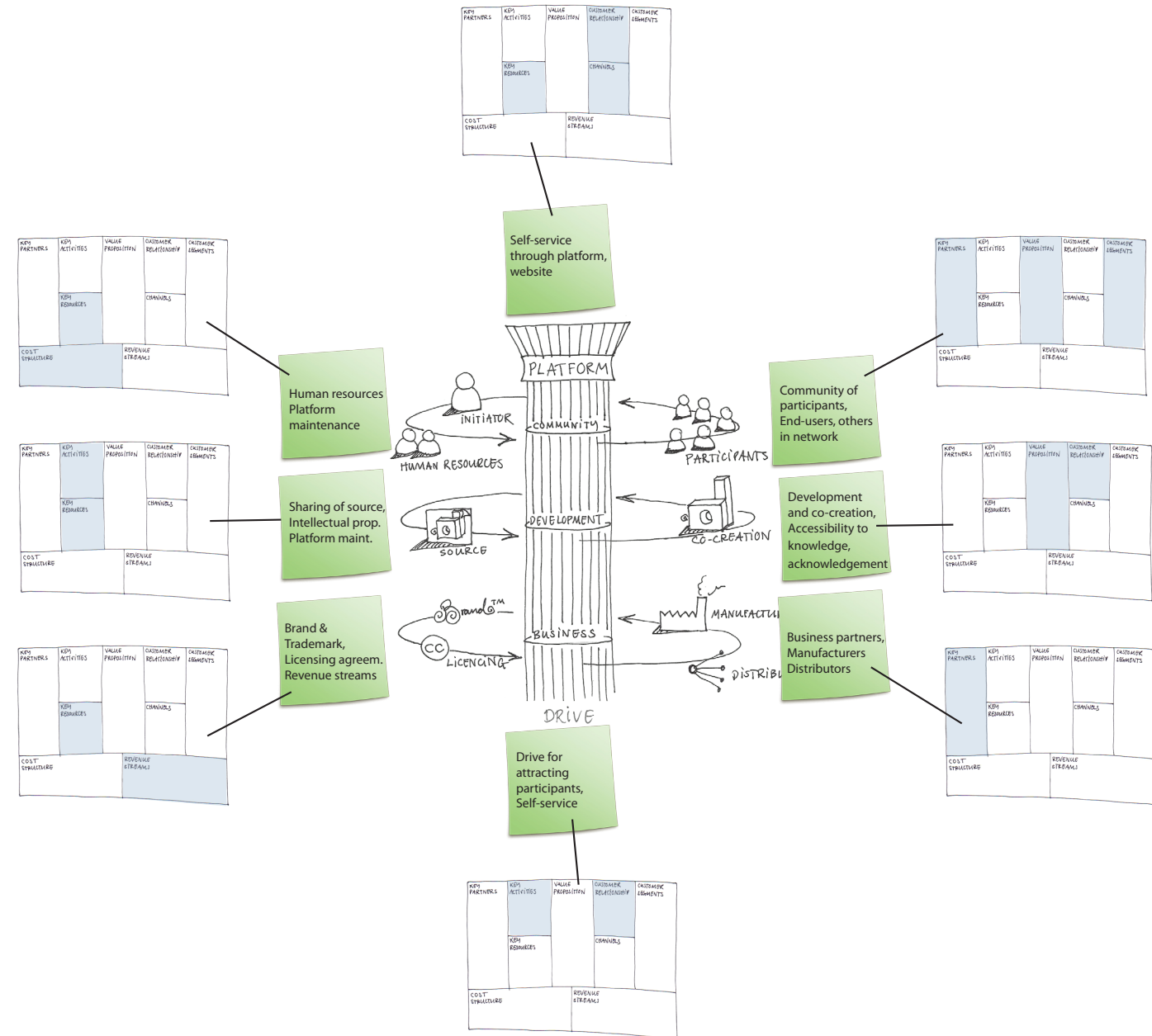
Figure 14: The 9 segments of the business model canvas related to the dimensions of The Open Design Process Model for a typical open design company

The 9 Building Blocks

In this chapter the Business Model Canvas (BMC) is used to gain insight into the business models of open design companies. Each of the 9 blocks is shortly described followed by a more detailed description of the open design archetypal business model segment. The blocks are presented and discussed in the following order:

1. *Key partners*

2. *Key activities*

3. *Key resources*

4. *Cost structure*

5. *Customer segments*

6. *Customer relationship*

7. *Channels*

8. *Value proposition*

9. *Revenue streams*
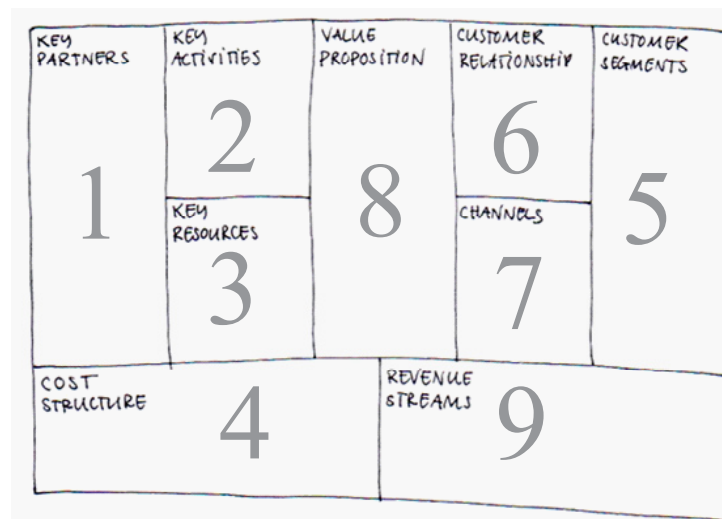
The last block on Revenue streams will be further elaborated on in relation to different revenue stream possibilities that should be considered when developing new business models related to open design strategies.

1. Key Partners

Key partners describes the network of partners that make the business model work. There are four different types of partnerships; strategic alliances between non-competitors, strategic partnerships between competitors (coopetition), joint ventures to develop new businesses, and buyer-supplier relationships to assure reliable supplies.

(Osterwalder and Pigneur, 2010)

Within open design the relationship between participants and the initiating company forms a community that is the essential key to make the business model work. This partnership is then supported by a platform that provides infrastructure that contributes to the following; optimization and economy, reduction of risk and uncertainty, and acquisition of particular resources and activities.

Optimization and economy of both resources and activities is the most basic form of partnership. It is usually formed to reduce cost, and often involves outsourcing or sharing infrastructure. An example of this is that open design companies outsource their product development (or a great part thereof) to the community, in addition to the platform providing a sharable infrastructure to create a solution that fits customer needs. When it comes to the reduction of risk and uncertainty certain operations can be outsourced, while the company places focus on their core competence. An example of this is the case of Arduino where they have outsourced manufacturing and distribution allowing them to focus on their core competence of knowledge creation. When it comes to acquisition it is mostly about acquiring the knowledge and workforce that resides within the community. This can be seen in the case of Architecture for Humanity where thousands architects and designers have joined the network and are willing to contribute and give input based on their extensive expertise and experience.

Other potential key partners include suppliers, manufacturers and distributors, depending on the activities that the company is involved with and how it is placed in the supply chain. For instance Adafruit is dependent on suppliers while distributing the products itself. Arduino on the other hand relies on manufacturers and independent distributors. See Table 3.

Cases	Community	Suppliers	Manufacturers	Distributors
IDEO	✓			
AfH	✓	✓		
Arduino	✓		✓	✓
Adafruit	✓	✓		

Table 3: Key Partners for the four cases

2. Key Activities

Key activities describes the most important things a company must do to make its business model work – they must create and offer a value proposition, reach markets, maintain costumer relationships and earn revenue.

<div align="right">

(Osterwalder and Pigneur, 2010)

</div>

It is highly dependent on the industry and business model what key activities are involved. Within open design, key activities are those that ensure that the platform works efficiently, that a crowd of participants is reached and retained, and finally the development of the product.

Operating the Platform

There are many activities that need to take place for the platform to run efficiently. These can be divided into platform management, maintenance, and providing service and support.

- *Management*: a person or a team needs to be made responsible for coordinating the forums and organizing the input and feedback from participants. Additionally, there has to be a team responsible for ultimately taking decisions on what product features are to be incorporated in the product, or at least continued with for further development. This decision can also be made through voting on the platform or ranking products based on various credentials. Contributors may also decide to take a different route and develop a product according to their own preferences.

- *Maintenance*: this activity requires the basic necessities when operating a website and maintaining a forum. This includes maintaining the website, adjust server space, remove bugs and spam and other undesired material, provide secure browsing, encryption and so forth.

- *Service and support*: a team must be made responsible for providing service and support to the community members. These activities include answering questions about the platform's functionality, the product development process, creating tutorials and having web conferences (i.e. skype webinars).

In many cases ambitious and trusted participants become a part of the administration team to ease the load of management, service and support. "*We have people that have answered 20.000 questions*" (Arduino, 2012, Appendix I). These participants in most cases have expert knowledge, have proven their dedication and involvement, and are highly influential in their input.

"We get a lot of help from our moderators and users. They can answer amazingly complex and difficult questions, as they know the products, the website, etc."

<div align="right">

(Coloplast, 2012, Appendix IV).

</div>

Attracting and Retaining the Right Crowd

"It [the project] needs to have a certain level of depth and madness attached to it in order to attract the crowd"

<div align="right">

(Copenhagen Suborbitals, 2012, Appendix VI)

</div>

This activity is perhaps one of the most important aspects of open design. The attractiveness of the platform as well as the quality of product development is highly dependent on the community. The platform needs to attract participants, keep them interested and make sure that participants are rewarded based on their input. In the cases examined a reward system mapping the contribution and rating it accordingly proved successful in giving participants a sense of recognition and motivation to contribute: *"We give them names of scientist, like Fahrenheit or Tesla so they move up in the system"* (Arduino, 2012, Appendix I). Closely related is platform promotion, which is crucial to spread the word and get people interested. It has been shown that in most cases when open source is used for development it will be watched, viewed, produced, copied, talked about and blogged about in more places than if it was a closed design, thereby reducing time and cost for marketing activities (van Abel et al., 2010).

To attract the right participants there has to be a strong value proposition in place that appeals to people and motives them to contribute: *"Arduino was unfinished enough so that anyone could appropriate the concept and make it their concept"* (Arduino, 2012, Appendix I). Companies must consider what participation will bring with it for the participant and what type of reward will motivate them to contribute. According to von Hippel and von Krogh (2003) rewards can be provided in a variety of forms, including elevated reputations, expected reciprocity, and incentives to help build the community. Based on our research the community composition is directly linked to the type of product that is to be developed. Companies therefore need to consider what the attributes of the product are and how they can use it to attract people to participate. An example of this is for instance OpenIDEO. There are no monetary gains in participating

in the development of the "challenge" which is posted. Yet there are thousands of users signed up on the platform and thousands that contribute to the challenges. OpenIDEO is operated by IDEO which donates their work and oversees the 10 week design phase. Here the value of reciprocity comes in, i.e. IDEO is giving something back to the community in turn for their contributions. Additionally, users are rated on their input and each has their own design quotient (DQ), which shows how active they are in each step of the product development process, and how good their comments have been (IDEO, 2012b). This in turn gives them a sense of recognition and this can influence their status within the community. See Figure 15 for the design quotient.

MY DESIGN QUOTIENT	
INSPIRATION	1420pt
CONCEPTING	1066pt
EVALUATION	496pt
COLLABORATION	5768pt
TOTAL	8750pt

MY DESIGN QUOTIENT	
INSPIRATION	1952pt
CONCEPTING	413pt
EVALUATION	485pt
COLLABORATION	2014pt
TOTAL	4864pt

MY DESIGN QUOTIENT	
INSPIRATION	90
CONCEPTING	8
EVALUATION	6
COLLABORATION	52
TOTAL	158
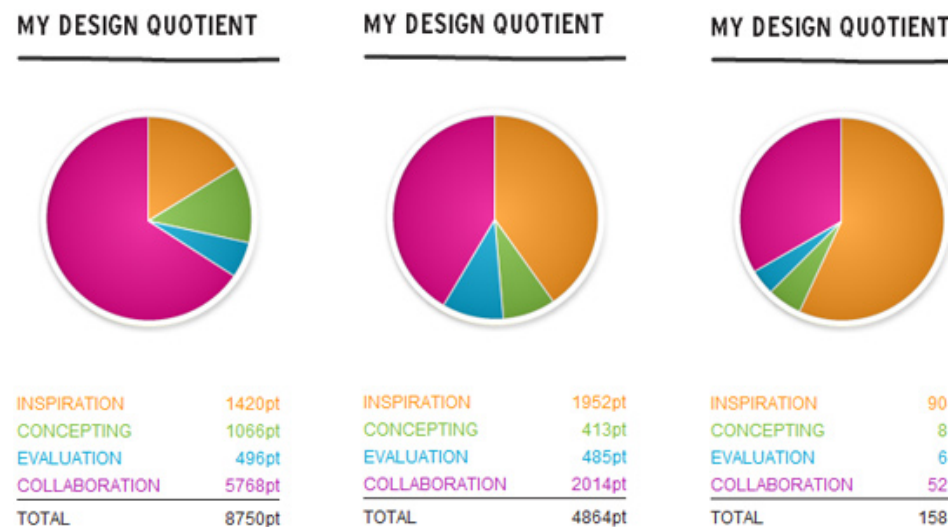
Figure 15: An example of the Design Quotient system that OpenIDEO uses

Product Development

Through open design the initiating company is able to take advantage of a crowd of free developers, increased user feedback and customised design. Another benefit of open design is that quality control to a large extent is placed in the hands of peer review from the public (van Abel et al., 2010, p. 121) or as one of the Linus' law goes: "*Given enough eyeballs, all bugs are shallow*" (Raymond, E., 1999). For these objectives to be reached the key activities are problem solving and encouraging innovate solutions. The process begins with the initiating company providing a "challenge" which motivates participants to build upon and provide different variations. If the company has a strong value proposition for participation the users will be quick to contribute their own ideas and solutions. The company can then give feedback and encourage further development on strong proposals and so the cycle of continuous interaction, development and iteration begins. This cycle will be further explained in the open design process model.

3. Key Resources

Key resources describe the most important assets required to make a business model work. They allow companies to fulfil their value proposition, reach markets, maintain customer relationships and earn revenue.

(Osterwalder and Pigneur, 2010)

Key resources when dealing with open design are human resources, participants and the platform. Intellectual resources can also play a huge role in creating revenue streams.

Human Resources

Human resources are required in all companies, but can be more crucial in some knowledge-intensive and creative industries. Within open design firms human resources mostly take care of the maintenance and management of the platform, including service and support to participants. It is important that some members of the administration team have expertise knowledge of the product so that the community has respect for the team operating the platform. In some cases these individuals will become some kind of gurus within the community where participants will look up to these expert individuals and strive for their recognition. An example is Limor Fried (aka Ladyada); the founder of Adafruit. She is a noticeable part of the electronics community having gained recognition and reputation through her hacking activities and awards she has been granted.

Participants

In general participants have the task of contributing to the product development but some can have an additional role of being a part of the administration team. This is in most cases voluntary work that is offered to participants that have shown that they are highly active and enthusiastic, and provide good comments and feedback. An example of this is Coloplast, which specialises in product development for people with very personal and private medical conditions. They created a platform for their innovation project called Innovation By You (www.innovationbyyou.dk) where they provide forums for stoma patients to share their thoughts and problems. One participant in particular was highly active, answering hundreds of inquiries and giving great feedback. This member was recruited to the administration team receiving an honourable placement within the community and some monetary compensation (Coloplast, 2012, Appendix IV).

Platform

The platform is the biggest resource since it ties together the various elements of open design. In most successful open design cases the initiating company has created a specific platform for product development, as opposed to utilising already existing platforms. This has mostly been driven by the benefits of having a customized platform that suits their needs and increases brand recognition and product awareness. It also contributes to attracting the 'right' crowd, or more specifically a concentrated crowd of people (i.e. Arduino with its microcontrollers attracts people with interest in electronics). Companies that wish to create their own platform have two options to choose from:

- The platform can be directly related to the company

  - *Adafruit*: provides electronic kits and tutorials for people that are interested in creating their own electronics. The website of the company also serves as a platform with discussion forums easily located. Service and support also available.

- The platform is set up as a spin-off

  - *IDEO*: a consulting company that focuses on innovation and is a for profit organisation. However, they were interested in including more people in the innovation phase and product development of their 'challenges' so they created OpenIDEO, a spin-off that is non-profit.

  - *Coloplast*: created a forum for people with stomas where they are able to discuss personal problems and come up with new and improved solutions to dealing with their disease. Coloplast sponsors this platform and gains from the customer feedback in turn. *"It is not a site where we are promoting our own products. If we had our logo and products all over the platform then I think people would be biased."* (Coloplast, 2012, Appendix IV).

The platform is provided by others

Another option is to utilise pre-existing open design platforms. The advantage of this approach is that the cost of setting up a platform and managing and maintaining it is dramatically reduced. The disadvantages are that the product might not receive as much attention on the platform and there is a risk that the crowd contributing is not concentrated enough. That can lead to a lack of valuable quality input and too much 'noise', which will disturb development both from the initiator's perspective as well as from the participants' perspective. This might also decrease the publicity that a company receives and the participants branding recognition related to the specific product.

It is important to look at what objectives are to be achieved when choosing the appropriate type of platform. Examples of platforms that are not associated to a particular company and have a vast variety of open design projects:

- Thingiverse[1]: a place to share digital designs where the objective is to create a community of people who create and share designs freely, so that all can benefit from them.

- Hackerspaces[2]: self-defined *"as community operated physical places, where people can meet and work on their projects"* (van Abel et al., 2010).

- Ponoko[3]: an online marketplace where creators, digital fabricators, materials suppliers and buyers meet to make anything.

Already existing platforms can also have another function, namely to raise awareness of a company's own open design platform. These include DesignSmash[4] where people post stories on open source projects online. Instructables can also raise awareness of the product. Instructables[5] is a web-based documentation platform where people share what they do and how they do it, and learn from and collaborate with others.

Intellectual Resources

Intellectual resources such as brands, proprietary knowledge, patents and copyrights, partnerships, and customer databases can be difficult to develop but are increasingly important components of a strong business model. If a company is able to create brand awareness and/or reap the benefits of first-mover-advantage it can trademark its logo and receive royalties of sales. This for instance is the main revenue stream for Arduino and has been stated by Fitzgerald (2006) to possibly being the new IP mechanism within open source development.

4. Cost Structure

Cost structure describes all costs incurred to operate a business model. It is the costs that are necessary for a company to create and deliver value and the cost of all activities associated. Cost structure can be either cost-driven or value-driven.

(Osterwalder and Pigneur, 2010)

Within open design there is no rule as to whether a company should adhere to a cost-driven or a value-driven business model. Both versions have been identified. In the case of Adafruit and Arduino the emphasis is more on cost, i.e. providing cheap and easy-access electronic kits or providing a less expensive option of circuit boards. With Architecture for Humanity and OpenIDEO the emphasis is placed on value rather than cost.

There are four main characteristics of cost structures; fixed costs, variable costs, economies of scale and economies of scope.

Fixed costs remain the same despite the volume of goods or services produced. Examples include salaries, rents, and physical manufacturing facilities. This is a cost that each company is faced with since it is hard to run any operations without employees, facilities, upkeep and so forth. Open design is no exception to this. **Variable costs** vary proportionally with the volume of goods or services produced. Within open design these costs are highly dependent on the type of company and product. **Economies of scale** are cost advantages that a business enjoys as its output expands. Larger companies, for instance, benefit from lower bulk purchase rates. This and other factors cause average cost per unit to fall as output rises. Within open design economies of scale can be easily achieved in terms of reaching a wider range of users and potential customers by creating a platform and opening up product development. **Economies of scope** are cost advantages that a business enjoys due to a larger scope of operations. In a large enterprise, for example, the same marketing activities or distribution channels may support multiple products. Economies of scope can also be attained through open design if the platform is agile enough to support more than one product.

Within open design the main costs are those associated with human resources and platform management and maintenance.

5. Customer Segments

According to Osterwalder and Pigneur (2010) an organization must make a conscious decision about which segments to serve and which segments to ignore. Customer groups represent separate segments if:

- *Their needs require and justify a distinct offer*
- *They are reached through different distribution channels*
- *They require different types of customer relationships*
- *They have substantially different profitabilities*
- *They are willing to pay for different aspects of the offer*

With this distinction it can be said that within open design practices there are three different customer segments; *the participants, the customers* and *the end-users* (see Figure 16). The participant is a user of the platform that contributes to the product development. The customer purchases the product and the end-user is the ultimate user of the product. An example of a customer could be a retailer and the end-user would then be someone who purchases the product from the retailer. Though this distinction is made between these three customer segments they are not mutually exclusive and can overlap, i.e. a participant can easily be a customer or end-user.

In the case of Adafruit the participants contribute to the platform's forum and they are a part of constant product development and feedback. The individual at home that wishes to buy the assembled kit acts only as an end-user since he does not participate in this process. Another example is the case of OpenIDEO. The participants count thousands of people but in most cases they will not be affected by the solution since it is in a large scale societal perspective and the challenge initiator (customer) will implement the solution. The solution will then potentially affect hundreds of people (end-users).

Customer segments can be divided into **mass market, niche market, segmented** and **diversified**.

Mass market represents business models that do not differentiate between different customer segments. Within the open design cases, OpenIDEO and Architecture for Humanity may fall into this category.

Niche market represents business models that cater to specific specialized customer segments. This is apparent in many cases of open design. For instance, Arduino caters to a customer segment of a small group of circuit board users which might be broader in the conventional terms of circuit board users but still remains a niche market with specific needs.

Segmented represents segments that vary only slightly in terms of value proposition. This is for instance the case with Red Hat, an American software company that is engaged in providing open source software products to the enterprise community. Their customers include companies in various industries but they require similar but slightly different solutions from Red Hat based on the Linux operating system (Red Hat, 2012).

Diversified represents two or more unrelated customer segments that have different needs. This is apparent in our cases with companies having to continuously distinguish between the key players of participants and end-users. For instance, Adafruit has a customer segment of participants that are "gadget freaks" and active participants in the Adafruit forum and chatrooms. They also have a customer segment of people that wish to buy assembled kits of electronics and use the tutorials to create gadgets, with little desire to innovate or share their findings. These are two distinct groups which have different needs and wants which Adafruit must cater to.
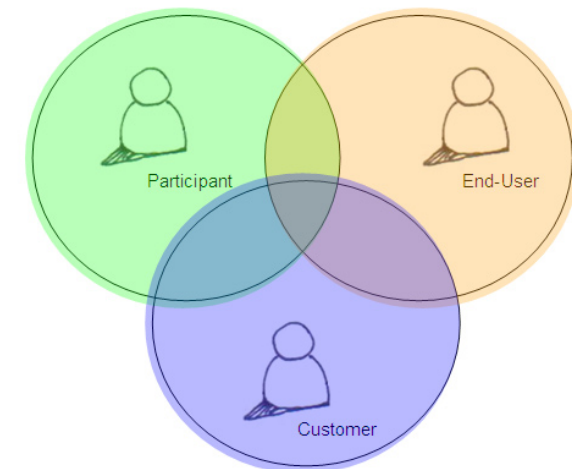

Figure 16: How the three customer segments are interrelated. All three can act in the same domain

6. Customer Relationships

A company should clarify the type of relationship it wants to establish with each customer segment. The customer relationship is very dependent on the value proposition and it must be adjusted accordingly to each customer segment. Different customer relation strategies can co-exist within a company and they can range from dedicated personal assistance to self-service. Customer relationships are driven by three motivators; customer acquisition, customer retention and boosting sales (upselling).

(Osterwalder and Pigneur, 2010)

Within open design we can see that **customer acquisition** (in the form of attracting the participants) and **customer retention** (motivating participants to continuously contribute) are highly important. **Boosting sales** has more to do with the end-user and so far the cases examined have not shown particular efforts in that aspect. The relationship that participants expect from the platform providers is mainly built on self-service but there are certain aspects that must be in place for participants to honour the community and be willing to contribute. These include openness and reciprocity (i.e. the company has to be willing to give something back for the knowledge that participants contribute), trust between stakeholders (i.e. what is open will remain open), and acknowledgement and recognition for contributions (i.e. some type of reward system or ranking that inspires participants to contribute). Lastly, there has to be some type of drive or motivation in place that motivates the participants to contribute. An example of how Arduino fulfils those requirements is that they leave everything open for the participant to copy, adjust, modify and reproduce with a CC licence. This means that the participant has access to codes and blueprints needed to make the product. The platform and the product are built on values of openness and the common goal of creating a solution based on collective input. Arduino then has a ranking system that participants become a part of. The rankings are based on the input that participants contribute with, both in terms of quality and quantity. Participants see this ranking system as a motivator for contributing since within this community of electronic enthusiasts being ranked highly is a status symbol and brings with it respect and recognition from peers.

Other types of customer relationships are **personal assistance, dedicated personal assistance, self-service, automated services, communities** and **co-creation.**

Personal assistance is a relationship based on human interaction. This requires a real customer representative that is available to service the customer at any given time in the customer relationship lifetime. Adafruit utilizes this type of customer relationship with personnel available to help customers with any problems they might have with payment, delivery, returns and so forth.

Dedicated personal assistance involves dedicating a customer representative specifically to an individual client and normally this relationship develops over time. An example could be an accounting firm that provides its customers with a personal accountant. The founders of Arduino have provided consultancy based on their expertise, which is a form of dedicated personal assistance.

Self-service means that there is no direct relationship between a company and customers. All the necessary means are provided for customers for them to help themselves. This type of service is very evident in open design since platform management and support thereof is a crucial part of the cost structure. Having operations automated and participants being able to learn the robes themselves saves a great deal of time and effort. An example could be Arduino and Adafruit where participants are not given a particular helping hand in learning how to contribute and influence the development process. Open design companies, in most cases, do not have direct relationship with their customers. They provide the necessary means for customers to help themselves and in that way empower them to take action and responsibility for their own outcome.

Automated services mix customer self-service with automated processes. Automated services can recognize individual customers and their characteristics, and offer information related to orders or transactions. An example of this is Amazon's recommendation for books, movies and other products, depending on what the customer has previously bought or browsed on their website. This has not been idenitifed in any of the open design cases but could definitely be of value.

Communities help companies become more involved with customers in addition to facilitate connection and interaction between community members. These communities often involve users exchanging knowledge and solving each other's problems. Every open design case has the community as a foundation for a strong customer relationship. As mentioned earlier, the network and community of open design companies, enables participants to exchange knowledge and solve each other's problems and challenges without the company interfering. Their interactions also help the companies to better understand their customers for further product or platform improvement or to introduce new propositions.

Co-creation goes beyond the traditional customer-vendor relationship for creating value with customers. This is very visible with open design where companies reach out to their customers and ask them to participate in the co-creation of objects. What open design companies have in common is their co-creation approach with their customers in order to create value. They invite their users to actively access, adopt and further develop their existing products in order to improve and even innovate new product offerings.

7. Channels

Channels describe how a company communicates with and reaches its customer segments to deliver a value proposition. Communication, distribution, and sales channels comprise a company's interface with customers. These channels play an important role in customer experience. An organization can choose between reaching its customers through its own channels or through partner channels (or even through a mix of both), directly or indirectly.

(Osterwalder and Pigneur, 2010)

Within open design companies theyr reach their customers through their own, direct channel: the platform. These companies try to incorporate a seamless experience for their customers by allocating the product within the same platform which development takes place. Some have added to their channel links to local retailers in order to facilitate access to products or sublementaries, creating a bundle of products and services to increase sale and accessibility. The benefit of using open source is that the platform can be used in every channel phase:

- *Awareness and evaluation*: the platform raises awareness of products and services by introducing them to the community and creating a momentum or buzz around them (i.e. by posting new information about coming products, reminding customers about certain features or services, etc.). It also serves as an evaluation tool since it allows customers to give their feedback on the product and services which the company has to offer.

- *Purchase and delivery*: the platform can serve as a distribution channel either with customers purchasing products directly from the platform or being referred to distributors.

- *After sales*: the platform also serves as an after sales tool since it allows customers to seek post-purchase support from administration.

Open design practices can therefore minimize cost and increase flexibility for companies since it can include all channel phases. However, it is important to note that the platform does not necessarily have to be the same throughout all phases. Arduino, for example, does not sell any boards directly; they provide access to local distributors that can provide the customers with a licensed Arduino product. Adafruit on the other hand sells Arduino boards directly (as a retailer) but adds other elements, such as diodes, transistors, wires, etc. in order to create thoroughly tested 'kits' that facilitate a smooth user experience.

8. Value Proposition

The value proposition describes the bundle of products and services that create value for a specific customer segment. It solves a customer problem or satisfies a customer need. Each value proposition consists of a selected bundle of products and/or services that caters to the requirements of a specific customer segment. Values may be quantitative (e.g. price, speed of service) or qualitative (e.g. design, customer experience). Offers may be innovative or disruptive while others may be similar to existing offering but with some kind of added features and properties.

(Osterwalder and Pigneur, 2010)

Within open design the value proposition must be customized to the three identified customer segments, namely the participants, the customer and the end-user. As mentioned earlier these customer segments can overlap, i.e. a participant can be a customer and end-user. For the participants the value proposition mainly consists of providing a network where knowledge sharing and information is easily accessible. The value proposition can also include recognition and sense of empowerment that the participant can experience through contribution and reward system. For the customer the value proposition consists of a design that the customer can either buy fully assembled or make himself. The product is customizable and in many cases it is relatively cheaper than competing products. The following is a non-exclusive list of value propositions that have been identified.

Network: The network offers a community of contributors and users that communicate freely with each other. Often positive network effects rule the actions of these platforms meaning that the more users become involved the more value the network has to offer (McIntyre and Subramaniam, 2009).

Accessibility: It is easy for users to become involved in the community and use the platform. They may have to register an e-mail address but there is no fee required. This provides easy access to information and other material that is open for anyone to use.

Knowledge sharing: Participants discuss and build on each other's input and development in an open environment. This brings learning and experience into play for all parties interested.

Cost reduction: Supporting low cost or non-profit offerings is an added value for community members, many of whom wish to challenge the stabilized profit-offering-businesses. Companies save on R&D cost by using the crowd to develop the product and by not having to spend time on patent and copyright issues.

These value propositions support the so-called Do-It-Yourself revolution (DIY) which enables people to access information freely so that they can make the products themselves.
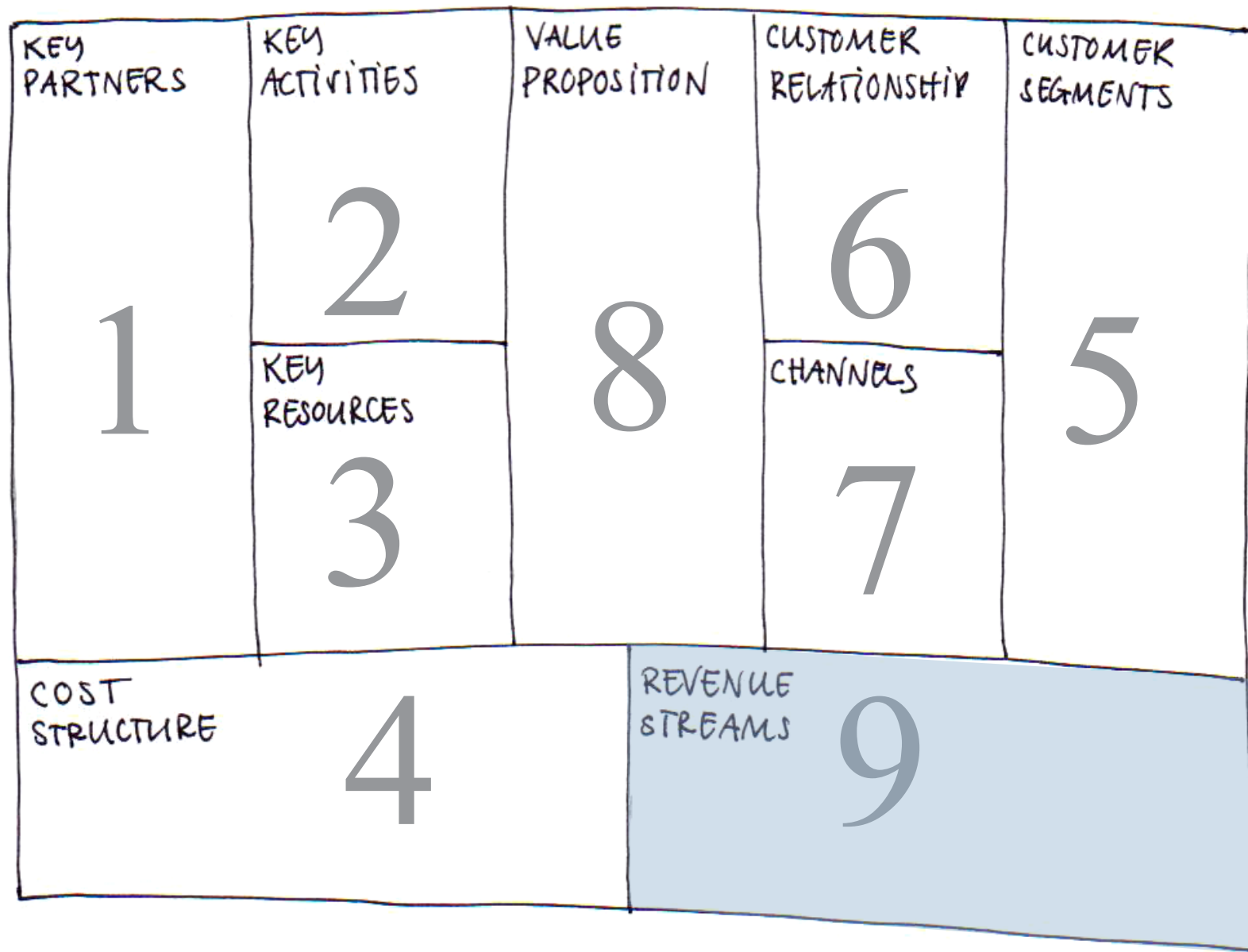
Figure 17: The Business Model Canvas with its 9 building blocks. The building block nr. 9: Revenue Streams is the one that differs from the rest

9. Revenue Streams - How to Run a Profitable OD Company

Revenue Streams represents the cash a company generates from each customer segment. In order for a company to survive its earnings must surpass its cost. Generating revenue streams requires understanding what the customer segments are truly willing to pay for, how much and when. A business model can involve different types of revenue streams such as asset sale (direct product sale), usage fee, subscription fees, renting, leasing, licensing, brokerage fees (credit card percentage) and advertising, all with different pricing mechanism.

(Osterwalder and Pigneur, 2010)

What characterizes open design is that in most cases the end product is free, or at least the means to make the product is freely accessible to anyone that wishes to manufacture the product themselves. Since this contradicts the "traditional" business model new revenue streams must be identified. So far we have seen that there is not one particular way of gaining revenue when it comes to open design. This can be seen through the four cases where the revenue comes in many different forms such as component sales, licensing, service sales and donations. A widely used and accepted business model with related revenue streams for open design has therefore not been established so far.

In order to broaden the scope of possible revenue streams some more traditional business models have been analysed and gathered for generating new options for open design companies. This has resulted in twelve revenue streams which have been put forth in The Wheel of 12 Revenue Streams (see Figure 18).

Figure 18: The Wheel of 12 Revenue Streams
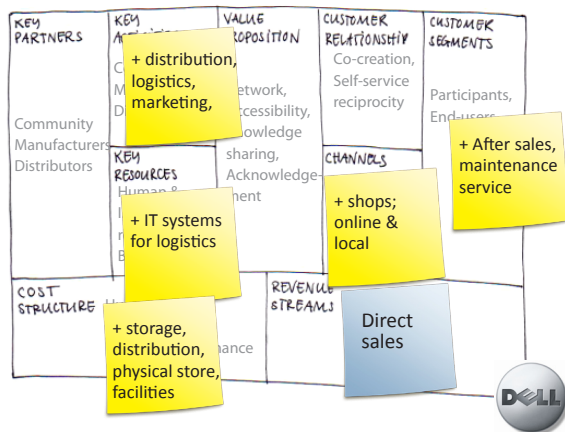
1. Direct Sales

By direct sales we are implying sales directly from producer to customer without any intervention of distributors and retail stores. With the arrival of the internet direct sales can change from being physical face-to-face relation between a customer and a sales person to self-service platforms where customers can purchase products and receive support without any personal contact. A famous model of this kind is Dell's direct sales model which revolutionised the PC industry in the late nineties (Dell and Fredman, 2006). For a company to undertake direct sales, it needs to incorporate into its business model inventory storage, logistics and distribution center, and in most cases add to its human resources. An excellent online shopping experience for the customer is also important to increase customer satisfaction and re-occuring purchases. Companies might also choose to market themselves as product sellers. This requires some substantial investments and risk taking, but which might bring a larger profit in the long run, allowing the company to reap benefit from eliminating actors from the value chain, such as distributors and retailers.
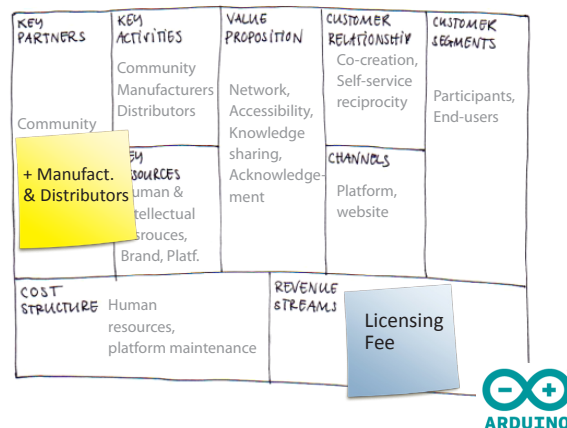
2. Licensing Fee

This is what characterises the Arduino business model, who license their brand and logo to manufacturers for a 10% share of sales. Other types of licensing agreements exist, such as the one of MySQL, which is a dual licensing. This means that anyone who is developing and distributing open source applications under an open source license is free to use MySQL software and share under the same license, while those who wish to develop and distribute but do not want to release the source code for their application, MySQL is able to provide a commercial license. Because MySQL has full ownership of the MySQL code, it is able to tailor its commercial licensing terms to meet the unique requirements of users interested in embedding or bundling MySQL (OSS-watch, 2012).
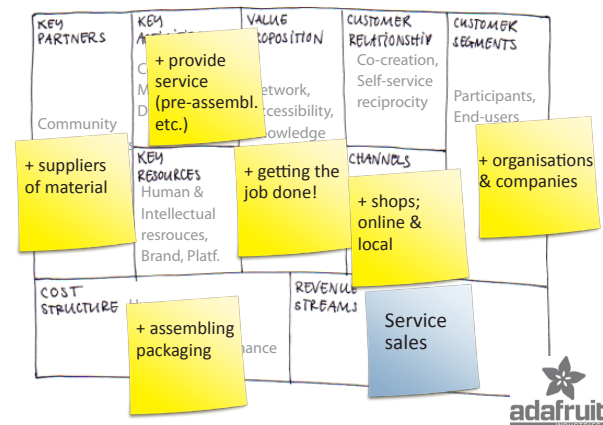
3. Service Sales

Many participants of open source development are fond of the DIY approach and wish to access codes and blueprints in order to build their own products from scratch. On the other hand there is a large group that might wish to do so but do not have the time, the patience or the capacity, and will therefore buy additional service in order to get the product delivered. This is what we call service sales. Adafruit is a good example of an open source tangible product service provider, allowing customers to purchase product 'kits', where every element of the product is pre-prepared, ready to be assembled (a bit like IKEA furniture) while others take it one step further and deliver a fully assembled product (such as 3dstuffmaker*). With such service customers are willing to pay significant amounts.

* http://www.3dstuffmaker.com/

Certain companies were used when forming The Wheel of 12 Revenue Streams. See more on this in Appendix XI. The logos attached to the different business model canvases in this section give an example of these companies.

architecture for humanity
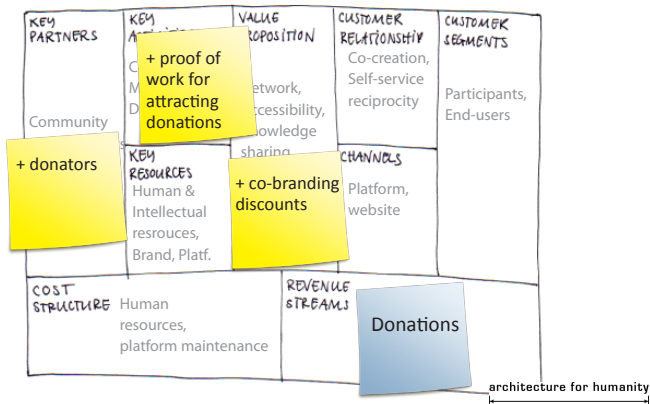
4. Donations

There are several open source companies that are dependent on donations. Wikipedia is one and Architecture for Humanity another. Implementing a 'donation' button on the company's website is rela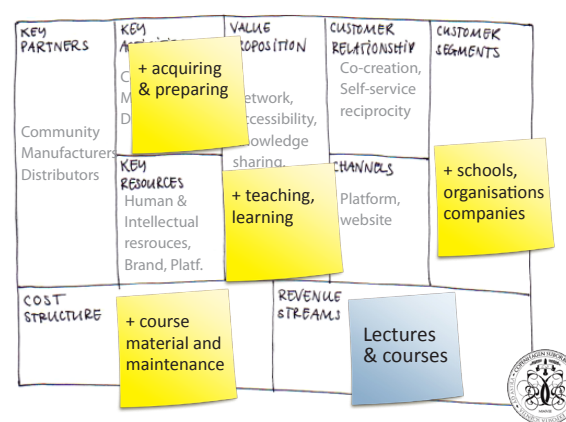tively easy, and impressive crowdfunding sites such as Kickstarter* or IndieGoGo** may enable a company to raise the amount needed. But there are a few considerations that need to be taken into account: The first concerns taxes and secondly it is the donors' expectations on what they should get in return for their contributions (Prodromou, 2011).
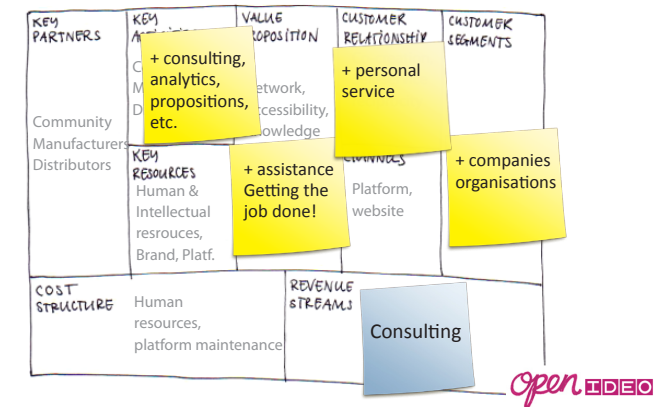
5. Lectures & Courses

Giving lectures on a company's approach and success, teaching, conducting workshops or providing training are well known activities for companies to increase their revenue and brand recognition. The person leading such actions is often the founder or CEO of a company; represented as the 'face' of the product. Being depended on personalities in such a way makes scalability a challenging task. An example is Cameron Sinclair, one of the founders of Architecture for Humanity, who has become a renowned lecturer around the world as people are interested in hearing about his experience with open source practices, creating and building amazing architectural structures and sustainable solutions for people in need worldwide. The founders of Arduino have similarly given lectures and provided workshops on the use of the microcontroller.

6. Consulting

Work-for-hire is a common way to generate income. Assisting and guiding companies or 'getting the job done' is what consultancy can provide. We wish to distinguish between *Consulting* and the *Lectures & Courses* revenue, as consultancy generally involves a lot more preparation and extensive analysis of the company. IDEO is a consultancy that indirectly reaps benefits from their non-profit open source platform OpenIDEO. Their expenses is paid by IDEO's customers whom in some cases are also involved in the Open IDEO platform challenges. Arduino is also providing some consultancy on the microcontroller for bigger organisations to adapt, such as Google at their Google Code platform .

"I do my lectures and that is how I make my money"
(Copenhagen Suborbitals, 2012, Appendix VI)
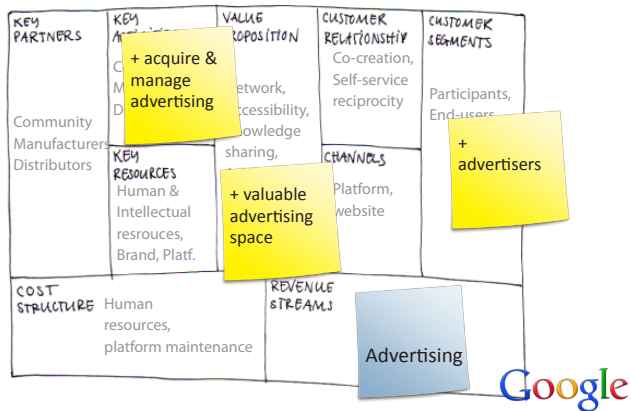
7. Advertising

Many of the worlds' biggest companies are basing their income purely on advertisements (Google, Facebook) or by letting third party place their product in their marketplace. Advertisement does require companies to identify a valuable advertising space and support an attractive pricing mechanism, such as Google's bidding system (Adwords). One should be aware of the advertising perception within the open source communities, which may not fit well with their philosophy.
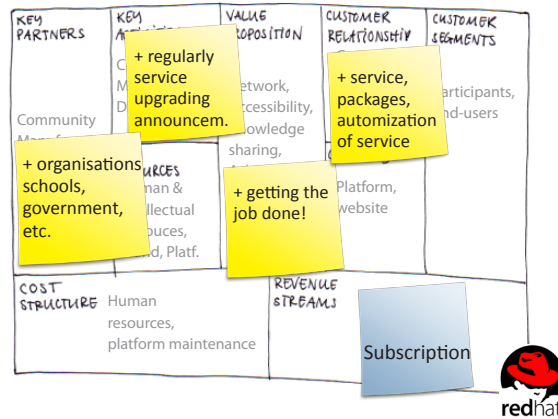
8. Subscription

Subscription is the equivalent with the freemium model within OSS. By offering the standard product for free and then charging for premium features or additional services has proven itself to be a sustainable business model and should be applicable to open design. Members can receive access to special versions, product details, invitations or events, competitions, books & magazines, discounts, etc. Upgrades and services on customizing the product can be offered against charge. One could imagine governmental and public institutions benefitting from such services. Arduino could for instance sell circuit boards to educational institutions and provide a year contract of service in regards to upgrading the circuit boards, having workshops, teaching and so forth. Just as with OSS, there is a fine line between using open design and making everything freely available. When charging for certain elements open design companies must keep in mind how the community will react to restrictions of accessing material freely.
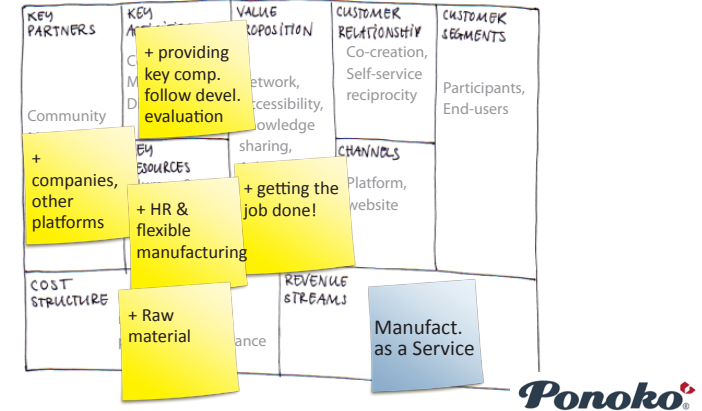
9. Manufacturing as a Service

Many companies wish to focus on their core competence such as research and development without having to worry about the actual production. Open source development enabling customized products in thousands of versions makes it almost impossible for a manufacturer to react to all requests. These niche requests which may be related to Anderson's (2004) Long Tail concept, can therefore allow multiple manufactures to reap benefit from the platform, providing manufacturing-as-a-service or selling default components for others to assemble. Ponoko* is an example of a company that is leading a *personal factory movement* by producing almost anything for their community participants and delivering at their home address. We believe that this type of revenue stream will be of great importance for boosting the economy, servicing customers in local areas with flexible production, using local materials and labour.
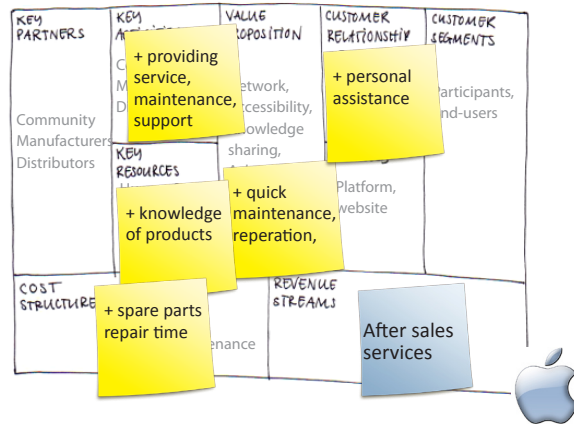
10. After Sales Services

Just as with manufacturing-as-a-service, after sales services may not necessarily be a company's core focus, and therefore an opportunity for others to capitalise on such services. Allowing 'licensed' or 'approved' after sales service companies to manage maintenance and support, might be of great value, especially for a highly dispersed audience in the need of local support. Creating such alliances may support customer feedback and identification of product failures that should be adopted and improved by the mother company. Apple is a company renowned for excellent after sales services, providing customers with a new, refurbished product or free repair.
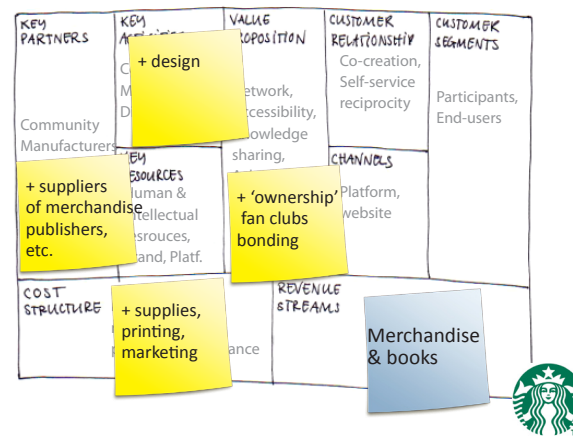
11. Merchandise & Books

Merchandise can range from T-shirts and coffee mugs, to books, giftcards and everything between. Companies such as Arduino already have dozens of books written about their products, both by the original founders as well as other enthusiasts and hobbyists. An excellent example is the ecosystem that Starbucks has created around their coffee concept.

12. Spin-offs

For some established companies, adopting open design, may not fit well with their traditional approach and reputation. They may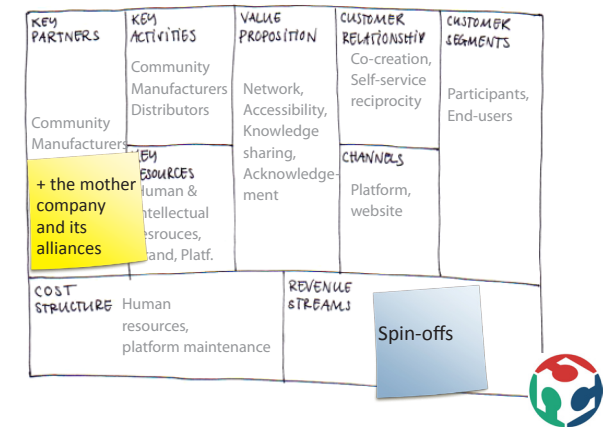 therefore choose to create a spin-off, or a sub-brand, in order to explore their possibilities within the domain of open source. Others may wish to create spin-offs of successful open source companies, such as Fab Lab, in order to boost local development and spread the open source phenomenon.

"I think we will [in the future] also have more manufacturers involved, for the ideas that Coloplast is not capable of producing, realising. Then we can say, just go ahead and make it. Today our members are very dependend on Coloplast to take the idea further and in the future we have talked about that some ideas that we can not follow up on, so why should we stop them. We shouldn't do that, we should actually guide them to others manufacturers in order to get the products produced. That would be a win win situation."

(Coloplast, 2012, Appendix IV).

Now all 12 possibilities of generating revenue have been presented. A company is not obliged to choose only one source of revenue stream, actually multiple combinations can go hand in hand, resulting in a hybrid model with several revenue streams.

Adapting to Open Design

Tackling new approaches in business and development requires preparation and foresight. In this chapter we wish to lay out a step-by-step process for companies to follow when considering and exploring the possibilities of open design. The process we call *The 6-Step Guide*. The guide has two objectives; namely to understand the current business environment which the company operates in (the *As-Is* phase), and how to take proactive actions in order to grow, prosper and transform the market (the *To-Be* phase). The As-Is phase is based on three tools: The business model canvas, The Business Landscape Mapping and SWOT. These were chosen to prepare the transition from conventional business model to the open design one. The To-Be phase builds up on the As-Is analysis by involving the results of the previous phase into To-Be scenarios of the *Open Design Process,* mapping open design resources and actions needed to realise a successful outcome. The second To-Be tool, the BMC, frames the business suggestions for open design allowing businesses to evaluate the different directions in which their business might evolve. Emphasis laid on the third tool of Revenue Streams Possibilities should inspire iterations of new business approaches/models for future scenarios.

Workshop

The 6-Step Guide can be used as a workshop process which can be performed in a one-day session but can also be divided into a one As-Is-day and another To-Be-day. If companies have limited time, consultants could prepare a mapping of an As-Is situation and present for evaluation in order to dive straight into the To-Be process. To make these processes flow efficiently and to stimulate brainstorming, it is suggested that each part of the model is shortly explained and then commented on by using post-its to write down thoughts and ideas.

An overview of the process is illustrated in Figure 19.

The 6-Step Guide to Open Design
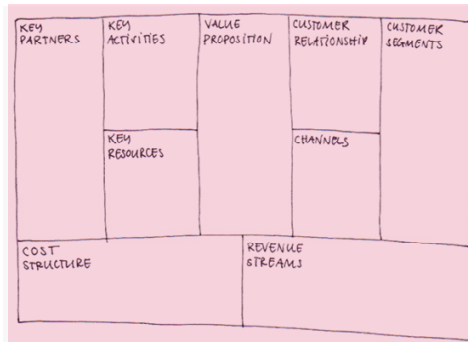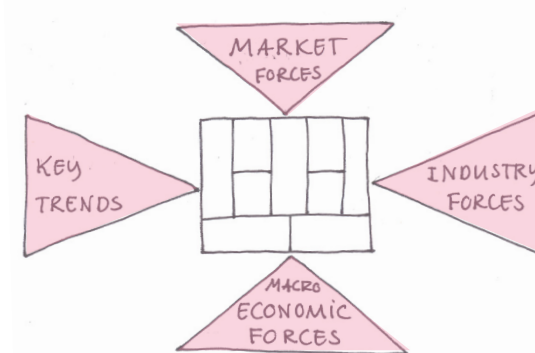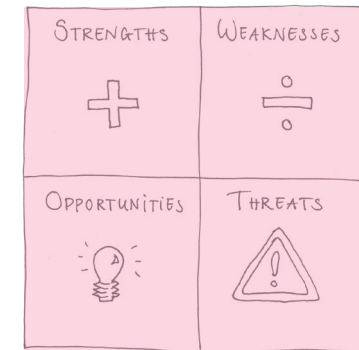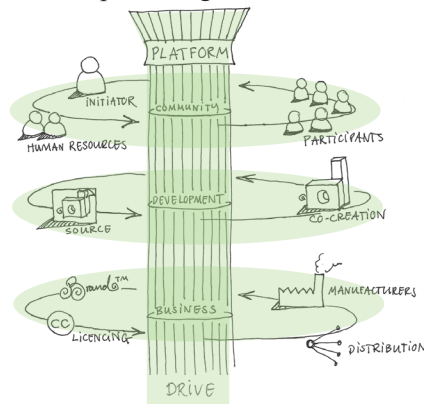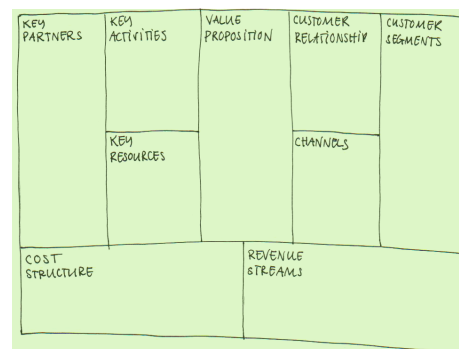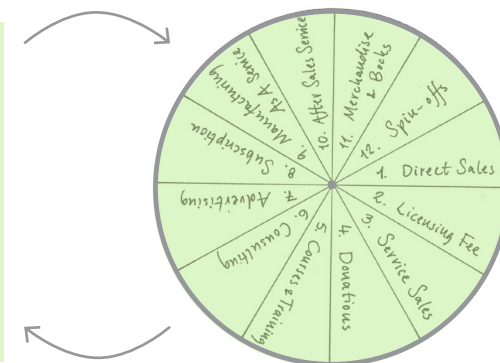
Figure 19: The 6-Step Guide to Open Design

As-Is Tool #1: The Business Model Canvas

The Business Model Canvas is used to map the business model in its *current* situation. In the case of a start-up company the canvas is used to map general business models in the environment that the company wishes to enter. Each of the 9 blocks of the canvas will provide an important overview and structure of the company's current business activities.

These are factors that the company can have an influence on and shape according to their preferences. However there are other elements that the company can not influence in any way. It is importnat to identify these and take into account when forming a business strategy. This is were Tool #2 comes in.
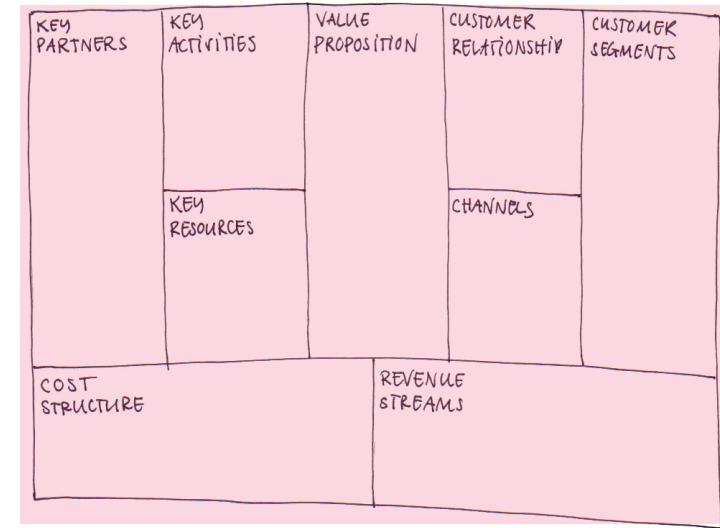
Figure 20: Tool #1: Business Model Canvas in its current state

As-Is Tool #2: Business Landscape Mapping

The Business Landscape Mapping is used to analyse the external environment of the company using four key drivers; market trends, industry factors, key trends and macro-economic forces, see Figure 21.

This should allow companies to be aware and prepared for any shifts on the market which might affect their business.
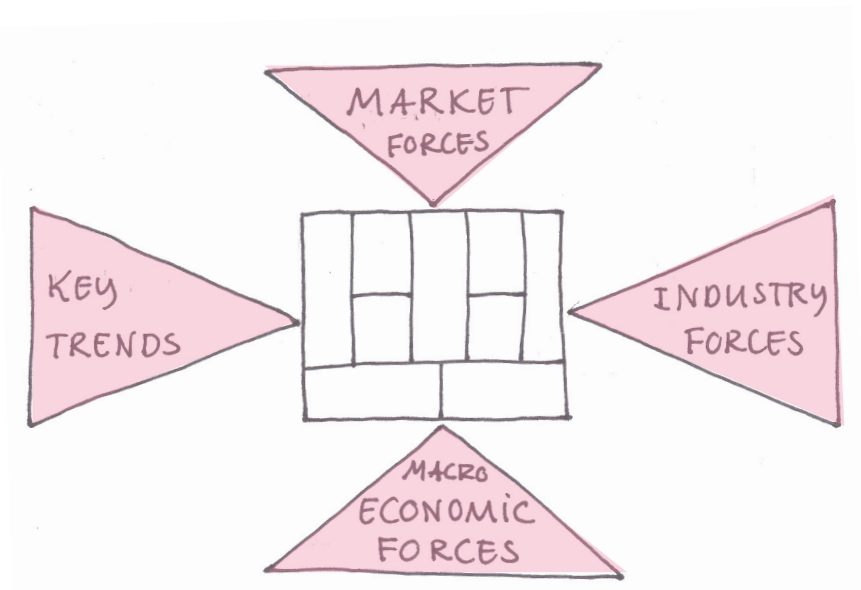
Figure 21: Tool #2: Business Landscape Mapping

Market Forces

- Market issues
- Market segments
- Market needs & demands
- Switching cost
- Revenue attractiveness

Market Forces

When looking at the market there are five main factors needed to consider. These are market issues, market segments, needs and demands, switching costs, and revenue attractiveness. These factors are important to determine what shifts are underway, where the market is heading and to understand the different customer segments within the market.

Industry Forces

- Competitiors
- New entrants
- Substitutes
- Suppliers, value chain actors
- Stakeholders

Industry Forces
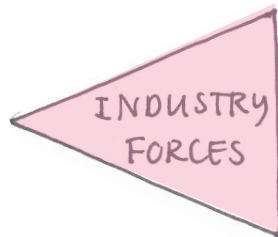
When identifying the industry forces the main factors are competitors, new entrants, substitute products and services, suppliers and other value chain actors, and stakeholders. It is important to understand the competitors and how they compare to the organisation, identify newcomers and whether they are a threat and make sure that stakeholders which can influence the organisation are specified.
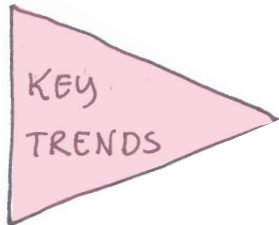
Key Trends

- Technology trends
- Regulatory trends
- Societal and cultural trends
- Socioeconomic trends

Key Trends

Key trends can have a drastic effect on the business model. Changes in consumer taste, new technologies or even global crisis such as recession or natural disasters can dramatically change the market. When looking at key trends there are four areas needed to consider; technology trends, regulatory trends, societal and cultural trends, and socioeconomic trends.

Macro Economic Forces

- Global market conditions
- Capital markets
- Commodities and other resources
- Economic infrastructure

Macro Economic Forces

Global market conditions, capital markets, commodities and other resources, and economic infrastructure are of most importance here. Making an overall estimation of global market conditions, determining current capital market conditions, prices and price trends for resources, and the economic infrastructure of the organization's market will provide solid foundation for further business model design.

As-Is Tool #3: SWOT

SWOT analysis is a simple framework for generating strategic alternatives. SWOT stands for Strengths, Weaknesses, Opportunities, and Threats. This framework was formulated in the late 1960s and focuses on issues that have potentially most impact on an organisation (Jones and George, 2003). The SWOT analysis classifies the internal aspects of the company as strengths and weaknesses and the external situational factors as opportunities or threats, see Figure 22. By understanding these four aspects an organisation can better leverage its strengths, correct its weaknesses, capitalize on opportunities and deter potentially devastating threats. The SWOT is seen as a summary from the two previous tools, providing a simple framework to position the findings made so far.

The first step is the internal analysis, which is an evaluation of the internal environment's potential strengths and weaknesses. This might include factors such as company culture, key staff, operational efficiency, market share and brand awareness. The next step is the external analysis which takes into account the opportunities and strengths. This may include customers, competitors, suppliers, social changes, technology changes and so forth.
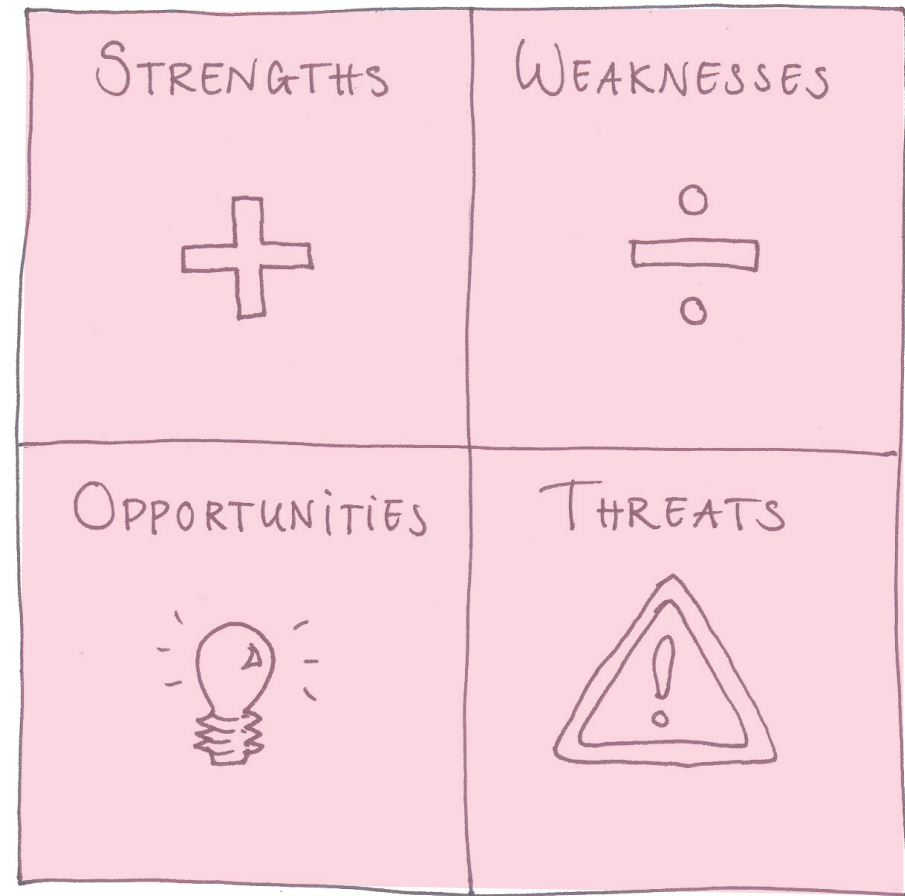
Figure 22: SWOT

Side note: It should be noted that the order of the As-Is tools is not sacred. We suggest the above mentioned sequence as we believe that it gives the best flow of discussion (workshop testing w/Arduino). It will be up to the executors of the process to decide on this.

To-Be Tool #A: The Open Design Process

The model is used to identify how the findings from the previous phase can be incorporated into an open design approach, see Figure 23. Here the company is challenged to consider how the open design community will be composed, how the development of the product will be conducted and what kind of business model they are willing to implement. The details of these elements may be built on the results from the As-Is Tool #3: SWOT where opportunities may have included identification of new customer segments for the community (types of participants) and weaknesses indicated need for partnership or outsourcing for product manufacturing.

A well rounded understanding of the current business situation (As-Is) should now be obtained and time to look towards the To-Be phase through the lenses of open design. There may be several ways of going from the one stage to another. What we suggest is using the results of the As-Is Tool #3: SWOT, which summarises the company's current situation, to incorporate strengths and opportunities in the To-Be phase.
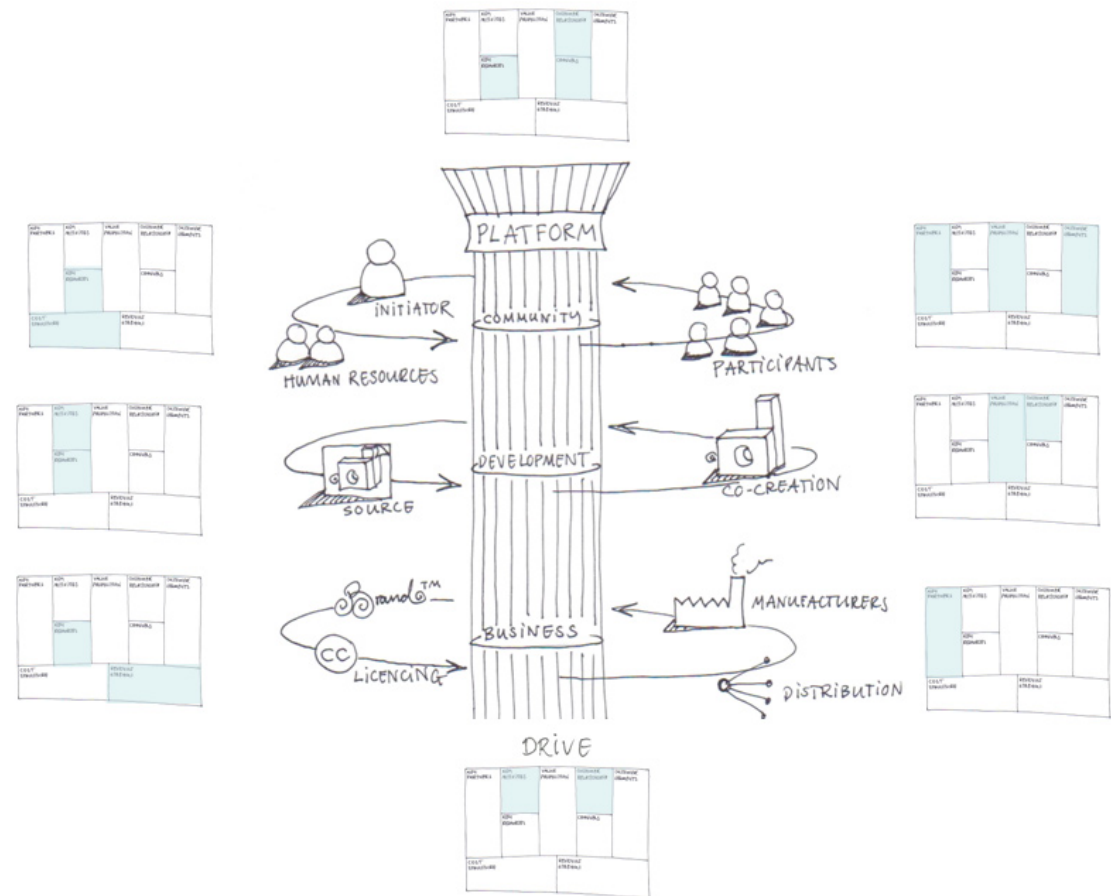
Figure 23: The Open Design Process

To-Be Tool #B: Business Model Canvas

Having spun around the centre of the open design process and touched upon important elements, the canvas is filled out in a more systematic way resulting in a structured business model (see more on p. 51).
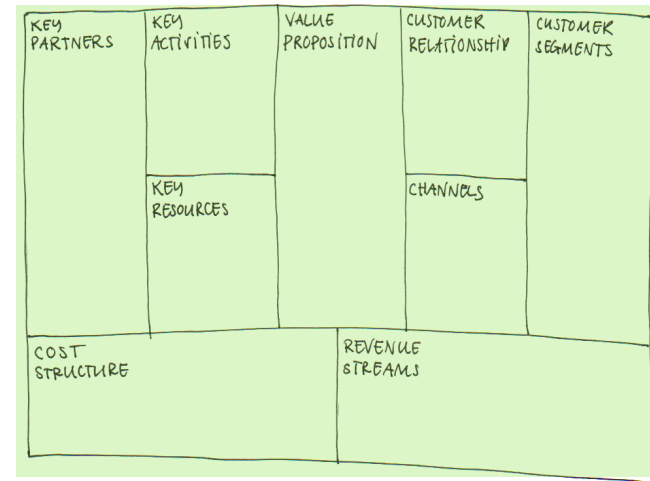
Figure 24: Tool #B: The Business Model Canvas in its future state

To-Be Tool #C: The 12 Revenue Streams

Now the business model canvas has been filled it is time to look at potential revenue streams by using The Wheel of 12 Revenue Streams. This is an iterative process where each revenue streams is tested and how it affects the business model.

Figure 25: The four building areas of a SWOT analysis

Workshop process

	As-Is			To-Be		
	Tool #1	**Tool #2**	**Tool #3**	**Tool #A**	**Tool #B**	**Tool #C**
	BMC	Landscape Mapping	SWOT	Open Design Process	BMC	Revenue Streams
	Internal	External	Summary	Relating to Open Design	Open Design Business Model	Iteration
What is it?	Mapping the business model in its current situation	Analysing the external environment	Summary of external and internal environment	Key elements of open design and their relation to the business model canvas	To-Be open design business model canvas	12 revenue streams to test with the new business model
Why use it?	Identify factors that the company can influence	Be aware of and prepare for any shifts in the market	Summarise the As-Is phase and to generate ideas	Identify how the current business model can be incorporated into an open design approach	Systematically draw together a new business model derived from the open design process	Determine what revenue streams are most applicable, depending on company's objective

Open Design Strategy

Figure 27: An overview of the workshop process

Crucial questions when considering open design

What is our objective with using open design?

Community
What type of product/service are we offering?
What type of users do we want to attract?
And how will we attract them?
What does the product/services offer that is
appealing to these users?
Are we, as managers/founders/company, appealing
to users? Do we comply with the open design
principles?

Platform
How much time and effort are we willing to spend on
managing and maintaining the platform?

Development
How much decision power do we want to have over
product development?
What source will we give out?
How will we create an effective co-creation
mechanism?

Business
Where will we be placed in the value chain?
Are there any specific revenue streams we must use?
Or cannot use?

Drive
What is the company's vision?
Can we get the community/users on board with this
vision?
How will we maintain this drive?
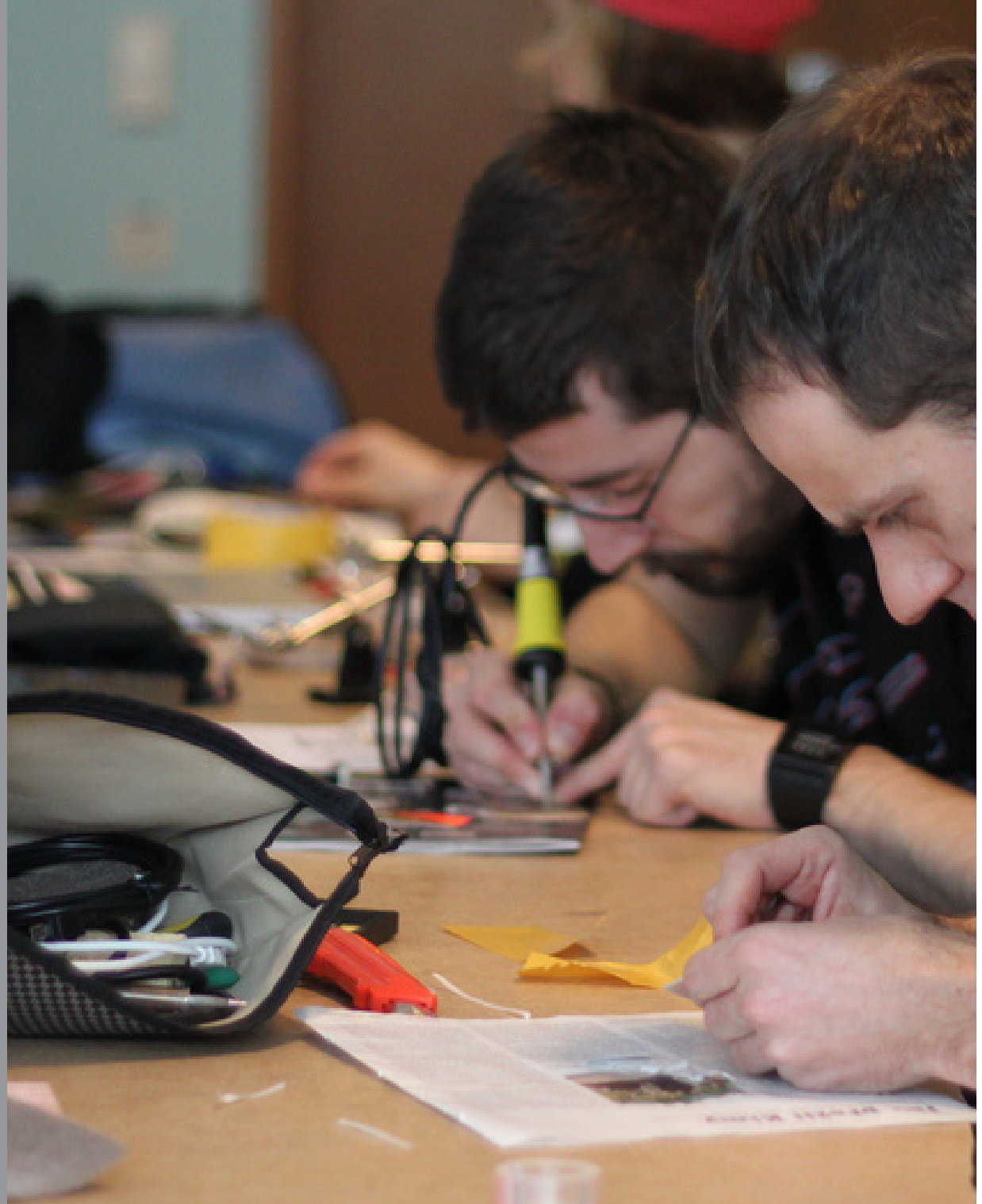
Testing the 6-Step Guide with Arduino

The aim with this section is to describe how the 6-Step Guide works in practice. The analysis will look into Arduino in its present state; "*an open design company with around half a million people somehow doing something with the Arduino board, whether they realise that they are using this platform or not*" (Torrone, 2011a). The company has been in business for seven years and is now looking for new ways to generate revenue and improve its business model. We will go through the 6-Step Guide with this objective in mind.

For Arduino to grasp our definition of open design the demarcation of open source development is presented. This allows for a general understanding of what we define as open design and how the product fits accordingly (see Figure 27).

As-Is Tool #1: The Business Model Canvas
The first step is to map Arduino's business model in its current situation with the help of the business model canvas (see Figure 28).

Arduino's main revenue stream is in the form of licensing while their biggest cost is human resources, in particular with operations related to product development (Arduino, 2012, Appendix II). Arduino outsources programming activities that they do not have the capacity for which allows them to be very agile and flexible in terms of where they want product development to take place and at what price. Their key partners are the community, manufacturers and distributors. They provide the community with the customer relationship they require, which is based on support and effective communication.

Figure 27: Arduino is a hybrid of Open Design and OSS
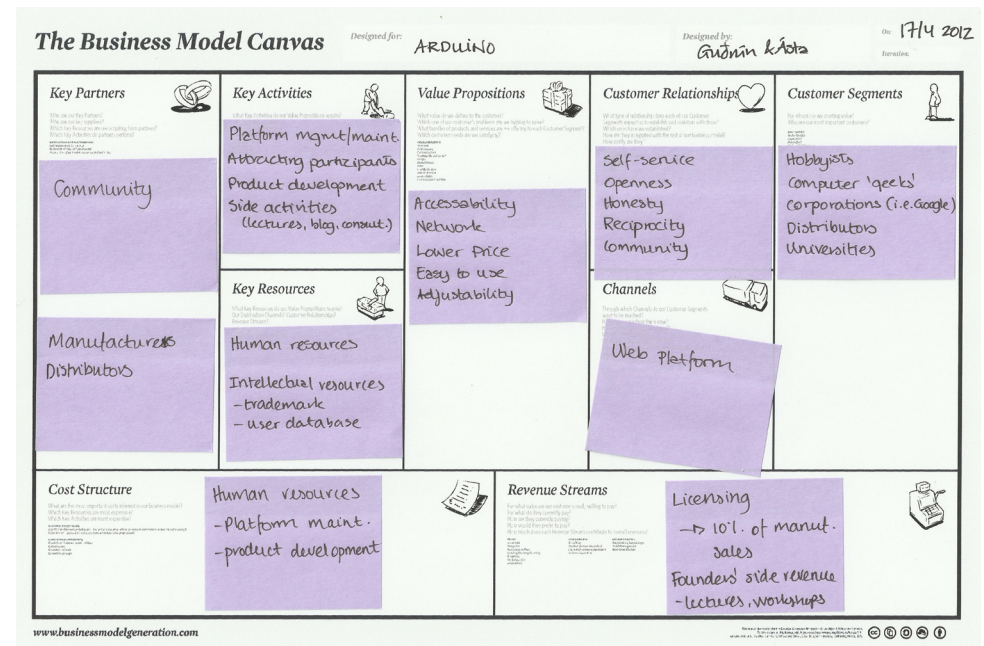
Figure 28: As-Is Tool #1: the business model canvas for Arduino in its current state

As-Is Tool #2: Business Landscape Mapping
For Arduino the key factors influencing the microcontroller market are the increased demand for cheaper and simpler electronics and the increased interest of DIY. The highlights of the Business Landscape Mapping can be seen in Figure 30. Let us look at the four elements in more detail.

Market forces
Other companies are starting to realize that it is worthwhile to have a more price pragmatic strategy (Torrone, 2011b). Some of the bigger players in the microcontroller market such as Intel, BlueEarth, and the like, can be expected to subsidize hardware to beat the $30 price tag of the Arduino board, but that should not matter if the support and quality that Arduino provides remains the same (Torrone, 2011b). Smaller competitors such as Netduino are starting to offer products that are more flexible and can pose a threat to Arduino. This signifies an increased competition since David mentions that in the beginning and for five years onward they had no competitors (Arduino, 2012, Appendix II). Arduino is still the number one company to serve a niche market segment of students, artists, hobbyists and so forth, with a simple and inexpensive product supported by a strong platform (Torrone, 2011a)

Industry forces
Finding manufacturers that provide large batches of microcontrollers is relatively easy leaving supplier power relatively low. Buyers have a high switching cost due to the various programming languages on microcontrollers but they have many products to choose from. Substitute products are not so common. Most competitors still have a different emphasis than Arduino, i.e. complex products not meant for niche market segments.

Key trends
The key trends affecting the market are the greater use of electronics, instrumentation and the lowering cost of electronics. Regulatory trends affecting the market are positive with open source becoming more and more accepted in the business world (Fitzgerald, 2006). Electronics are becoming more general commodities, with more accessible platforms (Android, AppStore, etc.) for others to adopt and contribute to. This indicates an on-going rise in non-professional participation. This can also be seen in the rise of the DIY movement.

Macroeconomic forces
Labour cost is rising in Asia yet the demand for lower price continues (Kopinski, 2011). Regulations on manufacturing processes are tightening. Economic infrastructure is specific to the region in which a company operates. Venture capital and credit is not easily available and capital markets are tight (Osterwalder and Pigneur, 2010).

Figure 29: David Cuartielles welding

Need and demand from students, hobbyists, artists, amateurs, etc.
Low margins due to cheaper manufacturing processes
High switching cost f. customers

MARKET FORCES

Lower cost of electronics
Instrumentation of things
Success of Open Source
Electronics a general commodity
More accessible platforms
Rise of DIY movement

KEY TRENDS

INDUSTRY FORCES

Increased competition
Low supplier power
Mass vs. niche markets
Custom-made products
Instrumentation of things

MACRO ECONOMIC FORCES

Global recession
Slower growth rates
Little venture capital available
Manufacturing cost declining
Labor cost rising
Lower price demand

Figure 30: As-Is Tool #2: External factors influencing the landscape of the microcontroller market

As-Is Tool #3: SWOT

Arduino's core competence is knowledge creation. When they founded the company they had little or no experience of running a business and lacked marketing and sales knowledge. They also had low capital and did not want to invest in risky manufacturing facilities or as David puts it: *"Running a factory is completely different to creating knowledge. If we were running a factory we would have to think differently than we do now. Now we are not dependent on any manufacturing facility in the world"* (Arduino, 2012, Appendix II). It was therefore their decision to concentrate on their core competence and outsource the rest. The team did not realise how the business would turn out, or as David mentions; *"In the beginning we never thought we would build so much around the product"* (Arduino, 2012, Appendix II).

Arduino has gathered immense strengths in the years it has been operating. It has created a strong platform consisting of a large network (100,000+ users) that continuously adds to the knowledge creation of both the community and the Arduino team. Arduino has a very clean and professional image which contributes to their brand recognition and customer loyalty. They have thrived to stay away from venture capital and loan taking, leaving them with less financial commitments but at the same time reduced financial capacity. The opportunities are many, in particular in terms of consulting. At the same time there are a number of threats they must look into, i.e. competitors and similar offerings. However, Arduino stands strong in terms of protecting themselves from competitors, gaining from first mover advantage, being the first to utilise open source in microcontroller development. For competitors to create something similar to what Arduino has to offer they must support their product and accessories immensely and write a great deal of code, provide software for multiple systems, have available lots of libraries and tutorials, and finally offer drivers that work effectively, are low cost and open source (Torrone, 2011b).
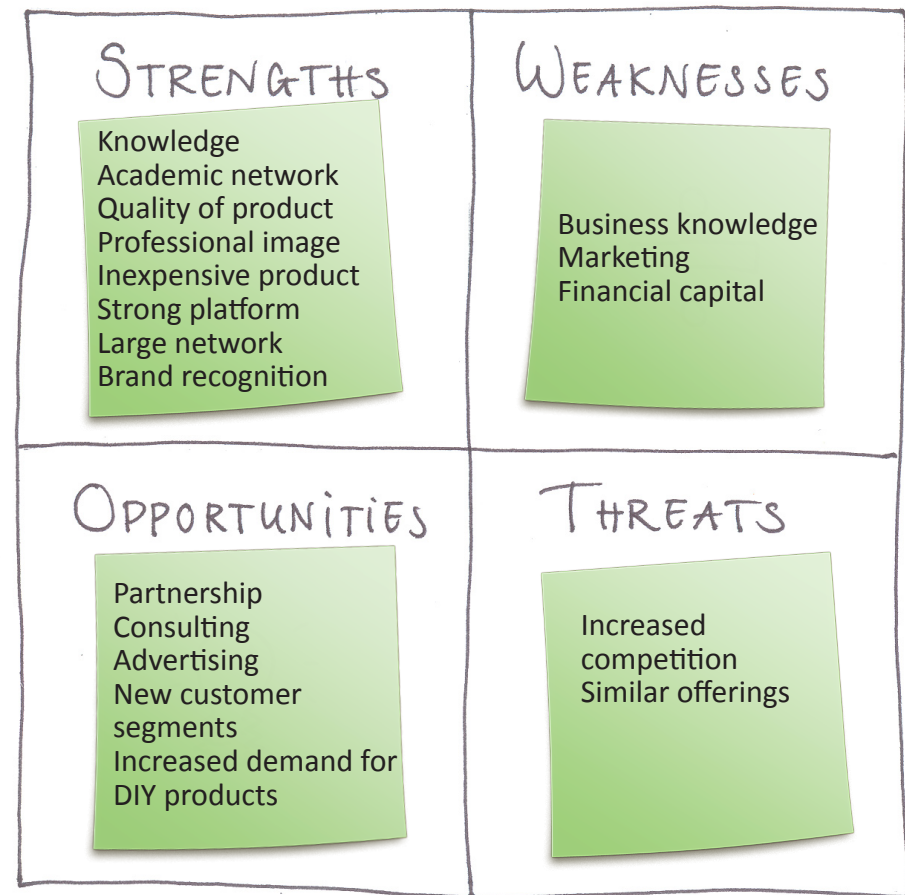
Figure 31: As-Is Tool #3: Arduino's SWOT profile

As-Is Scenario for Arduino

As-Is Tool #1:
Business Model Canvas

As-Is Tool #2:
Landscape Mapping

As-Is Tool #3:
SWOT
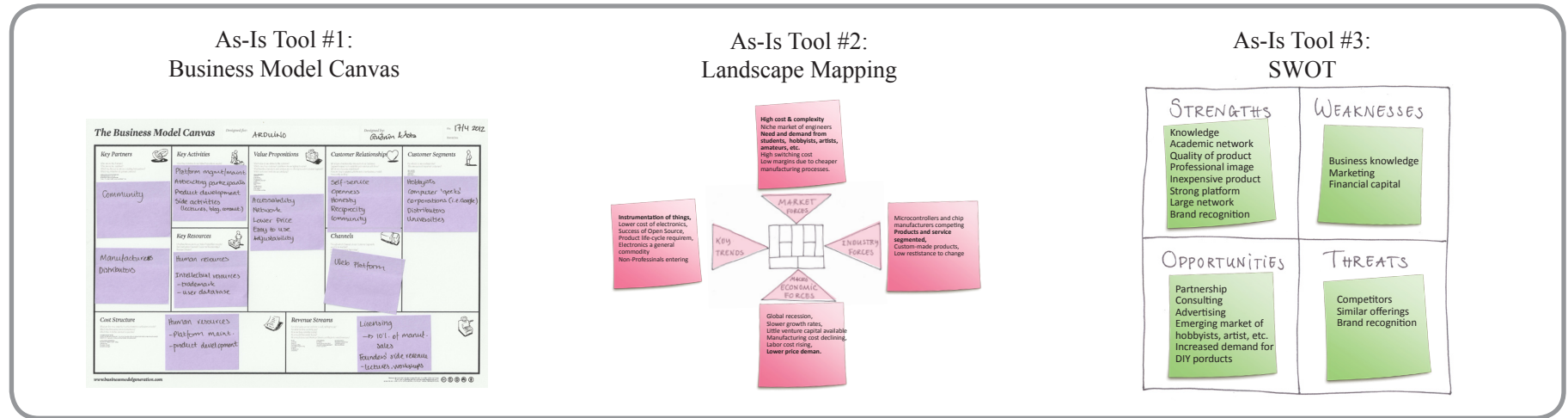
Figure 32: The first steps of the 6-Step Guide

A conclusion can be drawn that Arduino stands strong with its current business model but it seems like slowly, but surely, competitors are increasingly becoming more aware of what consumers are asking for, which is simplicity and cheaper products. This means that Arduino cannot rely too much on its current business model but they need to think a few steps ahead, since competition is increasing.

Arduino has become a pillar in the open design community and is one of the best examples of open design companies today. It has been operating for seven years and each step of the way it has been true to the open design principles, and while doing so gathered extensive experience in the field. The opportunity to approach and work with one of Arduino's founders; David Cuartielles, provided us with excellent insight and understanding of Arduino's business strategies and operations – and the founders' valuable view on open design, how it works and its future potentials. David also provided us with feedback on our analysis and suggestions which, given his expertise in the field, was highly valuable for us as researchers. We believe that validating our findings with non open design companies would not have provided us with the same clarification and assurance of our work and its relevance for future research and testing. Undoubtedly, the next step will be to try out our consultancy framework with companies currently not using open design.

To-Be Tool #A: The Open Design Process

The Open Design Process consists of five key elements; the platform, community, development, business and drive, which Arduino can clearly relate to, being an open design company already.

For Arduino, the *platform* was created on their website www.arduino.cc. For this platform to work, and for participants to be able to use it, it has to be easy to access tutorials, forums, view discussions and comment. From the start Arduino has made sure that there is a team of administrators that organise the discussion rooms by topic and relevance. There is also a ranking system in place that gives participants recognition for their contribution by automatically giving them status symbols based on the number of inputs they have given. In addition, David mentioned that participants also require a strong support system, so that if there is a problem with their board or its functionality, their situation will be handled by the Arduino team in a fast and reliable manner (Arduino, 2012, Appendix II).

Through the *community*, Arduino quickly realised how much interest there was from customer segments that valued simple and inexpensive electronics. The participants were not only people with specific knowledge within electronics but also hobbyists that were experimenting with the device without prior knowledge of how to work with electronics and program software code. In relation to human resources, the biggest cost goes into product development personnel. As the company began to expand more programmers were needed. The Arduino team decided to outsource programming projects so that the company would continue to consist of a core team of six people, leaving it agile and flexible. Platform maintenance cost is then insignificant to the cost of product development.

The *development* of the product is characterised by co-creation, accessibility to knowledge and sharing of source. The Arduino team placed their first prototype on the platform and quickly were amazed by the input and comments they received from the community. With this in mind, management of the platform and product development becomes crucial. According to David, there are two types of requests when it comes to open design. One he calls "push" which is when a completely new product is made at the initiative of Arduino. This is a product that has to be designed and programmed from scratch and for this purpose they or hired programmers take care of the design and development of the prototype. Once that is completed, the product is ready to be demonstrated to the community, which then has something to build upon, a 'reference point'. On the other hand, a product that is known by the community but needs some alteration or is to be adjusted to a new platform, is a good example of a product that can be designed by a community. This is called a "pull" request. An example of this could be a controller that has been used for years but now has to be integrated to a new platform. For this purpose Arduino can use the community to test the product and use countless iterations to improve it so that the best solution can be reached.

The *business* element has to do with revenue streams, branding mechanisms and trademarks, and how this interacts with other key actors in the supply chain. Arduino decided early on to trademark their logo and license their product to manufacturers. This still remains their main source of revenue.

The *drive* that makes the engine run is the perception that participants have of the company. The company has a very clean image (Arduino, 2012, Appendix II), they do not have any advertisements on their platform, they are not dependent on venture capital, they do not have a profit goal in mind – and the participants are aware that any profit generated goes back into the company so that its operations can be enhanced and improved, creating powerful solutions in the favour of all. The owners are not abstracting any significant profit of the participants' input to their personal income, and that on its own motivates people to contribute.

"We are an open source project, we support our own website, and everybody understands that basically all the money we are making is reinvested in them [the users]".

(Arduino, 2012, Appendix II)

To-Be Tool #B: Business Model Canvas

Seeing that Arduino is an already established open design company their business model is currently made for open design and therefore not many changes we would make on the nine building blocks before going into new revenue streams. If this were a company currently not using open design, its business model would be changed according to the findings from the previous tools.

Self-service through Arduino platform www.arduino.cc

Founders, dedicated participants, temp. hirees.

Community of participants; hobbyists, specialists, students, etc.

Reference point, sharing knowledge, source information, learning from users

Development and co-creation of Arduino boards, software and related gadets.

Arduino brand, Licensing agreem. Revenue streams, 10% of manufact. sales

3 manufacturers world wide, local and global distributors.

DIY, make it cheaper, simpler, accessible for anyone to try!
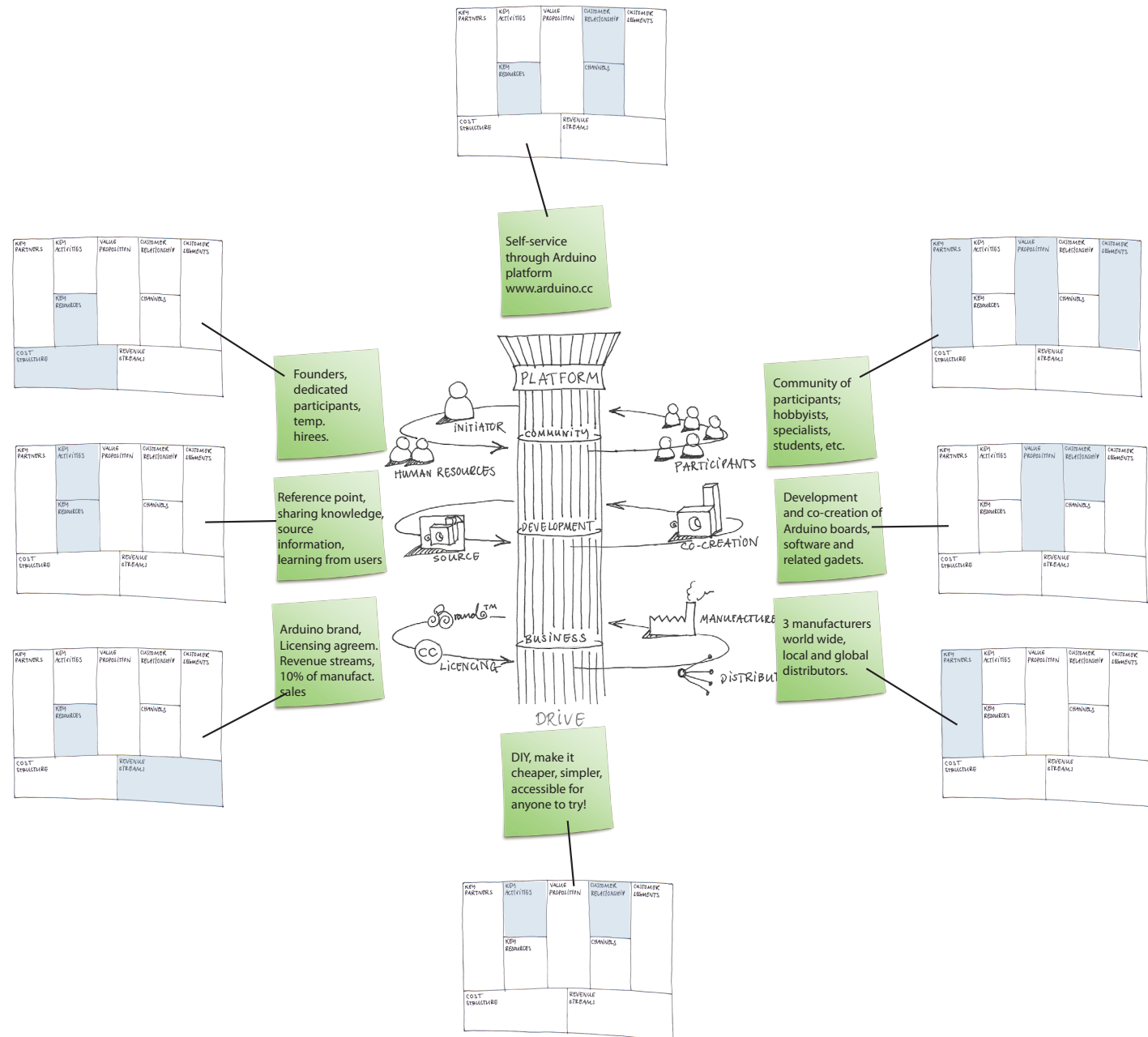
Figure 33: To-Be Situation for Arduino, demonstrated with To-Be Tool #A and connected to the BMC

After going through the 12 revenue streams (see Appendix XV) three were considered most appealing for further discussion. The criteria for choosing these three is based on the overall effect they will have on the operations of the company, whether they fit with the culture of the company and the image which the company wishes to maintain (i.e. 'clean' image). The three revenue streams are the following:

- Direct Sales
- Consultancy
- Manufacturing as a Service
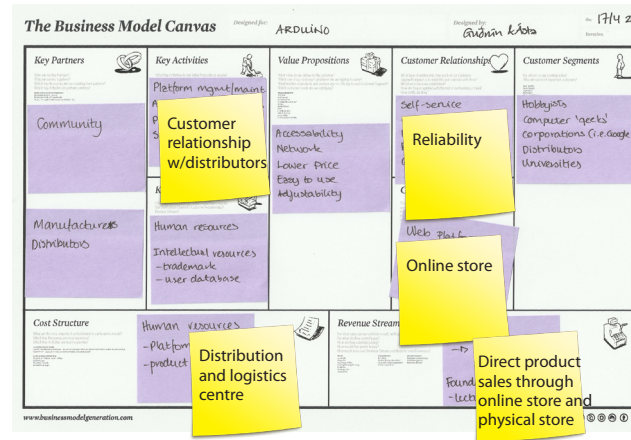
Direct Sales

This could be in the form of an online store and/or a physical store. Here we will explore both options. By having an online store Arduino would dramatically change their revenue stream. Arduino would then sell the units to distributors, as opposed to distributors going to manufacturers, as the situation is today. This would give Arduino greater control of distribution, and allow them to customize offerings better. This might also increase and improve customer relationship with distributors and could encourage more bulk purchase. This would on the other hand require Arduino to establish a distribution and logistics centre which would complicate their operations a great deal and increase the company's overall expenses. In regards to a physical store, which would be seen as a concept store, and mainly established to create a buzz and serve as a part of Arduino's marketing strategy.
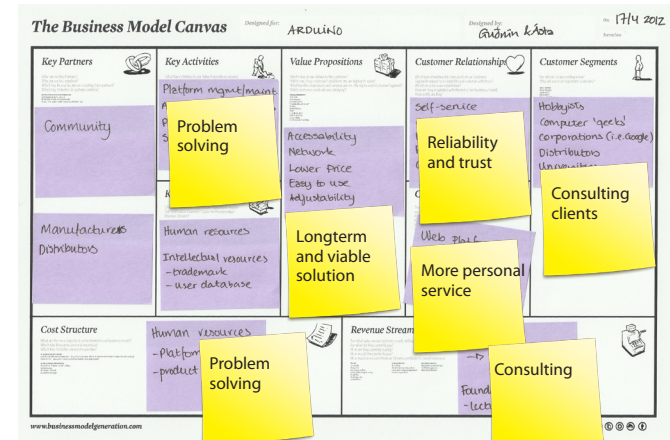
Consulting

Going into more consultancy based projects would still allow Arduino to remain true to their core competence of knowledge creation. They would need to hire more programmers to take care of programming tasks since the Arduino team would be occupied with attracting clients and working on consulting. In order to allow Arduino to grow as a consulting firm they would have to acquire and train specialists within the field.

The Business Model Canvas (for Arduino), showing key partners, key activities, value propositions, customer relationships, customer segments, cost structure, and revenue streams with annotated notes: Providing key components, Follow developm. & evolution, Accessible Components, Get the job done!, Customisation, Raw materials, Manufacturing as a service, Companies, individuals, & platforms.

Manufacturing as a Service

Providing manufacturing as a service is what many companies are currently doing and basing their business on the Arduino board. An example of this is for instance Adafruit and Makie Makie*. If Arduino was to go into manufacturing as a service it would require drastic changes in their business model. An online store would have to be set up where customers could easily browse through and customize their products. Arduino would then have to have dedicated manufactures able to provide customized products, and Arduino would have to hire people for assembling, packaging and sending of the products.

Being inspired by Anderson's Long Tail business approach (2004) Arduino might benefit from their current market segments by selling a large number of niche items in small quantities, as opposed to larger competitors which provide a few selected 'hit' products in bulks.

It must be noted that after we had done our analysis of Arduino we were pleased to see that Arduino had actually put up an online store on their website. However, the online store is outsourced to an independent company which pays Arduino 10% of each sale that is made, irrelevant whether it is an Arduino based product, or accessories and complementary products from other brands. When asked, David mentions that they are considering buying the store in the next few years.

David was particularly interested in the consultancy revenue stream and manufacturing as a service. He mentioned that they have actually been looking into it and were trying to establish a framework for it to work. He added that due to the strength of their platform and community this could have a considerable impact on their revenue. In regards to consulting he liked the idea of creating a package for educational purpose and providing this service to the government or to private institutions. This would be a huge task and something they might consider at a later point in time.

Going through the 6-Step Guide with an established company has shown us that the method can provide a good framework for mapping the situation and the environment in which the company resides. Using Arduino has provided an important first step in testing this method and a foundation for further testing. For Arduino, it gave them a clear guide and a step-by-step process towards new business model generation which they found helpful in dealing with complex issues and decisions.

* http://makie.me/

Conclusions

We have examined the emerging practice of open design and analysed the topic by using various models and theories, mostly derived from OSS. The ultimate objective was to determine how companies can adapt to open design so that it allows them to sustain a profitable and viable business.

Conducting carefully chosen case studies on successful open design companies we were able to demonstrate that the open source approach, despite going against all conventional methods of ´hiding and protecting´, has proven to enable companies to be profitable. The four cases chosen are both non-profit and for-profit, with each business being able to sustain itself. Furthermore, by analysing these cases the main characteristics of open design were identified in the Open Design Process, namely *platform*, *community*, *development*, *business* and *drive*. These characteristics were then further elaborated on.

The analysis of the cases furthermore led us to the identification of an Archetypal Business Model. The cases proved that despite different product offerings, core similarities remain when using open design. This includes, among other, a vibrant community, a functioning platform, value propositions offering knowledge sharing, cost reduction and acknowledgement, and important customer segments consisting of both end-users and participants. However, the cases differed in terms of revenue streams, ranging from licensing and product sales to consulting and donations. From a business perspective it was of high importance to identify various revenue streams which companies could use to improve their bottom line. This allowed for a particular focus and more in-depth approach to the issue. This led us to identify 12 revenue streams which should be used in an iterative process, to determine the effects of each one on the business model, and what is most applicable for the relevant company in question. With these findings in hand we were intrigued to determine whether the process of

adapting to open design could be systemized and if so, how that could be done. These considerations led us to develop the 6 Step Guide, which visually demonstrates how companies can move from an As-Is state to a To-Be state, i.e. how they can adapt their current practices to open design practices. By testing the guide on one of our chosen cases, the usability of the guide became clear, with our suggestions of new revenue streams and changes in business model being highly relevant and on point for capturing value and contributing to a viable business prospect.

Based on our findings we conclude that the 6 Step Guide provides companies with a step-by-step process when adapting to open design. Furthermore, having identified the key characteristics of open design and an archetypal business model, provides the backbone and benchmark for establishing and sustaining a profitable and viable open design business.

Furthermore, we suggest that open design may allow for niche markets to bloom, supporting Anderson's (2004) Long Tail market philosophy. It enables manufacturers and distributors to reap benefits in terms of customized products or local production and support. There is a need for much more variety and versions of products than one could think of. Keeping source codes, drawings and information open allows for increased innovation and new discoveries in untouched markets. The merging of roles and gathering of knowledge allows for network effects to bloom which further supports various forms of businesses, such as manufacturing, service sales, and so forth.

Outlook and Afterword

Open design is in its early stages and there are many issues that need further research and testing. Aspects related to the physicality of tangible products vs. intangible software keeps the complexity level of the supply chain higher. Additionally, the question of which types of products are more suitable for open design than others is yet to be answered. Whether established companies with known brands are capable of adapting open design practices is also a matter of concern, but seems to be a viable option such with giants such as IBM having been successful with OSS, and IDEO with open design platform.

Some claim that another decade of discussion is needed before open design will be able to make a considerable difference within the development of tangible products. Interestingly, the same arguments being used against the phenomenon now are the very same arguments that were once used against the introduction of democracy. The ruling elite will always feel threatened by the idea of giving power to the people.

(van Abel, 2010, p. 125)

It will certainly be interesting to see how the practices of open design will develop and the business arena around it. This research touches upon some of the fundamental questions in relation to open design and is just the beginning of a much bigger and broader research which will have to be performed within the real marketplace by established companies and start-ups. There are already numerous cases to follow but some time is needed for them to fully proof themselves, as was the case with pioneering OSS companies a few decades ago. Whether open design will revolutionize the entire development scenery cannot be determined yet but we believe that developers cannot ignore its impact and possibilities for transforming businesses as we know them today.

Limitations

Looking back on the process of writing this report some limitations have been considered which might have affected the final outcome.
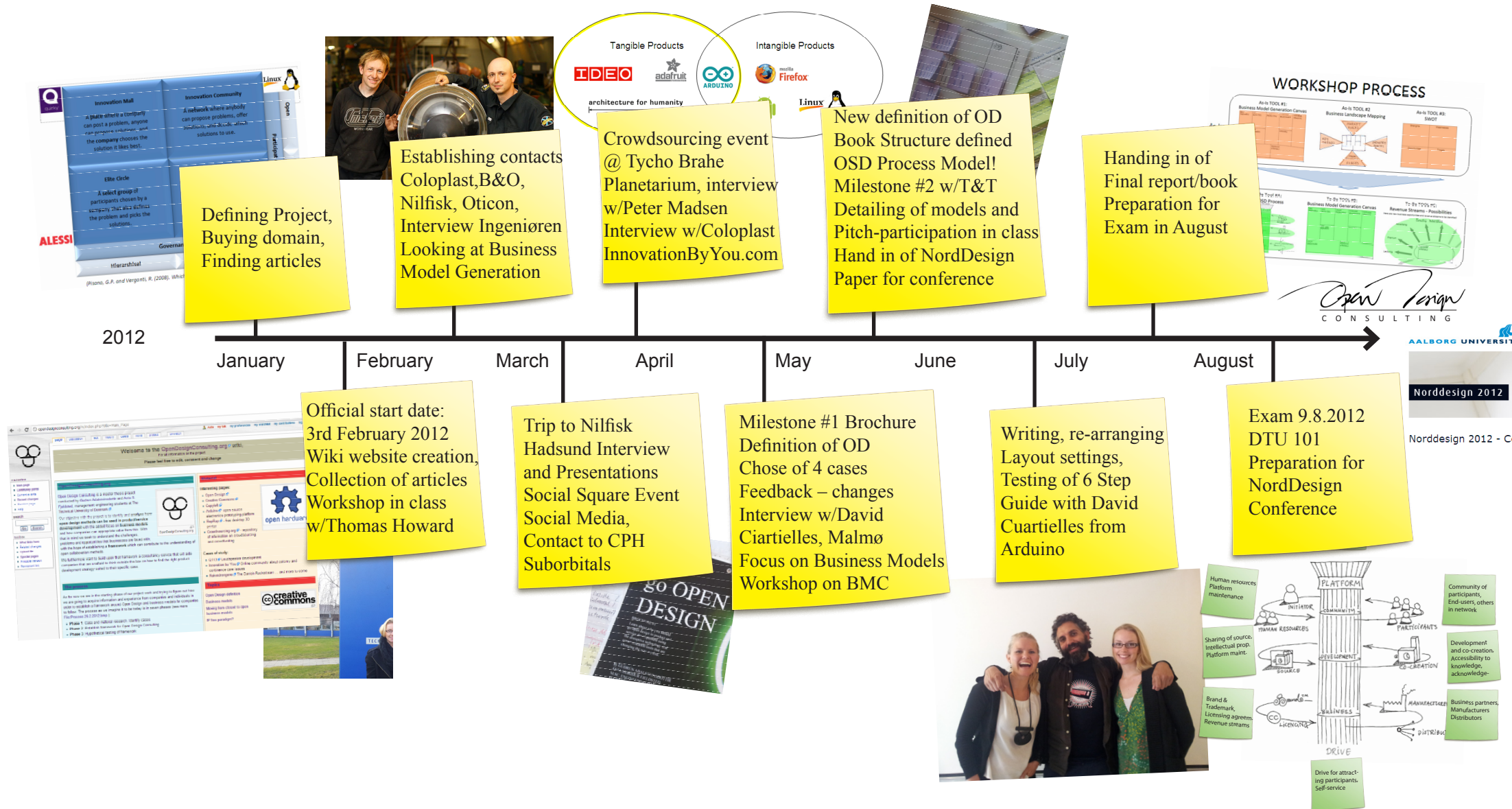
Our objectives with the report were broad and we tried to cover an extensive amount of topics related to open design. With hindsight we might have benefitted from having a more focused approach for research and consultations. Because of this we acknowledge that the outcome of the project is by no means a comprehensive synthesis of the issue of open design, but more importantly an introduction thereof, paving the way and establishing a foundation for further research.

The topic of open design is a nascent one with limited reading material and a scarcity of theories. The possibility of having a highly theoretical approach and basing our work on other research was drastically reduced because of this. This required us to use a proactive qualitative approach, i.e. conducting interviews with companies and individuals and relating the topic to OSS, the forerunner of open design. Also this required an experimental and critical way of thinking when generating and testing our models and concepts. Additionally, it would have been highly beneficial to involve traditional companies, i.e. those currently not using open design, to test the open design method suggested.

We have suggested a 6-Step Guide for companies that wish to use open design in their product development. This does not cover the implementation of open design or predict the effects of implementation. These are issues in need of further research. Furthermore, an interesting revenue stream could have been explored more in-depth, namely the value of user data. By using communities that share knowledge and communicate extensively, user groups can be identified and their preferences and behaviour mapped. However, this might go against the open design principles and in worst case lead to anti-trust issues which could deter users from participating.

Process

The process of this analysis has been broad and lively, spanning across diverse suggestions of models (Appendix XII) and strategies which have evolved over time through relevant feedback and testing. The project time was five months and was therefore an intense process of research, learning and production! Meetings with potential testing companies such as Nilfisk and Coloplast (Appendix IV & V) were arranged as well as crucial Milestones Meetings with supervisors (Appendix VIII & IX). A blog proposal was made to Ingeniøren (Appendix XIV) but due to limited time of the research they did not find it relevant. Getting the chance to participate in NordDesign conference in Aalborg in August 2012 required us to hand in an article in May (Appendix X) which reflects our findings during that point in our research phase.

Defining Project, Buying domain, Finding articles

Establishing contacts Coloplast,B&O, Nilfisk, Oticon, Interview Ingeniøren Looking at Business Model Generation

Crowdsourcing event @ Tycho Brahe Planetarium, interview w/Peter Madsen Interview w/Coloplast InnovationByYou.com

New definition of OD Book Structure defined OSD Process Model! Milestone #2 w/T&T Detailing of models and Pitch-participation in class Hand in of NordDesign Paper for conference

Handing in of Final report/book Preparation for Exam in August

2012

January February March April May June July August

Official start date: 3rd February 2012 Wiki website creation, Collection of articles Workshop in class w/Thomas Howard

Trip to Nilfisk Hadsund Interview and Presentations Social Square Event Social Media, Contact to CPH Suborbitals

Milestone #1 Brochure Definition of OD Chose of 4 cases Feedback – changes Interview w/David Ciartielles, Malmø Focus on Business Models Workshop on BMC

Writing, re-arranging Layout settings, Testing of 6 Step Guide with David Cuartielles from Arduino

Exam 9.8.2012 DTU 101 Preparation for NordDesign Conference

Norddesign 2012 - Co

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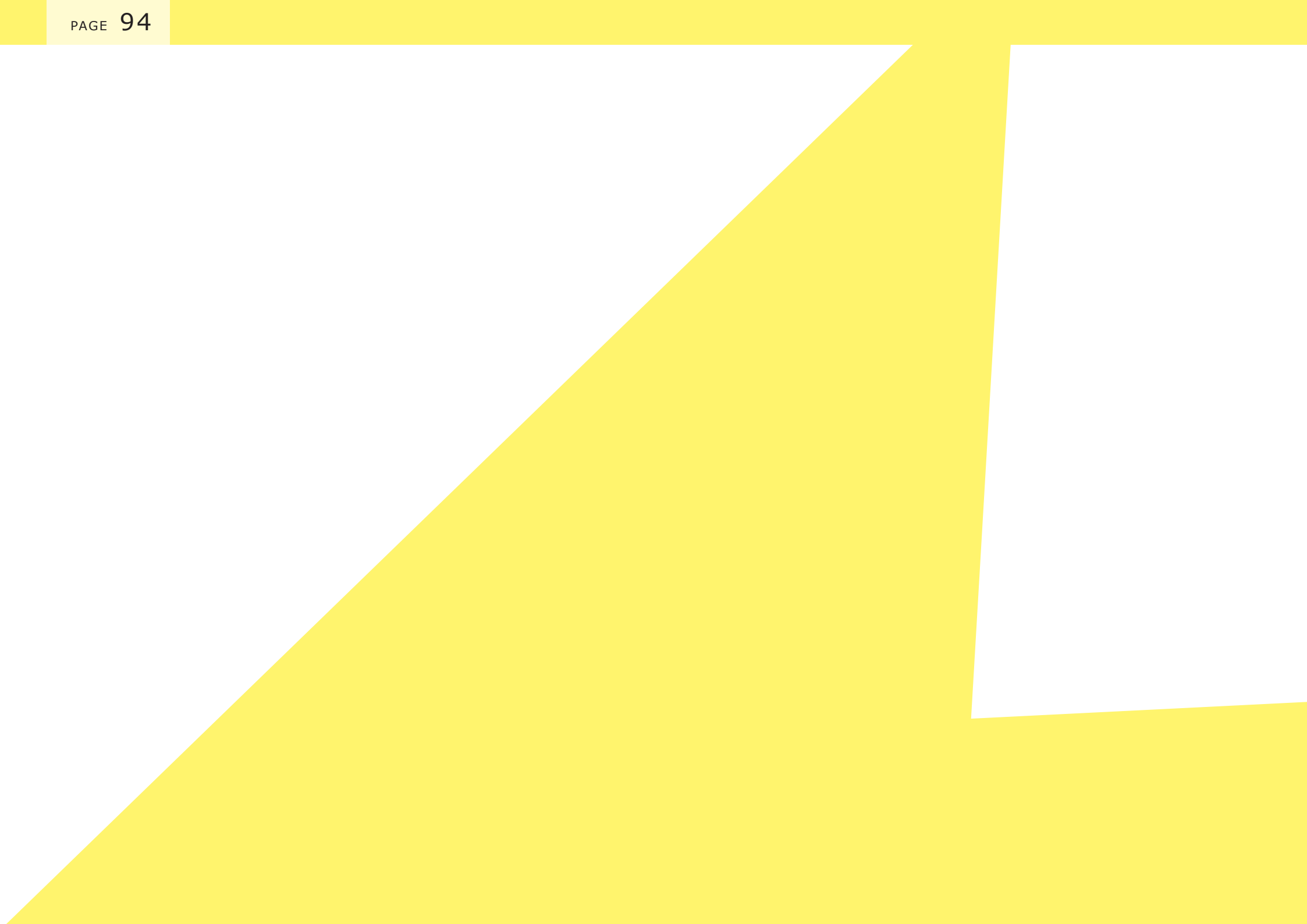
About the authors

Guðrún and Ásta first met in 2010 on the welcoming day for students beginning their 2-year master degree in Management Engineering at DTU. Immediately they noticed that they had some things in common... blonde hair and Icelandic roots... but also ambition and eagerness to make the most out of this experience. It was based on this foundation and the great chemistry between them that they decided to team up and write this master project together.

The process of writing the report has been exciting in many ways but also demanding and time consuming. All in all it has been an enjoyable process - so much that it is with some sadness to save the last version and send off to print. However, the authors are looking forward to embark on a yet another exciting journey and now outside the safe walls of DTU. Undoubtedly, the experience and knowledge gathered throughout the master degree and the making of this project will come of great use for their future endeavours.
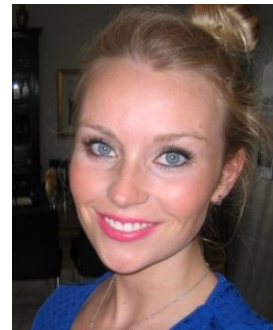
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