

CHALMERS



THE NEXT GENERATION POWER STRIPS

ENTREPRENEURIALY DRIVEN PRODUCT DEVELOPMENT
FOR COMMERCIALIZATION OF AN IDEA

MASTER OF SCIENCE THESIS

STEFAN ERIKSSON
NIKLAS LIDBERG

Department of Product and Production Development
Division of Product Development
CHALMERS UNIVERSITY OF TECHNOLOGY
Göteborg, Sweden, 2011

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STEFAN ERIKSSON
NIKLAS LIDBERG

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© NIKLAS LIDBERG

Department of Product and Production Development
Chalmers University of Technology
SE-412 96 Göteborg
Sweden
Telephone + 46 (0)31-772 1000

Examiner and supervisor: Lars Almfelt

Cover: Hinting the next generation power strip (Eriksson & Lidberg, 2011).

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ABSTRACT

It started off with Niklas Lidberg (author) having an idea of making the everyday life of anyone living in the vicinity of electronic devices less tangled than today. It later grew into this thesis, with the collaboration of Stefan G Eriksson (author). The aim was to have experts take a look at its potential and later founding a business on the very same idea. The entrepreneurially driven product development project is titled “The Next Generation Power Strips” and the work is launched as a master thesis at the Department of Product and Production Development at Chalmers University of Technology in the spring semester of 2011.

In order to clarify and define the core issues regarding existing power strips a range of methods are used with the aim of highlighting what the customer really wants, needs and expects from such a product. From the research, key factors such as price, size and environmental concern emerged. Along with the technical requirements, it lays the basis for the product development process.

The Product Development process generated a horde of solutions, in which one innovative solution surfaced. The search for similar existing products on the market turned up negative and the pursuit of assistance from an incubator, Chalmers Innovation, along with funding of a primary investigation for filing a patent, through Almi, was initiated. The authors have been granted 15,000 SEK by Almi in order to proceed with a primary investigation.

The investigation and selection of materials and manufacturing process resulted in the decision of a mixture of ABS/PC plastics using injection molding.

The business strategy intended to embark upon was first explored and then decided upon. The business direction leaned towards intellectual property and to capitalize on licensing.

Lastly, environmental impact and other environmental aspects is incorporated and evaluated on the basis of the prototype resulting from the Product Development process. Conclusions drawn from the analysis suggest that the intended use of the prototype will result in a more beneficial environmental situation than that from the products on the market today.

Power strip, Product Development, Entrepreneurship, Innovation, Production, Intellectual Property, Incubator, Chalmers Innovation, Almi.

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1. INTRODUCTION

A power strip is a device used for distributing electricity from a wall outlet or similar to different appliances. Its main function is to extend the number of available outlets in a certain area of for instance a building.

This master thesis is based on an idea for a technical innovation of Niklas Lidberg, student at the Product Development masters program at Chalmers. To get the aspects of production and logistics, Stefan G Eriksson, student at the Production masters program at Chalmers, is co-worker and partner. The intention is to lay a foundation for a future business based on the innovation.

Due to the nature of this thesis, being a stepping stone towards starting a business, the reader is advised that important information has been masked in order for the authors to proceed in filing for a patent.

1.1 BACKGROUND

The use of plugs and power outlets in general, and power strips in particular, are often experienced with some degree of frustration. Most often the power strips and extension cords form a maze behind furniture or in other places where they are possible to hide. The reason for this behavior is based on the fact that one most often has to put two or more power strips in series in order to get the right number of outlets available. The result is a lot of cords and power strips often lying on the floor gathering dust. This is the area of focus for this master thesis; to improve the power strips available today and try to make them more suitable for different situations.

1.2 DESCRIPTION OF THE NEED FOR A NEW PRODUCT

The innovation of the new type of power strip presented in this master thesis is also an attempt to try to solve the problem with different standards of plugs and sockets currently used around the world. The next sections are in general excerpts from a project written by Stefan G Eriksson, one of the authors of this master thesis. The entire paper can be found in Appendix A. The purpose of the paper was to investigate one of the larger future threats to this innovation.

1.2.1 PLUG & SOCKET TYPES

Historically, the development of the conductors used to transfer the energy from source to point of use was also, at the same time, development in the area of standards for the socket and plug, still used today, to connect the source to the point of use. Interestingly more or less every nation that took part in this development did so in its own way. Hence, today, there are currently 13 different types of plugs and outlets used in the world, see Figure 1. Recent efforts have strived to homogenize the different types of plugs used in different areas to reach a common standard but to make such a change is not done over night as every household and building connected to the power grid would need to physically exchange their outlets (World Standards, 2011; Electricaloutlet.org, 2011).

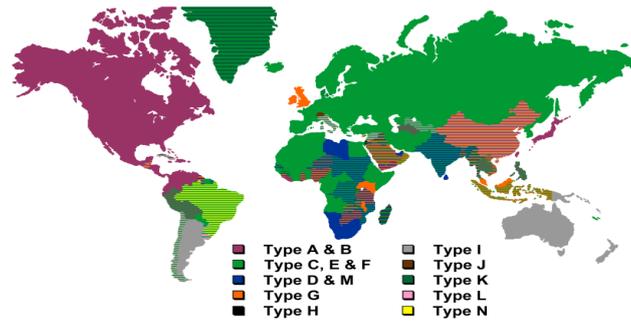


FIGURE 1. A MAP SHOWING THE DIFFERENT SOCKET AND PLUG TYPES OVER THE WORLD. (WORLD STANDARDS, 2011)

1.2.2 DIFFERENT POWER GRIDS

As if the plug and outlet diversity was not enough to complicate the situation, there is also a difference in the power used in different grids depending on in what part of the world one has in focus, see Figure 2. In Europe and the majority of the world 220 and 240 Volts are used whereas in the large portion of the Americas and the whole of Japan one encounters a voltage between 100 and 127 volts. Historically, Europe too, like the Americas and Japan, had 120 Volts but chose to increase the voltage due to factors of efficiency and loss reduction. The reason why the US did not follow the transformation was because of the immense cost that it would bring to the table as the average US house, at the time, had home appliances as fridges and washing-machines, which was not the case in Europe (World Standards, 2011).

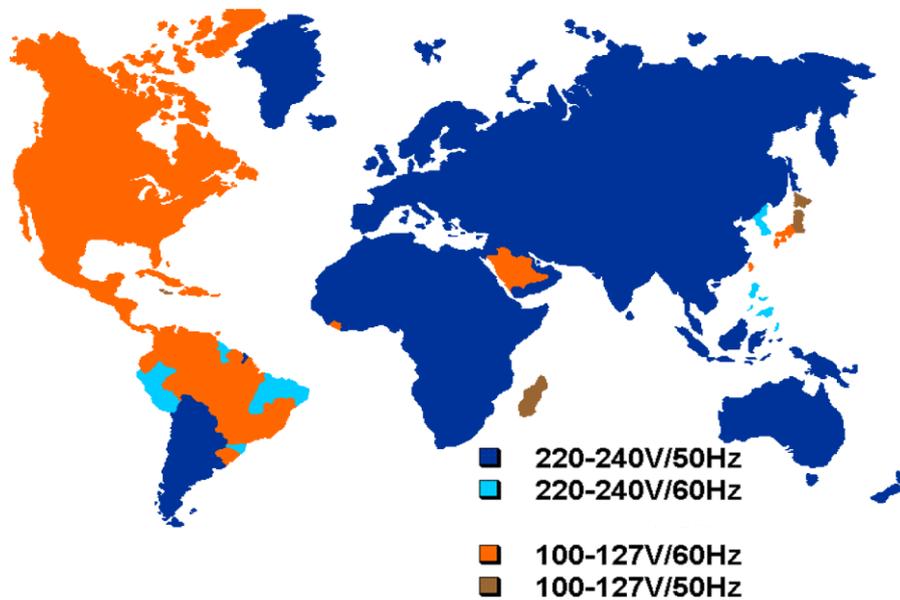


FIGURE 2. POWER GRID DIFFERENCES IN THE WORLD. (WORLD STANDARDS, 2011)

In this actual web of grids and plugs one might sense an urge of standardization to facilitate for both the constant users (population) and the temporary users (tourists). Moreover, one would think that there is an interest for companies in the electrical business sector to convert to a standard in order to more easily spread their products without having to take into account the different power grids and plugs.

1.3 PURPOSE & GOAL

The purpose of this master thesis is to, guided by a structured development process, evaluate if the innovation of the new power strip is a better solution than the ones already on the market. If that is the result, the authors intend to try to make business on the innovation. For this reason a lot of investigations in different areas have to be made, in order to base future decisions on facts.

The primary goal is to build a solid base to make a decision about whether or not to proceed with the work of establishing a business. Furthermore, the following activity goals are key:

- Produce a CAD model
- Produce a prototype
- Initiate the process of having a granted patent
- Map out ways of making business
- Instigate co-operation with business partner

1.4 APPROACH

The master thesis is carried out following a structured product development process. To verify the needs of the innovation, the project starts with a small market research, which in turn makes up the groundwork for the development work. The development process starts with a breakdown of the problem in distinct areas, and solutions of these problems are generated, i.e. sub-solutions. When all sub-solutions are identified the complete product concept is tested against existing solutions to verify the innovation. A pilot study of detail design using the CAD system CATIA V5 is done, to get an understanding of the possibilities and the restrictions of the design. Normally the detail design should not be a pilot study, but the time limit of the project is an apparent restriction. Parallel to the development of the product, work with future business strategy, IP, material selection and production, and so on has been performed, using established methods.

1.5 LIMITATIONS

The main limitation of this project was the time dedicated. This master thesis work is a 30 credit course for each student, i.e. in total 60 credits. A project like this specific master thesis tends to involve a diversity of different areas to be covered. It is not just the development of a new product and the different aspects of production and logistics that are of importance here, but also the market, regulations, IP, business planning, presenting to investors, applying for money at different establishments and so on. A list of activities of great significance for the thesis is found in Appendix K. The result is that in each of these areas, a limitation has been necessary to be able to finish in time. For example, one of the most important areas of a product development project, the market research, is limited to a questionnaire and a focus group session. More on, no calculations in the area of strength of materials or simulations on the final concept have been done. Lastly, the technical and legal requirements posed by Svenska Elektriska Kommissionen (SEK) in their publications have been used but cannot, due to legal concerns, be appended. Nevertheless, the publications are referenced and may thereby be looked up on an individual basis.

The list of limitations can be seen as extensive, but the authors have tried to prioritize to be able to present a report that covers the most relevant problem areas for new entrepreneurs trying to realize an idea for a global market.

1.6 OUTLINE OF THE REPORT

Chapter 1 aims to introduce the reader to the thesis by putting him or her in the context of the authors' frame of mind in the outset of the thesis. The reader is presented with the background of this thesis along with the purpose and goals in order to clarify the relevance of this thesis for the reader.

Chapter 2 focuses on the investigation and mapping of existing solutions on the market today. In addition, the customer and his or her needs are put forward in order to build a foundation of criteria to initiate the product development process.

In Chapter 3, the process used in this thesis for product development is laid out along with the results generated from the process of developing a product from the needs and requirements from Chapter 2. The final concept is presented in the final part of this chapter.

In Chapter 4 the selected materials, which are most commonly used, are put forward along with the selected manufacturing process.

Chapter 5 offers the reader an introduction to business strategy as well as putting him or her in the context of the complexity of the situation the authors face. It also lays out the option of initiating contact and collaboration with a business incubator, which is a fairly common pathway for business ventures in their infancy.

Chapter 6 introduces the reader to intellectual property and its role in the thesis. Furthermore are different types of intellectual property presented and evaluated.

Chapter 7, "Our way", is the title of this chapter and entails the way the authors intend to make business of the developed prototype. Additionally, one may state that "Our way" is a summarizing chapter where product development merges with entrepreneurship in order to take one step closer to business start-up.

In Chapter 8, the environmental aspects are considered. Moreover, a comparative study of an existing solution and the prototype is put forward for comparative purpose. Also, the concern of producer responsibility is brought up and discussed on the base of the prototype.

Chapter 9, "Outcome and outlook", presents the results along with a discussion of them. In addition, it puts forward conclusions drawn from the thesis and lays out future work that lay in the hands of the authors.

2. POWER STRIP PRODUCTS:

- A MARKET & CUSTOMER ASSESSMENT

A proper market research is a way to increase the probability of developing a product that the customers really want and asks for. In this master thesis however, the limited amount of time does not allow that to be done and moreover it must be considered as somewhat outside the main path of the education. Nevertheless it is important to get a hint of the customers' needs and what they wish for. Here, a customer needs screening has been done based on a simple survey, a focus group session, and an analysis of existing solutions. Hence, the customer has been identified as a private person ranging from 15 to 75 years of age independent of gender.

2.1 EXISTING POWER STRIP PRODUCTS

There are a variety of different products on the market for making it possible to expand the number of power outlets in a building, Figure 3. Power strips of different sizes, extension cords, and different types of adapters and plugs, makes it possible to connect your appliances wherever you want, Figure 4. Moreover these different arrangements are manufactured in a lot of different variants to cover all standards in the world. Below some of the most common solutions are presented, and these are also the ones in focus of competition for the product of this master thesis.

2.1.1 POWER STRIPS WITH DIFFERENT OUTLETS

Power strips come in different sizes and shapes, from 2 outlets up to 24 or even more. The basic function is the same between all of them – you can connect one or more a standard plugs into the different outlets. The power strips are sometimes equipped with a switch that controls the outlets. If the user wants to extend the power strip with more outlets he/she can do that by connecting another power strip or an extension cord.



FIGURE 3. EXAMPLES OF EXISTING POWER STRIP PRODUCTS.
SOURCE: GETTY IMAGES 2011

2.1.2 WALL MOUNTED POWER OUTLETS

Wall mounted power outlets can either be surfaced mounted or inset into the wall. The advantage with the surface mounted outlet is that it is easy to install and makes a minimum of damage to the wall. To extend the number of outlets, the user can connect one of the power strips mentioned above.

The outlet that is inset into the wall has the advantage of being more discreet in its appearance. In return a hole must be made in the wall to fit the outlet, and this demands more work than needed for a surface mounted one.



American power plug

European power plug

FIGURE 4. DIFFERENT POWER PLUGS AND OUTLETS. SOURCE: GETTY IMAGES 2011; ERIKSSON & LIDBERG 2011.

2.2 RESULTS FROM THE FOCUS GROUP

According to McQuarrie (2006) a focus group session involves about 8-12 people that meet for about two hours discussing the subject in focus, moderated by an interviewer. The interviewer will explain the procedure of the session and also describe the matter in focus. The focus group method is useful in the early exploratory stages when generation of new ideas for product development is wanted.

The focus group in this thesis project consisted of four persons of different professional and cultural background. Moreover, there was also a mix of gender. Initially the group was gathered and presented with the concept by verbal communication. After the short introduction to the topic they set out to brainstorm on ways to improve or change the products and solutions of today. Then, the first brainstorm was presented by each of the participants in order to give each other new ideas. The next stage entailed showing the participants images of existing products on the market and the ways they solve the problem of increasing the number of outlets. Another brainstorming session was embarked upon and new ideas surfaced. The work session ended by giving the participants the floor in order to be able to present their suggestions, this resulted in a creative discussion. The results from each of the four participants are to be found in Appendix I.

From the results in Appendix I, one may distinguish common points that were believed to be of greater significance. Following is a list of pros and cons common to all of the participants when giving their opinion of existing products on the market.

PROS OF EXISTING POWER STRIP SOLUTIONS

- + On/Off switch
- + Tailored to need (module)
- + USB

CONS OF EXISTING POWER STRIP SOLUTIONS

- Large
- Clumsy
- Gather dust
- Too deep socket
- Ugly plug
- Difficult to hide
- Hard to unplug/plug in
- Different standards
- No space for plugs and transformers

Focus in the results was on modularization and that environmental friendliness might be an important factor to consider when designing a new product in order to reach out to the people of today.

2.3 RESULTS FROM THE SURVEY

McQuarrie (2006) describes the survey research; “A survey takes place when a fixed set of questions is asked of a sample of customers.” The survey allows for a directed set of questions to a limited sample of participants, and this is of value when it is important to get specific information about some areas. A questionnaire is prepared and sent out to the participants, and the questions could be for example how satisfied they are with existing solutions on the market, or how a certain product is used. McQuarrie (2006) states that; “Perhaps the most significant weakness of descriptive survey research is that it tends to tell you *what* but not *why*.” He says that this could be compensated for by combining the survey research with more exploratory research like focus groups.

Here a questionnaire was sent out to people in the authors’ network in order to grasp opinions of what potential customers value and dislike when it comes to the solutions of today. The questionnaire was comprised of a number of questions ranging from questions of economic nature to more practical ones, such as the situation with cords to extending the number of outlets. See Appendix H for the responses from the questionnaire.

The survey confirmed, as far as it was possible at this stage, that the environmental aspect was one that was identified as important. In addition, most of the respondents were positive to the question of whether they would be prepared to purchase a product, which was more environmentally friendly than the products of today, if it was priced higher. Moreover, the survey pointed out that a smaller product would be to prefer. Also, as for the environmental aspect, the respondents would be prepared to purchase a smaller product for a higher price.

In conclusion, the customers value environmentally friendly products with an agreeable size and for this they are prepared to pay more. Furthermore, the customer is identified through “Canvas” as being both a private person as well as an electrician, see Appendix M.

2.3.1 IDENTIFYING THE CUSTOMER USING THE CANVAS TOOL

The text in this section is based on a publication by Osterwalder & Pigneur and some of the formulations are copied direct from this. To get full information about this process we refer to this publication, since only a small part of the process will be presented here. The reason to why this method was introduced into the thesis was as a tool for communication for Chalmers Innovation in order for them to more clearly identify the business potential, see Appendix M.

Canvas is a way to present a business model of an organization by creating nine blocks that shows how the company intends to make money. The nine blocks are;

1. Customer segments – the ones an organization intend to reach and serve
2. Value propositions – the product and services that creates value for a customer
3. Channels – the communication between a company and its customers
4. Customer relationships – the type of relationship a company establish with a customer
5. Revenue streams – the cash a company gets from each customer segment
6. Key resources – the most important assets needed to make a business model work
7. Key activities – the most important things a company have to do to make a business model work
8. Key partnerships – the network of suppliers that makes a business model work
9. Cost structure – all costs incurred to operate a business model

2.4 IDENTIFIED CUSTOMER NEEDS

Based on the customer needs collected, measurable specifications can be created. According to Ulrich and Eppinger (2008) this transformation is a way to realize the subjective needs and wants into a physical product. The first thing to do is to collect all wants and needs in a list, Appendix C. (A short version of the customer needs list can be seen below.)

Ulrich and Eppinger (2008) state that the needs must be translated into metrics to be able to measure them. When this is done the metrics are compiled in a metrics list, and it is now possible to identify the unit of the metric, see the importance of a specific metric and so on. Then we are numbering them according to their importance on a scale i.e. 1-5, and the collected information is divided into two different groups; requirements and wishes, Appendix D. The requirements are needs that have to be fulfilled, while wishes are not necessary to fulfill but the customer will be positive if they are

According to Lars Almefelt¹ metric values can be changed or replaced during the development process. There are several reasons for this, for example that the level of knowledge will increase during the work, and also some new regulations can be adopted.

To handle the information collected from the potential customers, the process described by Ulrich and Eppinger (2008) was used. Because electric appliances are involved in the development of this innovation, there is a set of regulations that has to be followed in order for the product to be allowed to be sold on the market. The international standard IEC 60884-1 contains general requirements for plugs and socket-outlets for households and similar purposes. This standard is a booklet with several hundreds of pages with information of technical requirements and testing procedures for plugs and outlets. To cover all of these requirements in this master thesis is not feasible, thus only a few examples are presented here, see Appendix B. Of course, all requirements in this standard are to be taken into account if the product in focus of this work is to be commercialized.

Short list of customer needs (The complete list can be found in Appendix C):

- I want no mess with the cords
- I want a discrete solution
- I want the same standard all over the world
- I want it to be reliable
- I want to extend the power strip with one socket at a time
- I want the product to have a long life expectancy

¹ Lars Almefelt Ph.D. – Supervisor & Examiner



3. PRODUCT DEVELOPMENT

In this chapter the workflow of this development project will be presented. Generally it can be argued that structured methods can support the development process by providing a way forward.

The product development process used is illustrated by Figure 5, where an iterative process of several steps is run through in order to obtain results. The same procedure is performed three times but only one of the processes is presented fully in the report as the other two are executed in the same manner. The remaining two procedures are found in Appendix E.

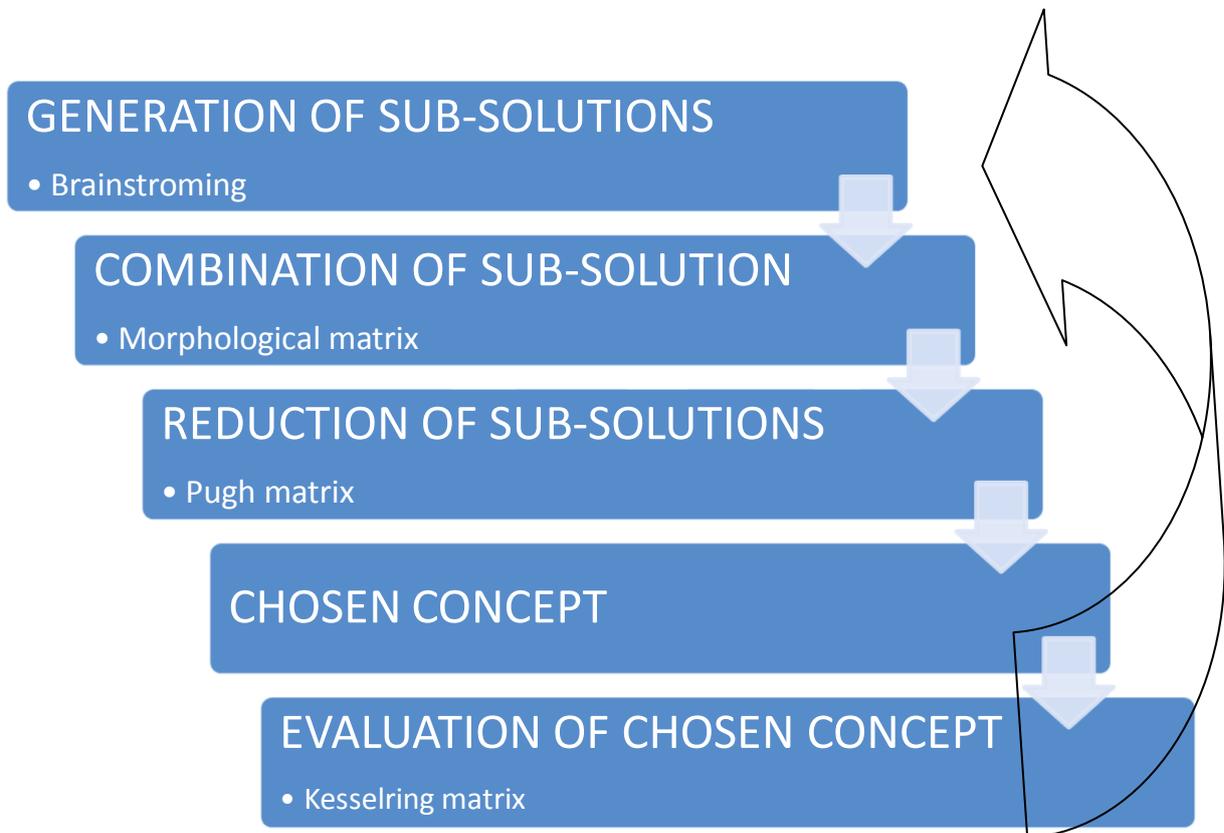


FIGURE 5. PROCESS FLOW CHART OVER THE PRODUCT DEVELOPMENT PROCESS UNDERTAKEN IN THIS THESIS.

3.1 RE-DEFINING THE PROBLEM – CLARIFYING SUB-FUNCTIONS

To be able to handle the development of a fairly complex technical product, the problem has to be broken down into smaller areas which in turn are investigated and worked through one by one. In this master thesis a Functions-Means-Tree, Figure 6, has been used to generate and present the different areas of the problem.

In the development of a technical product, the first thing to do according to Ulrich and Eppinger (2008) is to clarify the problem. This can be done in a number of ways. The chosen path is by using a Functions-Means-Tree, Figure 6.

In this, functional requirements (FR) and design parameters (DP) are presented in different levels. The FR shows the problem to be solved, while the DP shows a way to solve it. By structuring the problem in this hierarchical order, one gets a good overview of the complex product and what problems to solve. According to the model, concepts should first be generated on the higher level in the tree and then on the lower. In our case the solution of the first level is already decided, since we know that the power strip is the aim of this development project. On the second FR level however, several solutions for each part were generated. The functions-means-tree makes it easy to follow the work from the statement of the overall problem, through the breakdown into sub functions and the solutions of these, and finally what choices have been done in the process.

The main problem “Transfer incoming electricity to an arbitrary number of appliances” is first broken down into three different possible solutions, “Power strip”, “Additional outlet”, and “WiTricity”. The point of interest in the following process is the “Power strip”, while the two other possibilities are left out. The solution “Power strip” is then broken down into four sub-functions:

- Enclose parts
- Transfer electricity internally
- Transfer electricity externally
- Ensure safety

For each of these four sub-functions, a number of possible solutions were generated.

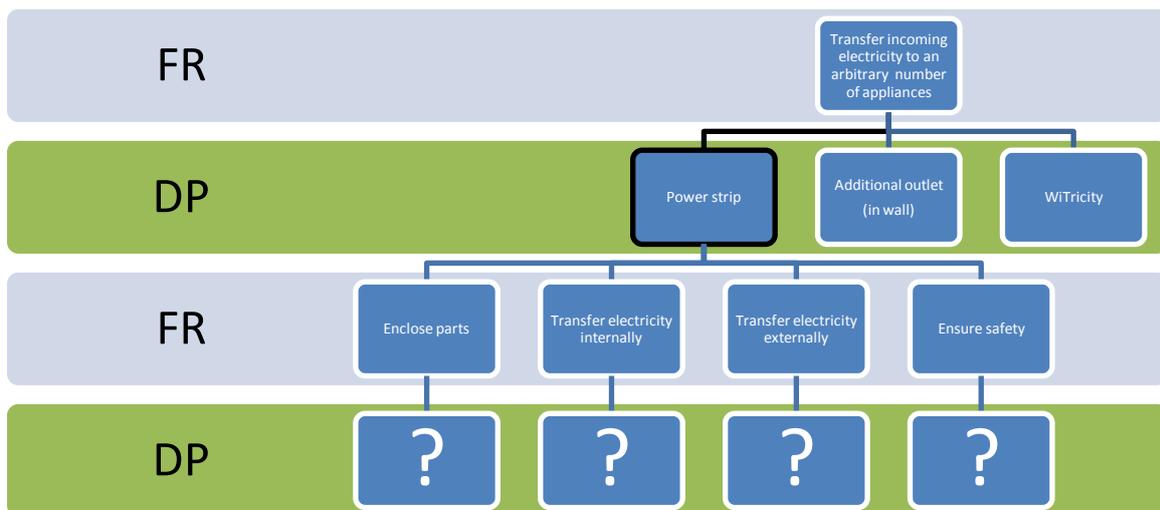


FIGURE 6. STRUCTURAL VISUALIZATION OF THE PROBLEM BEING BROKEN DOWN INTO SUB-PROBLEMS USING A FUNCTIONS-MEANS-TREE. SOURCE: SVENDSEN & MANSSEN 1993

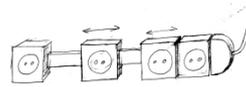
3.2 GENERATED SUB-SOLUTIONS

From The Function-Means-Tree several solutions to the different sub functions were generated by brainstorming, and by looking at existing solutions. The solutions for each category of sub-functions are presented below.

A. **Function:** Enclose parts

Sub-solutions:

1. Sockets are slide along the power strip



2. Torus socket with multiple outlets



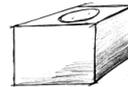
3. Ball socket



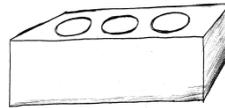
4. Cylindrical socket



5. Single socket



6. Rectangular socket



B. **Function:** Transfer electricity internally

Sub-solutions:

1. Cord, cable



2. Metal rail



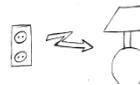
3. Liquid



4. Polymer rail



5. Cordless



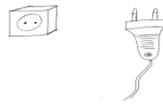
6. Super ceramic rail



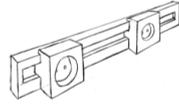
C. **Function:** Transfer electricity externally

Sub-solutions:

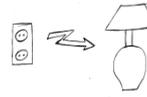
- 1. Plug and socket



- 2. Rail



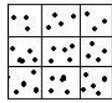
- 3. Cordless



- 4. Liquid



- 5. Solar cell



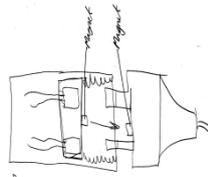
- 6. Super ceramic rail



D. **Function:** Ensure safety

Sub-solutions:

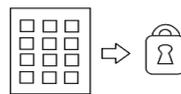
- 1. Magnetic child protection



- 2. Child protection



- 3. Code lock



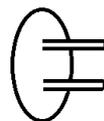
- 4. Lock



- 5. Spring lid



- 6. Plug



3.3 COMBINATION & REDUCTION OF SUB-SOLUTIONS

To generate solutions for the different steps in The Functions-Means-Tree a number of methods such as brainstorming, looking at existing solutions, as well as using a Morphological matrix (Zwicky, F. 1969) was used. The Morphological matrix is a method discussed in the lectures in the masters program in Product Development at Chalmers. In this method, different generated sub-solutions are put in a matrix. The different rows of the matrix contain one or several solutions to one of the sub-problems.

The idea is to combine the different solutions to other solutions on different levels in the matrix. This tends to result in a vast amount of different combined solutions, and thus it is necessary to sort out those ideas that seem not to be feasible. It is also important that all the solutions are matched against the requirements list, and then to sort out the solutions not compatible with the requirements. This process will narrow down the number of solutions so that the matrix is possible to handle.

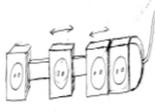
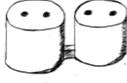
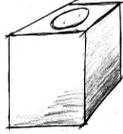
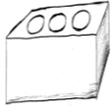
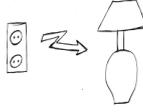
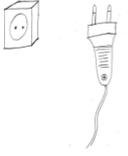
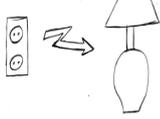
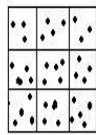
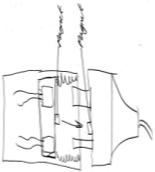
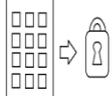
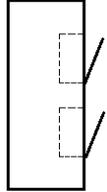
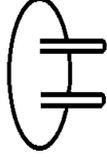
By combining solutions through the Morphological matrix, several possible solutions to solve the actual problem have now been established. The matrix is thus a structured way of combining different sub-solutions of a problem, and can be done on different levels in the Functions-Means-Tree described above.

All sub functions created from the second highest level in The Function-Means-Tree were then placed in a Morphological matrix in order to combine these functions to a set of different total solutions. From above one can see that we generated 6 sub-solutions on each level, which are 36 in total. In theory this can give $6^4 = 1296$ different solutions, but a lot of these are not realistic solutions and thus they can be sorted out, leaving us with a total of 100 possible solutions.

- WiTricity – Not feasible
- Water- Not suitable
- Super Ceramics – Expensive
- Solar cell – Expensive

Prior to effectuating the process of generating possible solutions, given by the Morphological matrix, a scanning of the different sub solutions was made whereby some less feasible options were excluded. This, in turn, significantly narrowed the number of solutions down to a manageable number. However, by doing so, one also automatically restricts the degree of freedom for the solution to take. The motivation to the reduction was done on an individual basis for each sub-solution where its feasibility, technical possibility and economical viability were analyzed. In Table 1 the remaining 24 solutions are presented.

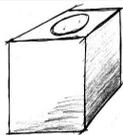
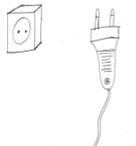
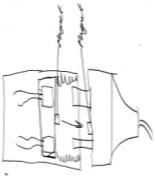
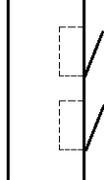
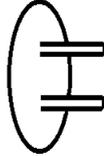
TABLE 1. GRAPHICAL REPRESENTATION OF SUB-SOLUTIONS IN A MORPHOLOGICAL MATRIX.

Number	1	2	3	4	5	6
Criteria						
A) Enclose parts						
B) Transfer electricity internally		Metal 		Polymer 		Super ceramics 
C) Transfer electricity externally						Ceramic 
D) Ensure safety						

It is important that all of these solutions are matched against the requirements list. Some of the 24 solutions are not feasible according to the requirements list and therefore these can be filtered out, together with a few more solutions that seem hard to realize. When this is done, there are only 11 solutions left to handle. See target specifications in Appendix D, Table 2.

- Metric No 5 removes: A1/A2/A4
- Metric No 7 removes: A6
- Metric No 8, 9 removes: B4/D1
- Metric No 18 removes: D6

TABLE 2. REJECTION OF NOT FEASIBLE SUBSOLUTIONS PRIOR TO THE EXECUTION OF THE MORPHOLOGICAL MATRIX.

Number	1	2	3	4	5	6
Criteria						
A) Enclose parts						
B) Transfer electricity internally		Metal 		Polymer 		Super family 
C) Transfer electricity externally						
D) Ensure safety						

Now, the different solutions to the sub-problems can be combined in the Morphological matrix creating a variety of possibilities that can be evaluated further. The process is presented in Table 3 and Table 4, and the results are presented in the next section.

TABLE 3. GENERATED SOLUTIONS FROM FIRST ITERATION OF THE MORPHOLOGICAL MATRIX.

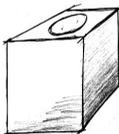
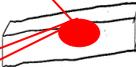
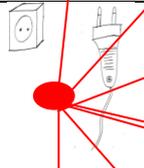
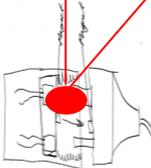
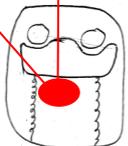
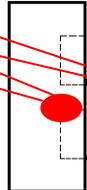
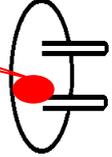
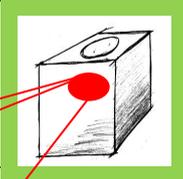
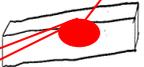
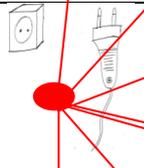
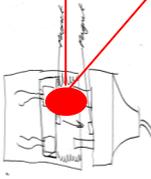
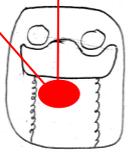
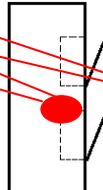
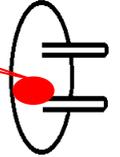
Number	1	2	3	4	5	6
Criteria						
A) Enclose parts						
B) Transfer electricity internally		Metal 		Polymer 		
C) Transfer electricity externally						
D) Ensure safety						

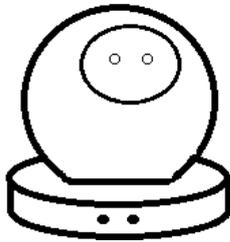
TABLE 4. GENERATED SOLUTIONS FROM SECOND ITERATION OF THE MORPHOLOGICAL MATRIX.

Number	1	2	3	4	5	6
Criteria						
A) Enclose parts						
B) Transfer electricity internally		Metal 		Polymer 		
C) Transfer electricity externally						
D) Ensure safety						

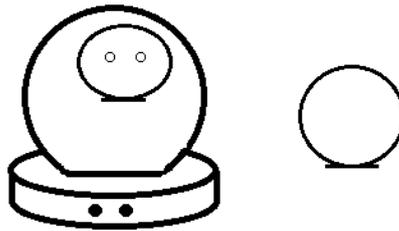
3.4 CONCEPTS EMERGING FROM THE MORPHOLOGICAL MATRIX

From the Morphological matrix several solutions were generated. Each of the concepts presented below can be derived from the morphological matrices on pages 18 and 19 by following the red lines from level to level.

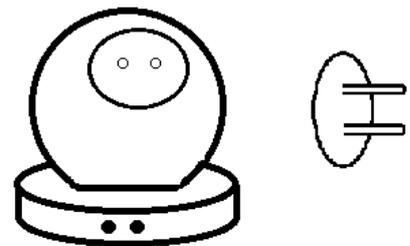
A3 – B1/B2/B4 – C1 – D1/D2



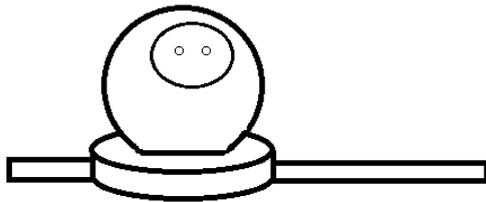
A3 – B1/B2/B4 – C1 – D5



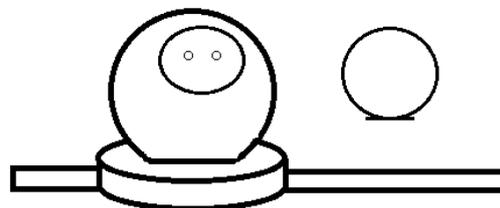
A3 – B1/B2/B4 – C1 – D6



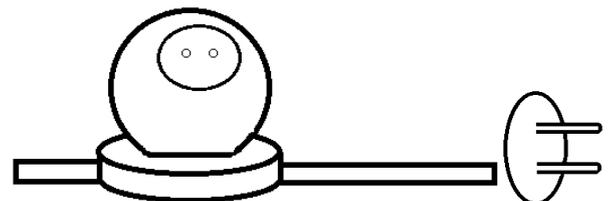
A3 – B1/B2/B4 – C2 – D1/D2



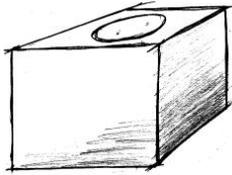
A3 – B1/B2/B4 – C2 – D5



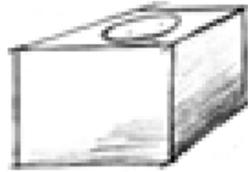
A3 – B1/B2/B4 – C2 – D6



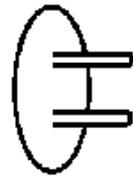
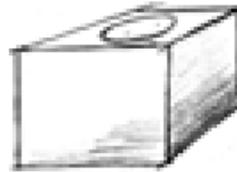
A5 - B1/B2/B4 - C1 - D1/D2



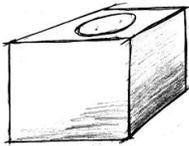
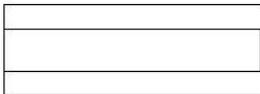
A5 - B1/B2/B4 - C1 - D5



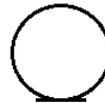
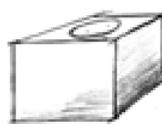
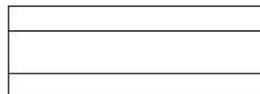
A5 - B1/B2/B4 - C1 - D6



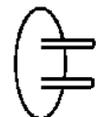
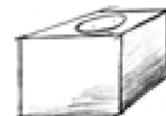
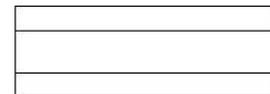
A5 - B1/B2/B4 - C2 - D1/D2



A5 - B1/B2/B4 - C2 - D5



A5 - B1/B2/B4 - C2 - D6



The results from the Morphological matrix are now be evaluated in a Pugh matrix, Table 5. The Pugh matrix is used to compare different concept solutions against each other. One of the concepts is chosen as a reference, and the others are evaluated against that reference according to a number of criteria. If a concept is better than the reference, that concept gets a plus for that criterion. If it is worse it gets a minus, and if it is neutral it gets zero. When all the criteria are compared for all the concepts, the pluses, minuses, and zeroes are summed up and a net value for each concept is calculated. Now it is possible to rank the different concepts according to their sum. The concept with the lowest score is eliminated, and the procedure goes on until a satisfactory result is achieved.

The different solutions are compared to a reference (in this case an existing solution - a power strip with three outlets) and ranked by its score. From the Pugh matrix one can get indications which of the solutions that are to be developed further.

TABLE 5. THE RESULTS FROM THE MORHOLOGICAL MATRIC ARE EVALUATED BY COMPARISON USING A PUGH MATRIX.

Criteria	Alternative																	
	1 (Existing)	2 (A3- B1- C1- D2)	3 (A3- B1- C1- D5)	4 (A3- B2- C1- D2)	5 (A3- B2- C1- D5)	6 (A3- B1- C2- D2)	7 (A3- B1- C2- D5)	8 (A3- B2- C2- D2)	9 (A3- B2- C2- D5)	10 (A5- B1- C2- D2)	11 (A5- B1- C1- D5)	12 (A5- B1- C2- D2)	13 (A5- B1- C2- D5)	14 (A5- B2- C1- D2)	15 (A5- B2- C1- D5)	16 (A5- B2- C2- D2)	17 (A5- B2- C2- D5)	
Modularization	REFERENCE	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Use standard components		-	-	-	-	-	-	-	-	0	-	-	-	0	-	-	-	
Number of parts		-	-	-	-	-	-	-	-	+	-	-	-	+	-	-	-	
Material adaptation		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Time to assemble (installation)		-	-	-	-	-	-	-	-	+	-	-	-	+	-	-	-	
Manufacturing cost		-	-	-	-	-	-	-	-	+	-	-	-	+	-	-	-	
Able to produce in large numbers		-	-	-	-	-	-	-	-	0	0	-	-	0	0	-	-	
Width		-	-	-	-	-	-	-	-	+	+	-	-	+	+	-	-	
Height		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Depth		0	0	0	0	-	-	-	-	0	0	0	0	0	0	0	0	
Weight		-	-	-	-	-	-	-	-	+	0	-	-	+	0	-	-	
Compatibility with other standards		0	0	0	0	0	0	0	0	0	0	+	+	0	0	+	+	
Environmentally friendly		-	-	-	-	-	-	-	-	+	+	-	-	+	+	-	-	
Safe		0	-	0	-	0	-	0	-	0	-	0	-	0	-	0	-	
Appearance		0	0	0	0	-	-	-	-	+	-	-	-	+	-	-	-	
Robust		-	-	-	-	-	-	-	-	0	-	-	-	0	-	-	-	
User friendly		+	-	+	-	+	0	+	0	+	0	+	-	+	0	+	-	
Sum +		0	2	1	2	1	2	1	2	1	9	3	3	2	9	3	3	2
Sum 0		0	6	5	6	5	5	4	5	4	8	7	4	3	8	7	4	3
Sum -		0	9	11	9	11	11	12	11	12	0	7	10	12	0	7	10	12
Net value	0	-7	10	-7	10	-9	11	-9	11	9	-4	-7	10	9	-4	-7	10	
Ranking	2	4	6	4	6	5	7	5	7	1	3	4	6	1	3	4	6	
Further development (Y/N)		N	N	N	N	N	N	N	N	Y	N	N	N	Y	N	N	N	

The results from the Pugh matrix show that there are two solutions that are ranked as number one, and therefore should be developed further. Here it would be possible to choose to develop the solutions with the second or even third ranking. But because the solution ranked as number two in this Pugh matrix is the existing solution and, more importantly, the fact that the difference in net value is significant this is not done here. A presentation of the chosen concepts is done in Figure 7. Along with the chosen concepts we also take another solution with us, as it contributes in fulfilling customer need 11 of “Independence”.

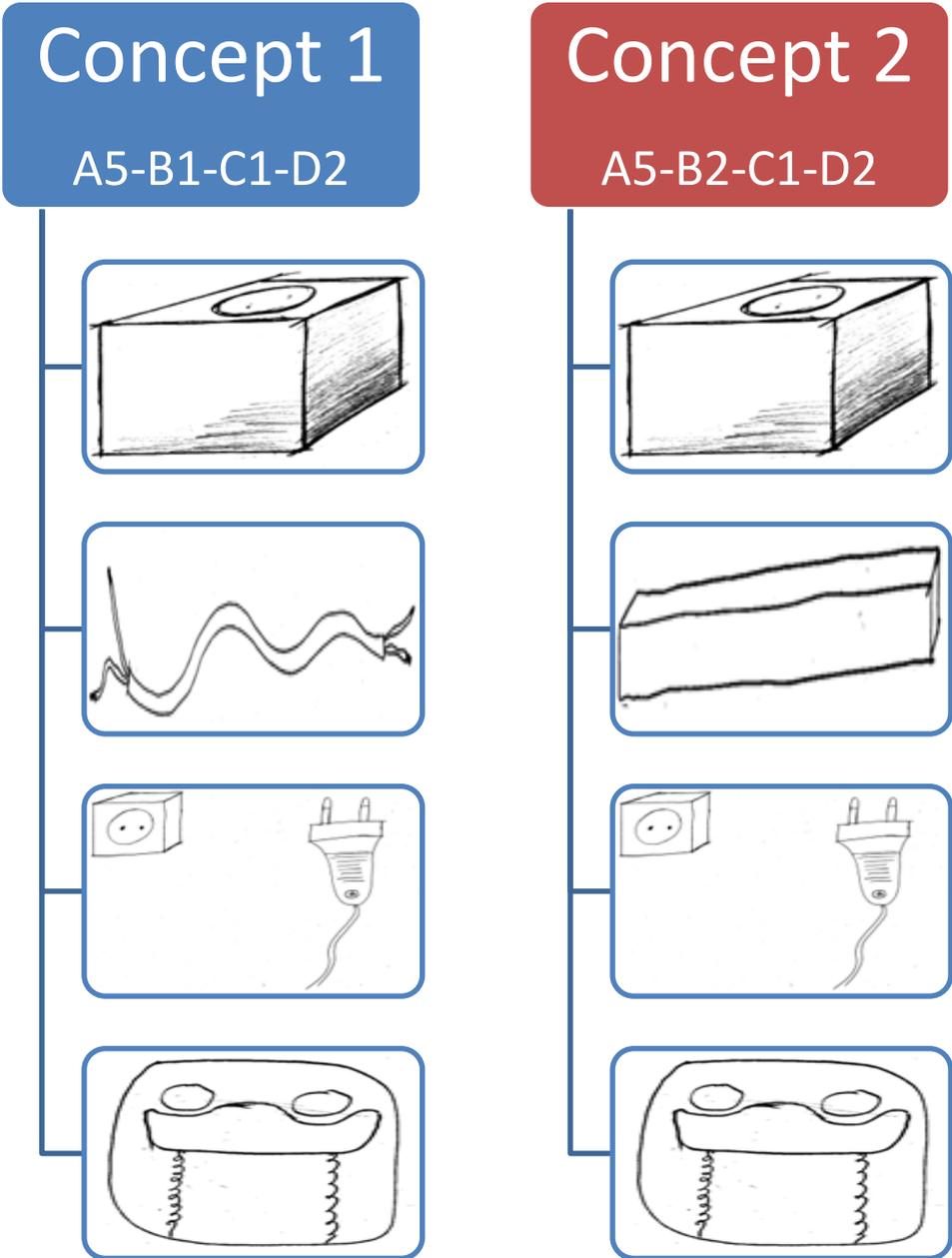
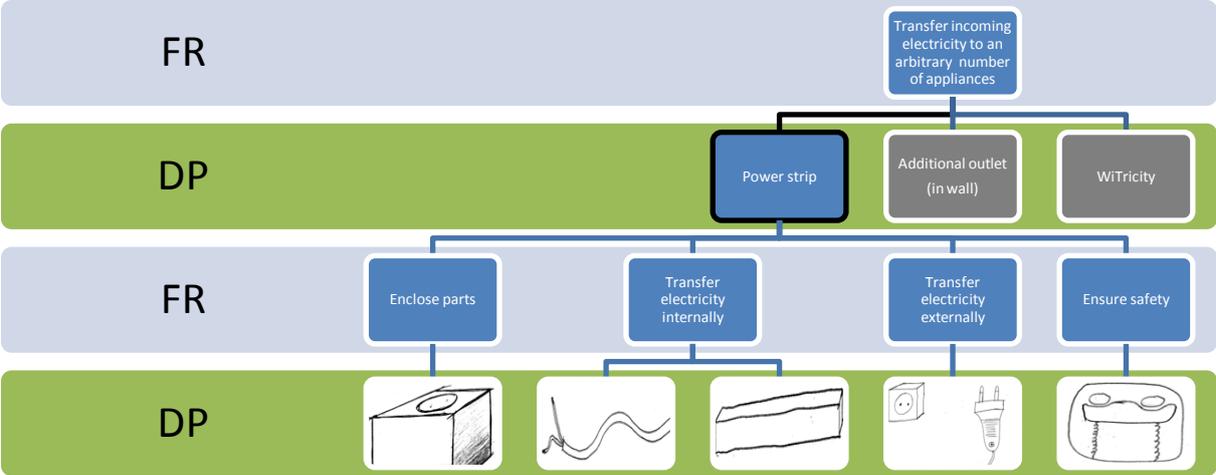


FIGURE 7. THE FINAL TWO CONTENDERS IN THE PRODUCT DEVELOPMENT PROCESS.

In Figure 8 the Functions-Means-Tree is shown with the chosen solutions, followed by the chosen concept.



Chosen concept:

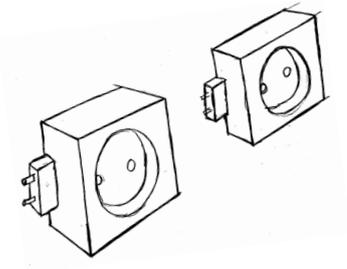


FIGURE 8. THE FINALIZED FUNCTIONS-MEANS-TREE SHOWING THE DIFFERENT SUB-SOLUTIONS SELECTED, WHICH MAKE UP THE CONCEPT.

3.5 EVALUATION OF THE CHOSEN CONCEPT AGAINST KNOWN SOLUTIONS

The next step was to evaluate the chosen concept against other solutions to verify that the further development was done in the right direction. This was done with a Kesselring matrix (Kesselring, 1942; Kesselring, 1954; Cross, 1994), presented in Table 6, and the result shows that the chosen concept should be chosen for further development.

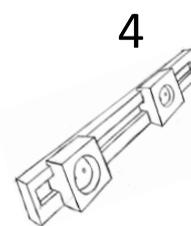
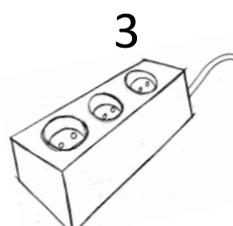
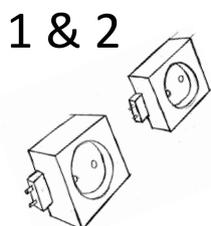
The Kesselring matrix is very similar to the Pugh matrix, with the difference that in the Kesselring matrix, the reference is an ideal solution and not one of the actual concepts or an existing solution. The criteria are also weighted 1-5 where the most important criterion is weighted 5. The score that a concept receives for each criterion is then multiplied with the corresponding weight, to finally be summed up in a total. In this way the concept which is the strongest in the most important areas is likely to win. Often there is more than one concept as a result from the Pugh matrix, and doing a Kesselring is often a way to sort out one single concept.

The weights in this Kesselring matrix are based on reasoning, together with the different aspects found in the requirements list. Of course, the weights are somewhat subjective and one should bear in mind that the result of the matrix should be interpreted reflecting this.

TABLE 6. EVALUATION OF THE CHOSEN CONCEPT AGAINST KNOWN SOLUTIONS USING A KESSELRING MATRIX.

Criteria	w	Solution									
		Ideal		1 (A5-B1-C1-D2)		2 (A5-B2-C1-D2)		3 (Existing power strip)		4 (Existing rail)	
		v	t	v	t	v	t	v	t	v	t
Modularization	5	5	25	4	20	4	20	2	10	3	15
Use standard components	4	5	20	3	12	3	12	4	16	2	8
Number of parts	3	5	15	4	12	4	12	4	12	3	9
Material adaptation	3	5	15	5	15	5	15	5	15	5	15
Time to assemble (installation)	4	5	20	3	12	3	12	4	16	2	8
Manufacturing cost	4	5	20	4	16	4	16	4	16	3	12
Able to produce in large numbers	5	5	25	4	20	4	20	4	20	3	15
Width	3	5	15	4	12	4	12	3	9	2	6
Height	3	5	15	5	15	5	15	5	15	5	15
Depth	3	5	15	5	15	5	15	5	15	4	12
Weight	2	5	10	4	8	4	8	3	6	2	4
Compatibility with other standards	5	5	25	2	10	2	10	1	5	4	20
Environmentally friendly	4	5	20	4	16	4	16	3	12	3	12
Safe	5	5	25	4	20	4	20	4	20	3	15
Appearance	4	5	20	4	16	4	16	2	8	2	8
Robust	4	5	20	3	12	3	12	4	16	2	8
User friendly	5	5	25	4	20	4	20	3	15	4	20
Total		85	330	66	251	66	251	60	226	52	202
Rel. total		1	1	0,78	0,76	0,78	0,76	0,71	0,68	0,61	0,61
Mean		5	18,5	3,88	14,9	3,88	14,9	3,53	14,4	3,06	11,5
Rank				1		1		2		3	
Further development				YES		YES		NO		NO	

From now on we consider concept 1 and 2 as one solution, as the difference lay in detail design.



3.6 COMBINING FOR “THE BEST”

The chosen concept resulting from the previous process is actually an already known solution. Due to the fact that this emerges as the most preferable option, the conclusion can be drawn that this concept is a good point of departure for further improvement. However, from now on, new terminology is introduced as to ensure the novelty of the innovation that was realized during the process, before any intellectual property is filed for.

Therefore, “Solution 1 & 2” is combined with another solution called “Solution R”. Consequently, one obtains the advantages of both solutions, while at the same time reducing the disadvantages of both solutions. The advantage is that of fulfilling customer need 11, which entails the possibility of “Performance Z” on “Solution S”, Figure 9.

By “Performance X” one achieves larger freedom in utility, as the customer is able to both increase the length of the power strip overall, while at the same time achieve “Performance Y” according to his or her taste and preference.

In addition, this solution enables “Performance Z”. This allows the desired functionality of the customer. Moreover, according to preference and need the customer can enjoy “Performance N”.

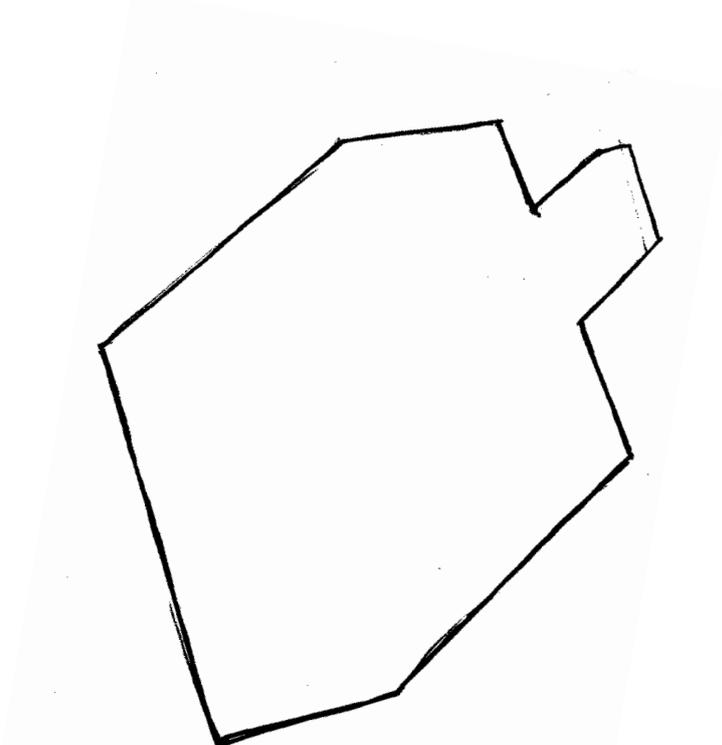


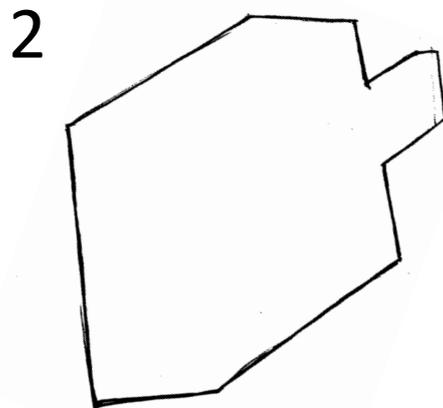
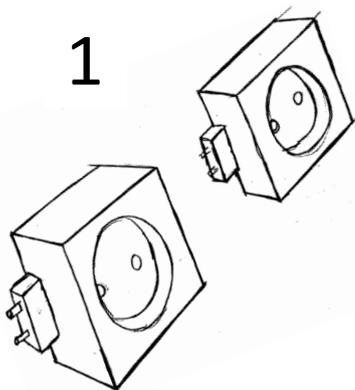
FIGURE 9. THE FINAL CONCEPT (MASKED IN ORDER TO ALLOW FOR PATENT APPLICATION).

To verify our choice of new concept we evaluate it against the previous one and the ideal situation, using a Kesselring matrix presented in Table 7. The outcome shows that further development should be aimed at the new concept, which in turn results in the need of investigation of some new areas, presented in the next section.

3.7 KESSELRING MATRIX TO CONFIRM CONCEPT RESULT

TABLE 7. EVALUATION OF CHOSEN CONCEPT TO CONFIRM CHOICE.

Criteria	w	Solution					
		Ideal		1		2	
		v	t	v	t	v	t
Modularization	5	5	25	4	20	5	25
Use standard components	4	5	20	3	12	3	12
Number of parts	3	5	15	4	12	2	6
Material adaptation	3	5	15	5	15	5	15
Time to assemble (installation)	4	5	20	3	12	4	16
Manufacturing cost	4	5	20	4	16	3	12
Able to produce in large numbers	5	5	25	4	20	4	20
Width	3	5	15	4	12	4	12
Height	3	5	15	5	15	5	15
Depth	3	5	15	5	15	5	15
Weight	2	5	10	4	8	4	8
Compatibility with other standards	5	5	25	2	10	5	25
Environmentally friendly	4	5	20	4	16	5	20
Safe	5	5	25	4	20	5	25
Appearance	4	5	20	4	16	4	16
Robust	4	5	20	3	12	3	12
User friendly	5	5	25	4	20	5	25
Total		85	330	66	251	71	279
Rel. total		1	1	0,78	0,76	0,84	0,85
Mean		5	19,4	3,9	14,8	4,2	16,4
Rank		-		2		1	
Further development				NO		YES	



3.8 NEW AREAS OF INVESTIGATION

The new concept brings 2 main problems to solve.

- 1) Problem 1: Sequential fit (masked definition)
- 2) Problem 2: Structural performance (masked definition)

The two problem areas are investigated one at a time essentially following the same pattern as the process described above, and thus the comments are kept to a minimum, Figure 10. The major exception is that the sub-solutions are evaluated against a “pros and cons”-list for reducing the number of alternatives, instead of the customer requirements list. Of course the customer requirement list is also checked so that these aspects too are taken into consideration.

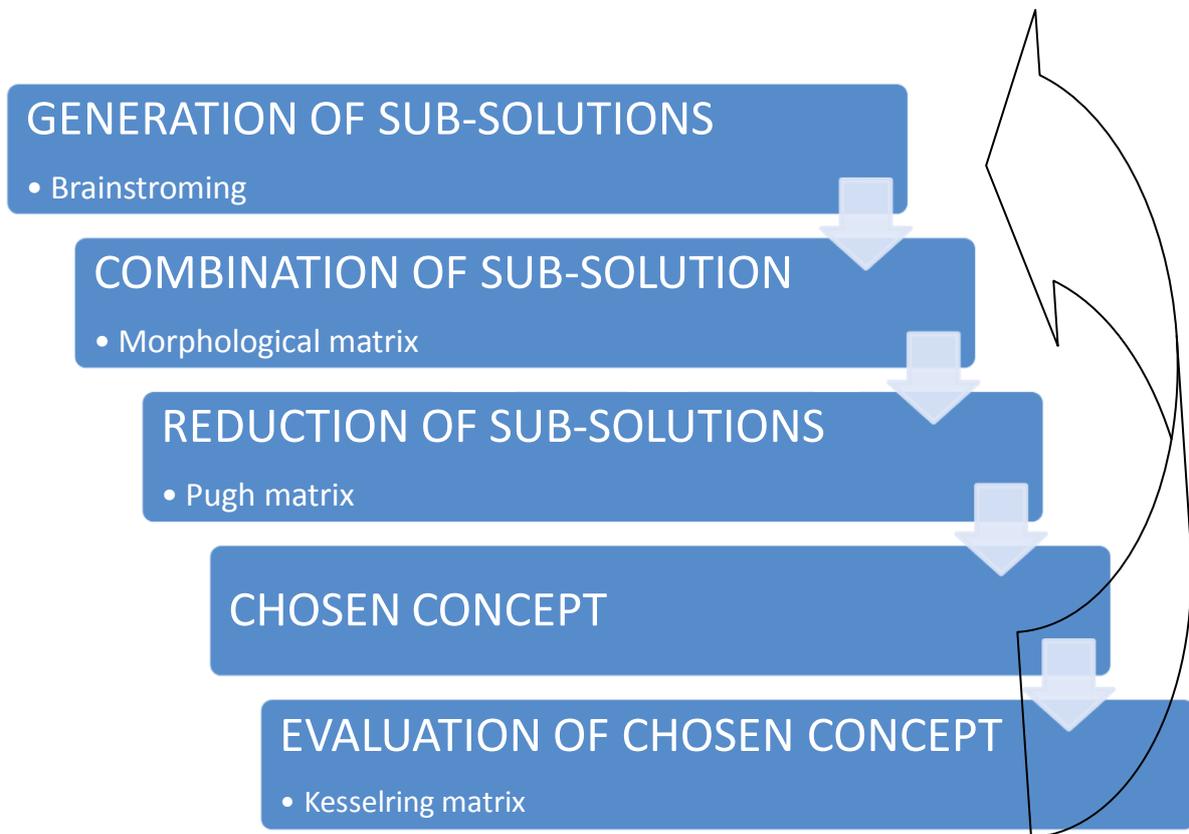


FIGURE 10. PROCESS FLOW OF THE PRODUCT DEVELOPMENT PROCESS USED.

Figure 11 shows the two new problem areas – “Problem 1” and “Problem 2” with the different sub-solutions.

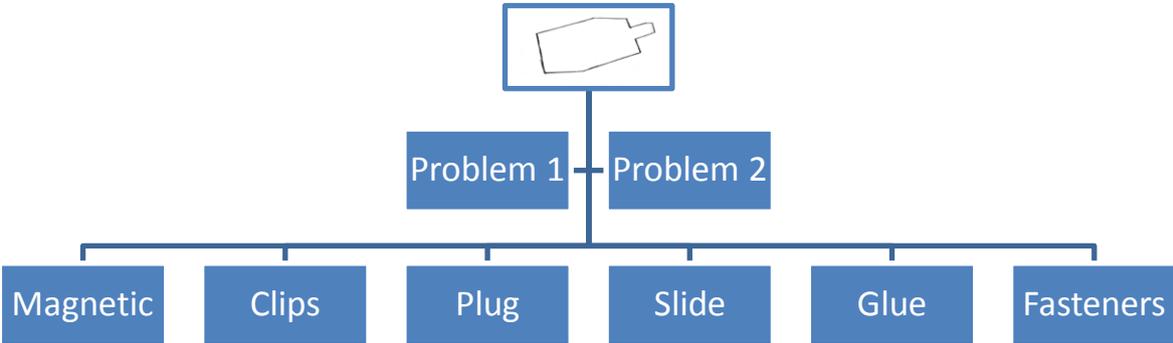


FIGURE 11. MAPPING NEW PROBLEMS AND POSSIBLE SOLUTIONS.

The generation of solutions for “Problem 1”, and the corresponding evaluation process (see appendix E) shows that the best solution for this problem is using some kind of plug, Figure 12.

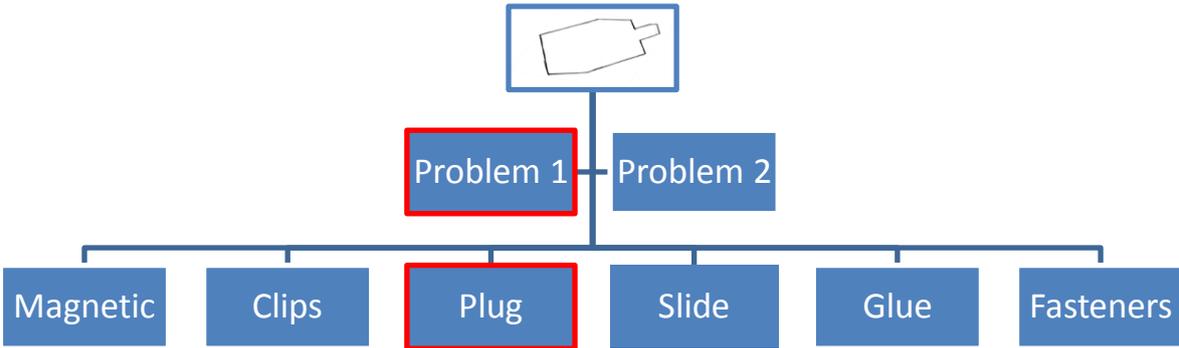


FIGURE 12. THE USE OF A PLUG HAS BEEN CHOSEN AS SUB-SOLUTION.

The next area is “Problem 2”. Like before solutions were generated and then evaluated (see appendix E), which gives the result shown in Figure 13; Plug.

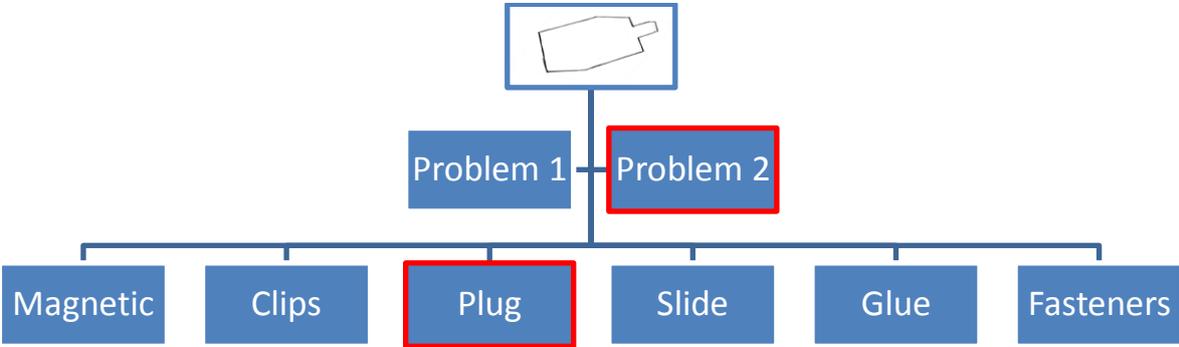


FIGURE 13. THE USE OF A PLUG HAS BEEN CHOSEN AS SUB-SOLUTION TO PROBLEM 2.

3.9 DESCRIPTION OF THE RESULTING PRODUCT CONCEPT & ITS FUNCTIONS

To solve the problem with the different standards of sockets and plugs around the world, “Performance R” is enabled. This will allow the customer to freely decide the number of outlets he or she wants to be available at any given position in for example a building. The product is thus designed as a modular system.

The new design facilitates for “Performance RS” and has now created conditions to successively switch to a common standard for plugs and outlets.

The product is moreover designed in a way that makes it possible for “Performance DR”. This makes it possible for the user to design the function of for example a power strip more freely, Figure 14.

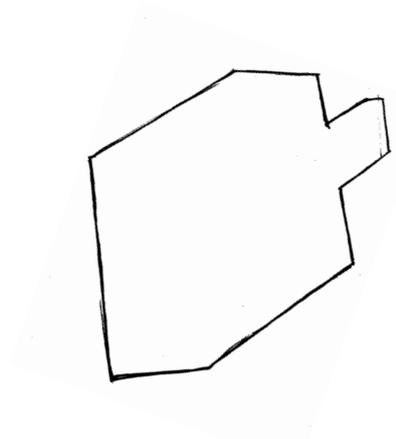


FIGURE 14. THE CHOSEN CONCEPT (MASKED IN ORDER TO ALLOW FOR PATENT APPLICATION).

The product makes the transition to a common standard for outlets and plugs around the world feasible in a number of different ways. “Solution R” can be installed by an electrician in new buildings or conversions. Together with “Solution S” the user is now in direct access of the new standard without being forced to replace appliances that have old plugs. New appliances can now be equipped with the new type of plugs making a new world standard feasible. Another way is to offer the product as a kind of modular power strip where the users successively will introduce the new standard into their homes.

3.10 DETAIL DESIGN & PROTOTYPING

When the final concept from the Pugh and Kesselring matrices were chosen, the work with detail design started. To support this work the CAD tool CATIA V5 was used, which is a powerful tool to design and thus visualize the different parts of the design. Before this CAD tool was used however, a simple model of wood and a material called oasis (usually used for flower arrangement) were made. The reason for this simple model was to get a feeling of the size and appearance of the final product. The authors of this thesis think that it is crucial for the success of this product on the market that the customers find the appearance attractive, and one of the most important factors for this is its size.

When performing the detail design in CATIA the hardest thing was to fit all parts in to the limited volume specified by the wooden/oasis model. There are a lot of aspects to take into account, i.e. manufacturing, assembly, electrical regulations, material behavior, cost, and customer usage, to mention a few. The complete product consists of several different parts (about 20) and the designs of some of these parts are specified by regulations, making it impossible to size down the solution to a desirable size. Despite that, the authors think that the physical model created from the CAD files is satisfying in most aspects.

From the CAD files a physical model was created using Free Form Fabrication (FFF). The CATIA files were transformed into STL files (STL= stereo lithography) and then send to a FFF machine in the prototype laboratory in Chalmers. This physical model is not a proper functioning prototype, but a model to make sure that the size is right, that all details fit, it is possible to manufacture, and so on. The reader must here observe that the design is one way to realize the product, and that it may be changed due to aspects that will emerge in the continuing work.

In “Solution R” there are two contact rails going from one side to the other conducting the electricity. A third rail, the earth, also goes from one side to another. The live parts in “Solution R” are protected with child protections. In Figure 15, “Solution R” is shown on the left hand side.

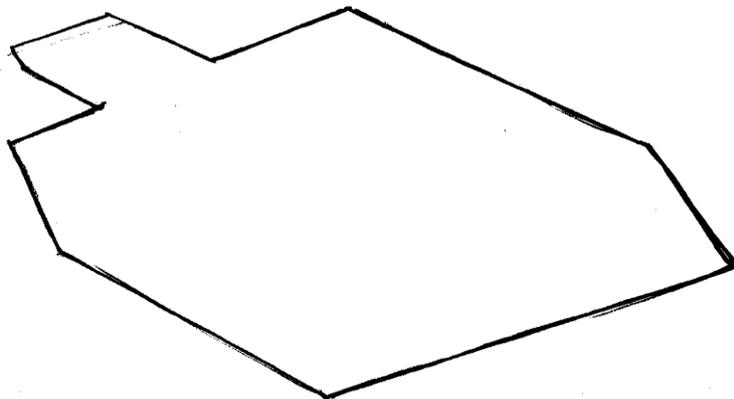


FIGURE 15. THE CHOSEN CONCEPT (MASKED IN ORDER TO ALLOW FOR PATENT APPLICATION)



4. MATERIAL SELECTION & MANUFACTURING

Parallel to the product development process, continual evaluation and discussion regarding manufacturability and material selection has been undertaken. It is important to consider aspects like these to ensure that the developed product at the end of the line, in fact, is possible to manufacture.

4.1 SELECTING MATERIALS

During materials research aiming to identify what polymer or plastic is used today in similar applications, it was found that the blend ABS/PC is widely used in similar electrical applications. However, the ratios ABS/PC vary as different qualities are obtained while generating different properties (Klason et al., 2006; Serini, 2000; Fortus, 2009).

4.1.1 ACRYLONITRILE BUTADIENE STYRENE (ABS)

ABS is an amorphous thermoplastic, which is copolymerized by acrylonitrile, butadiene and styrene (Klason et al., 2006). The different ingoing chemical components of ABS, thus their ratio, give its properties, Table 8. Acrylonitrile gives the polymer chemical resistance, heat resistance and thermal stability. Furthermore, butadiene put in low temperature impact and general property retention, while styrene adds gloss, moldability, strength and rigidity (Mount et al., 2005). It is frequently used for housings in various applications, such as dashboards, home appliances and industrial applications (Boyd, 2011). Suitable manufacturing processes include; injection molding, vacuum forming, thermoforming, blow molding and extrusion (Klason et al., 2006).

TABLE 8 LISTING ADVANTAGES AND DISADVANTAGES OF ABS. (KLASON ET AL., 2006)

Advantage	Disadvantage
Cost efficient material with balanced mechanical and chemical properties	Limited weather resistance
High toughness, surface hardness and finish	Low resistance to some solvents
Low form shrinkage	
Good properties at low temperatures	

In addition to the advantages listed above, ABS is also found in a wide range of quality in terms of toughness and heat resistance. This, in turn, thus is linked to the disadvantage of varying heat resistance. A remedy to this flaw is found to be to blend in Polycarbonate (Serini, 2000), which brings good flame retardation, excellent heat resistance and outstanding electrical insulation to the table.

4.1.2 POLYCARBONATE (PC)

PC is an amorphous thermoplastic that, apart from the properties stated earlier, is transparent and has excellent dielectric properties (Klason et al., 2006). PC is widely used, however the most famous example being the compact disc, Table 9. Other applications include office as well as medical appliances (Serini, 2000). Manufacturing processes for PC include injection molding, blow molding and extrusion (Klason et al., 2006).

TABLE 9 LISTING ADVANTAGES AND DISADVANTAGES OF PC. (KLASON ET AL., 2006)

Advantage	Disadvantage
Extremely high toughness, even at low temperatures	Cannot be used in water over 60°C (continuously)
Dimensionally stable material	Low scratch resistance
Excellent dielectric properties	Difficult to injection mold
Good creep resistance in dry air	

4.1.3 ABS/PC

ABS/PC blends mainly inherit the advantageous properties from both sides while improving the down sides to every material. As a result, the ABS/PC blends exhibit good processibility, as opposed to standard PC, while at the same time demonstrate increased heat resistance. These improvements added to the advantages of the two separate materials result in a new material that is eminent for use in the electrical field and for electrical appliances (Klason et al., 2006; Serini, 2000). The ratios of both plastics were set after researching different plastics suppliers and taking in account that 10 % normally is some other additive. Finally, a ratio of 60% ABS and 30 % PC was decided upon.

4.2 SELECTING MANUFACTURING PROCESS

There are several methods in which the process of manufacturing for a given polymer or plastic can be achieved. The most common processes are (Klason et al., 2006):

- Extrusion
- Injection molding

Both extrusion and injection molding are categories in which more specific types of the two processes can be found. At this stage, however, it is found to be of higher relevance to stick to the general idea of manufacturing than to dive into details, when at this stage in the product development phase geometries and shapes may change.

The authors have explored different manufacturing processes for plastics and have ruled out extrusion, vacuum forming etc due to the complexity of the product. Extrusion is primarily used in the manufacture of profiles, tubes, sheets and films (Gordon, 2003). Furthermore, extrusion is used to obtain geometries in a continuous operation (Gordon, 2003). From plastics manufacturers of vacuum forming the authors received word that the product being developed in this thesis was not suitable. As a result of the preceding discussion injection molding was thereby selected as a viable option for manufacture.

4.2.2 INJECTION MOLDING

Injection molding is, opposed to extrusion, a more widely used method as it enables manufacturing of a larger variety of products, ranging from less than a gram to over 20 kg (Gordon, 2003). Additionally, it is favorable to use injection molding if one's aim is to achieve tight tolerances (Gordon, 2003).

Injection molding is most suitable when dealing with longer production series, as the tools are relatively expensive and one would have to produce in large numbers in order to make it economically worthwhile (Klason et al., 2006). Raw materials and their handling account for at least half of the costs, while wages, utilities and equipment costs account for the remainder of the cost (Rosato et al., 2000). Hence, it is of the utmost importance to investigate more economic paths in order to source from the most beneficial player, whilst keeping quality in mind.

From a purchase request, see Appendix G, sent out to several manufacturers of plastic products an indication regarding cost of tooling and total production cost per piece manufactured was obtained. The supplier in question indicated a tooling cost of approximately 100,000 SEK, see Appendix G. Due to the CAD-files simplified nature and incompleteness and the importance of keeping the innovation a secret so that a patent may be put in place, the tools are assumed to be somewhat more expensive than previously indicated. Still, it gives an indication of what to expect.

Furthermore, the cost per piece will also be higher than indicated by the manufacturer (2.5-2.75 SEK), as neither assembly nor distribution is included in the cost. Nevertheless, it is a good pointer to what costs to expect when approaching suppliers and manufacturers with a product such as the one being developed in this thesis.



5. BUSINESS STRATEGY

To advance from the process of product development and achieve a foundation for further development in the form of founding a business, one needs to attack the dimensions associated with directing the work so that future gates of advancement is passed through. In this case it entails activities to identify business potential and to maximize one's chances in the pursuit of individual investors and incubators. This, of course, is the most feasible path to embark upon when personal financial assets are scarce and the financial need from the business is significant.

Here, theory and mindsets are presented in principle to explore different paths for a new venture. These will, along with Chapter 6 (Intellectual Property), be applied to the situation of the authors (Chapter 7 – "Our Way").

Normally, the next step after having a business idea would be to establish a basis to initially interest investors, in which the main purpose is to convince investors of the underpinning financing dignity of the idea. This includes (Kubr et al., 2005):

- Defining the problem to which the idea is remedy
- Clarify the business idea - WHAT the aim of the business is
- Identify and estimate the potential market
- Define the business model – HOW business is made

With this information one is "prepared" to engage investors and incubators. This groundwork has been generated throughout this thesis. However, it is not appended in the report as masking of sensitive information would consequently make the appendix useless from the view of the reader as little, if any, content may be revealed. As a result, the general idea of the business strategy and direction as well as central and broad aspects of the business is put forward in the coming section. Thus, no product specific information is laid out.

5.1 INTRODUCTION TO BUSINESS STRATEGY

Business strategy may be viewed as setting the direction for an enterprise by establishing broad objectives. Moreover, it is a way of looking at a company long-term while dealing with the total picture rather than stressing individual activities (Slack et al., 2008). At the outset of a business venture it is imperative to engage in strategic planning as to ensure future development and direction. That is, to establish goals to strive towards. However, the level difficulty to direct a venture at an early stage is considerable as many factors will change along the way. Nevertheless, it is, one might argue, equally important to establish and develop basic operations to secure the "mechanics" for future development. Without the basic operations of day-to-day activities in a newly founded business there is little or no need what so ever to pursue a strategic mindset, as the business itself is jeopardized by a frail foundation.

This is why, in the coming section, the framework of the venture, together with the intended pathway to reach a commercialization is explored, and finally laid out in terms of choosing the appropriate course of action to reach the ambition of starting a business.

5.1.1 IDENTIFYING POTENTIAL AND PITFALLS OF THE CONCEPT

Initially to get a grasp of the business idea and its potential and weaknesses, a SWOT analysis (Kotler et al., 2009) was done. SWOT stands for; Strengths, Weaknesses, Opportunities, and Threats (Kotler et al., 2009). By listing aspects of these four areas one can get an idea of how to plan future work, what the difficulties are, and of what to be observant. The analysis was used as a tool for identifying future and present problem areas with

the product in order to increase its chances on the market in the future. The SWOT analysis is viewed in Figure 16.



FIGURE 16. SWOT ANALYSIS OF THE CHOSEN CONCEPT.

The most significant outcomes of the SWOT analysis are:

- Large potential market
- Low level of financial capability at the present time (need more funding)
- Possible to develop a common world standard
- Cordless electricity transfer is a future threat

5.2 BUSINESS MODEL

“The ultimate role of the business model for an innovation is to ensure that the technological core of the innovation is embodied in an economically viable enterprise.”

- Chesbrough and Rosenbloom (2000)

A business model too has to be chosen. Chesbrough and Rosenbloom (2000) present one definition of the term “Business Model”.

“... a Business model is a description of how your company intends to create value in the marketplace. It includes that unique combination of products, services, image, and distribution that your company carries forward. It also includes the underlying organization of people, and the operational infrastructure that they use to accomplish their work.”

In addition, Chesbrough and Rosenbloom (2000), also, in detail put forward the different elements of a business model and their function in the current context.

- *“articulate the value proposition, that is, the value created for users by the offering based on the technology;*
- *identify a market segment, that is, the users to whom the technology is useful and for what purpose;*
- *define the structure of the value chain within the firm required to create and distribute the offering;*
- *estimate the cost structure and profit potential of producing the offering, given the value proposition and value chain structure chosen;*
- *describe the position of the firm within the value network linking suppliers and customers, including identification of potential complementors and competitors;*
- *formulate the competitive strategy by which the innovating firm will gain and hold advantage over rivals.”*

The six elements collectively assist in justifying the financial capital needed to realize the business model and further to set the direction for future development of the business. Hence, the business model serves as a framework of how business is made, developed and sustained.

Primarily, the focus is on the structure of the value chain and the method used to generate profit. Due to the previous clarification, it is consequently needed to highlight two central issues, which are investigated for future venture as they are the authors’ primary areas of concern and the basis for making business at the time of the establishment of this thesis. Moreover, since time is a considerably constraining factor it is thought wise to focus on these issues at the outset of the venture.

- Degree of vertical integration
- Possibilities of capitalization on intellectual property

Even though the authors have chosen to concentrate on the above mentioned aspects, it is imperative to underline the fact that the authors have mapped the different pathways in which a venture can take, see Figure 17. Further, Figure 17 illustrates the path chosen by the authors to serve as the business model.

The degree of vertical integration is put forward at the end of this chapter while “Possibilities of capitalization on intellectual property” is laid out in the next.

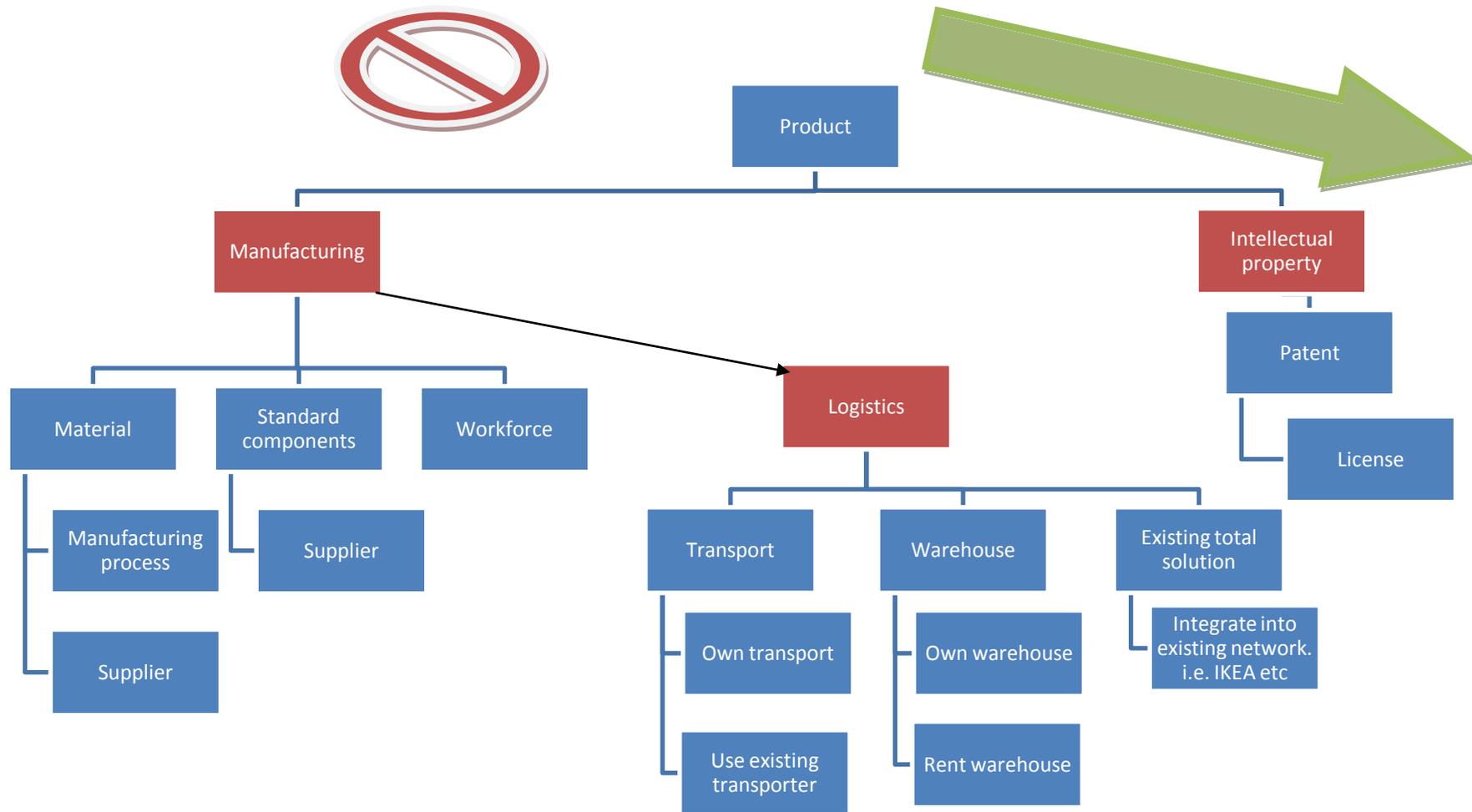


FIGURE 17. MAPPING OF POSSIBLE WAYS TO DIRECT A VENTURE, IN WHICH THE AUTHORS CHOICE IS INDICATED BY THE GREEN ARROW.

Here, general principles and mindsets are put forward in order to explore and investigate different paths for a newly started venture and to highlight core issues, which are considered key in the early stages of establishing a business. These principles will, together with chapter 6 (Intellectual Property), be addressed to the situation of the authors and their venture, pointing out their idea (at the present time) of doing business (chapter 7).

5.2.1 DEGREE OF VERTICAL INTEGRATION

Slack et al. (2008) defines vertical integration as:

“...the extent to which an organization owns the network of which it is a part.”

Hence, it entails identifying the core competence of the enterprise and concentrating on the sectors of importance, which gives the competitive advantage. Basically, it all comes down to one question – do or buy?

Generally, one must evaluate whether or not the choice of outsourcing aids in reaching the strategic goal defined at the outset of the venture. Areas of importance for the enterprise such as; special skills or key strategic long-term activities are rarely outsourced, as it would distance the company’s degree of influence, thus impairing and surrendering the governance of a business.

5.2.1.1 ADVANTAGES OF IN-HOUSE OPERATIONS

- + It may reduce costs
- + It increases understanding of activities in the supply network
- + It may help to improve product quality

When it comes to the possibility of reducing cost, it refers to the perception of producing one unit at a lower cost than the current purchasing price from your supplier. However, one needs to consider the obvious investments of production equipment and materials etc, which initially would result in a more expensive product. On the other hand, there is knowledge to be gained as a result of keeping the process in-house, as you learn how activities within the supply network interact, which enables the benefit of viewing the network as a whole. Lastly, as you own the operation you are solemnly in charge of the output quality of the process, consequently the quality control remains within company walls (Slack et al., 2008).

5.2.1.2 DISADVANTAGES OF IN-HOUSE OPERATIONS

- Inability to exploit economies of scale
- It may cut you off from innovation
- It distracts you from core activities

The inability to exploit economies of scale is evident as specialist suppliers, serving several clients, have the possibility to scale up their production accordingly, thus decreasing the cost per part. Conversely, an in-house operation supplies only itself and has a rather, in comparison, limited demand. As both customers and suppliers are a major source of innovation, you run the risk of cutting yourself off from innovation when walling the process off from external players. Also, keeping in-house activities increases the risk of distraction from what are the core activities in your business, thereby focusing on the least value-adding activities (Slack et al., 2008).

5.3 ASSISTANCE FROM AN INCUBATOR

Another course of action, especially viable for firms in their infancy, is to make use of a business incubator. On its internet website, the Swedish business incubator “Chalmers Innovation” (CI) defines its purpose as;

“Our goal and our unique competence is to transform ideas of technical nature at an early stage to successful growth companies.”

An entrepreneur initiating a start-up is faced with a range of problems to which he or she may not be accustomed. It is this, the limited competence of the entrepreneur, which the incubating organizations try and aim to give advice in sectors such as building business relations and marketing as a complement to the entrepreneur’s efforts with expertise and experience (Kannjainen et al., 2004). There is a vast range of business incubators worldwide. In Appendix J may be found some of the business incubators and venture capitalists situated or concentrated on business growth in the area of Gothenburg, Sweden.

In exchange for the services provided by the incubator, they sometimes take a percentage of the business as floating assets are a scarcity in firms taking their first step towards development. During the course of time, the company may need even more financial assets. In this case, the incubator would, given that they see a profit, assist in financing steps towards growth in exchange for a higher stake in the business.

The cooperation between the business incubator and the incubated venture may end at different stages and for various reasons, this is called an exit. An exit of an incubator is done when they have achieved satisfying profit on their investment, found an interesting party aimed at purchasing the venture or if they simply do not see a future for the business.

5.3.1 ENGAGING CHALMERS INNOVATION

During the thesis the authors have been in contact with a business incubator located in Gothenburg, Sweden, called Chalmers Innovation (CI). CI was founded 1997 by Sten A Olsson’s fund for research and culture and filled the need of a business incubator connected to Chalmers University of Technology.

CI’s aim and core competency is to transform early stage technology ideas into prosperous development ventures. It does so by using its own incubating process, known as “DRIVE”. The authors have been to CI on a number of occasions and have had one of the business developers have a look at what are being developed in this thesis. According to Andrej Brud, a business developer at CI, the product, on which this thesis is written, holds definite business potential. He has further advised the authors to verify the novelty of the innovation by performing a primary investigation, from which it is possible to decide whether or not it is worth moving ahead with and ultimately filing for a patent. This, in turn, needs to be funded. Hence, the authors has currently an application for financial support pending at Almi – an organization giving support to ventures in the early stages of development.

These two activities are just a few of the entire list of activities that the authors have participated in. These activities are put forward in Appendix K. It is important to underline the fact that many summits and much time has been spent in getting feedback and opinions from experienced venture capitalists, incubators and other business support organizations.



6. EXPLORING INTELLECTUAL PROPERTY

6.1 INTRODUCTION TO INTELLECTUAL PROPERTY

The second area of interest and furthermore investigation is the possibility to capitalize on intellectual property and the different forms of protection linked to innovation and their role in businesses generating a profit. Notwithstanding its perceived juridical complexity and constant evolution, it is imperative that an enterprise, either still in the cradle or well on its way, engage in exploring, learning and apply the mechanisms and strategies of IP in order to secure its competitive advantage while at the same time lay the foundation for the base structure and competence of the business.

6.2 WHAT IS INTELLECTUAL PROPERTY?

World Intellectual Property Organization (WIPO, 2011) offers the following definition of Intellectual Property:

“Intellectual property (IP) refers to creations of the mind: inventions, literary and artistic works, and symbols, names, images, and designs used in commerce.”

IP is made up of two different categories, namely; Industrial Property and Copyright. While Industrial Property deals with issues such as; inventions (patents), trademarks, industrial design and geographic indications of source, is Copyright focused more towards the literary and artistic sector. In short, it deals with protection for different products, in both an industrial and a medial context.

6.3 WHAT IS A PATENT?

The most well-known protection for an industrial innovation is probably a patent. There are several different definitions of a patent. Granstrand (2000) presents one definition;

“A patent is a legal title granting its holder the exclusive right to make use of an innovation for a limited area and time by stopping others from, among other things, making, using or selling it without authorization.”

It is important to point out that a patent does not directly imply that an exclusive right to sell or manufacture is given to the holder of the patent, but rather is the patent a legal right with a possible economic value. One consequence of patenting is the disclosure of technical information. As the patent is made public, it will directly allow easy access to information concerning the patent. Another consequence, which for small enterprises has a larger impact, is the cost related of a patent. Normally, there are substantial fees, differing from region to region, in the primary investigation for existing patents and novelty of the idea. Furthermore, there are annual fees for keeping the patent valid, which sum the total cost of a patent to a substantial amount – especially for small and medium enterprises (SME) – as the lifetime for a patent normally is 20 years (Granstrand, 2000).

On the other hand, one hinders competitors from reaping benefits from the same or a similar innovation by owning a patent. Moreover, a valid patent improves one’s bargaining position with competitors, partners and other players who see usefulness or benefits to be reaped by utilizing the patented innovation or simply incorporating it in a venture of their own (Granstrand, 2000).

In addition, the timing of a patent is of the utmost importance, especially when looking at the strategic impact of a timed admission. If the patent application is turned in early in the innovation process, one ensures the uniqueness of the innovation while on the other hand shortening the time of the patent to reap any returns as the time to market usually is a considerable amount of time from the spawn of an idea to commercialization.

Conversely, by applying late one achieves a longer lifetime of the patent's profitability, while concurrently increasing the possibility of obtaining a stronger patent than had it been filed earlier (Granstrand, 2000).

An advantage of the patent, which is further subject to venture in this work, is the enabling of economic returns by licensing the right to manufacture, sell or distribute. In this way one is still the proprietor of the patent while permitting others to make use of it under certain conditions and circumstances regulated by contract. These conditions include performance targets as well as sales targets and upon breach of contract the licensor may retract the right to exploit the patent from the licensee (Mendes, 2011).

6.4 HOW TO REGISTER A DESIGN

Another way to protect a business idea from competition is to register a design. By doing so, one gets exclusive rights to the design and no one else is allowed to use your design without permission. According to the Swedish Patent and Registration Office (PRV) you get a protection of your design for a maximum of 25 years by registering a design (PRV, 2011).

The product developed in this master thesis is intended to be protected by a proper patent. The reason for this is that the product is an innovation that creates a new generation of power strips. By just protecting the design, the risk of competitors copying the idea with just a slightly different appearance is obvious. And the protection of the idea is for us as new entrepreneurs of utmost importance, because we are not able to gather a vast set of resources in order to overflow the market in short time with this new invention, and thus getting a large piece of the market. By having a valid patent an advantage is gained when negotiating with potential investors or other parties such as suppliers and potential new partners.

6.5 WHAT IF THE APPLICATION IS NOT GRANTED?

One of the major threats to this project is that the patent application is not granted, either because there already is an existing patent, or that the idea in some way can be seen as known to the public. By searching in the Swedish Patent Database on the Swedish Patent and Registration Office's website one can get an indication of the possibility of patenting the idea. The authors have looked through 1000-2000 existing patents in databases, looking for innovations similar to the one described in this master thesis. This resulted in a few patents that are somewhat similar to this idea. However, to be sure, the best thing is to let a patent firm handle the search and application process.

If it turns out that there already is a patent or that the innovation is known in some way and that patenting our innovation is not possible, this by itself will be seen as a result for the thesis. Looking into the future of the authors' ambition to create a business on this innovation, however, it is necessary to find a new way to realize the idea. Maybe there are some things that can be used to create new possibilities of developing a slightly different product, which has the same or even greater business potential than the present.



7. OUR WAY

Leading up to this point, exploration in key issues for a new business venture has been explored and presented. However, it is important to underline the fact that all ways possible of starting and developing an enterprise have not been offered to the reader. This is due to the master thesis not only being a limited venture in time but most importantly because of the fact that given the starting point from which the business is thought to originate there are a select number of feasible paths to embark upon. In addition, it is the authors' conjoint belief that the primary issues to solve and establish is the previously stated questions, concerning vertical integration and intellectual property. These two areas of focus, which serve as core issues, are considered to act as a framework for setting up the rest of the business structure. As the major strategic objectives constrain the number of possibilities down to a manageable number of options, when simultaneously evaluating the economic feasibility, it will result in giving a total picture of feasible scenarios possible to venture.

The main issue at the present time, which is also experienced by most new technology-based firms (NTBFs), is the lack of financial resources. Furthermore, additional corresponding assets such as large sales figures or an existing supply network in order to successfully introduce a product to market are also deficient. It is from this reality and situation that strategic business decisions needs to be set in order to take a step towards market launch. The financial constraints at the outset of a start-up are thus affecting the choice regarding the course of action for NTBFs (Kollmer & Dowling, 2004).

7.1 VERTICAL INTEGRATION

The choice of vertical integration, given the previous discussion on financial constraints, immediately excluded the option of doing all processes and operations in-house. This conclusion was reached from the apparent and obvious capital intensity a choice such as that would bring to the table. Given the scarce economic resources of the business at the present time and the rather limited funding that may be applied for in both specialized incubator environments and by the authorities such as subsidiaries, the exclusion of the business alternative suggesting an all in-house activity is hereby executed.

By ruling out the "all-in" option, leaves, nevertheless, a wide range of alternatives and combinations of different choices to decide upon. Although partial outsourcing may be seen as a viable option, it is thought that in order to make any profit on the product one would have to scale up the operations in terms of human resources as well as for equipment and raw material. This, in turn, would also drive the cost and the cost of capital to an unacceptable level for a business venture well in its infancy. What lies in the scope of interest is the possibility to exploit the intellectual property by means of either licensing or assigning the license. Thus a lower level of vertical integration is sought after and in accordance with increasing potential for maximizing the output of profit from a rather constrained input of resources. Hence, the most topical solutions understood at the present time are the following:

- Total outsourcing of manufacturing, while taking care of issues concerning the supply network
- Licensing
- Assignment (selling the intellectual property (patent))

7.2 POSSIBILITIES OF CAPITALIZATION ON INTELLECTUAL PROPERTY

As the idea of owning manufacturing processes has been rejected on the basis of economic and financial aspects, what remains are options dealing with different degrees of exploitation of intellectual property. The benefit from such a focus is that one achieves savings on expenditures of manufacturing equipment and manpower to run the operations. Existing suppliers with already developed specialized know-how in the

manufacturing process and material selection will be able to produce in a more cost efficient way the numbers required to satisfy the market need. Hence, it is not rare that NTBFs, given their situation, more frequently enter alliances with larger partners and exploiting the technical innovation by licensing (Kollmer & Dowling, 2004).

7.3 TOTAL OUTSOURCING

The suggestion of total outsourcing is appealing due to the fact that there are players in the market capable of performing the different steps of production in much more efficient way, right away, than a newly established business would reach in a considerable time. Moreover, as a higher number of the more physical steps of the value chain are placed in sites elsewhere, a higher cost efficiency and quality level can be reached and ensured as a result of a longer professional experience. Consequently, as previously mentioned, this enables the entrepreneur to concentrate on the core activity/activities, which in the case of this thesis is the patentable technology, to ensure future competitiveness and development.

The issue of supply and demand is also one aspect that does not, however, take care of itself by outsourcing the main operations as the need for coordination, assembly and distribution is left aside to be dealt with. As a metaphor, these areas function as the nodes in the supply network in order to connect the point of manufacture and assembly to the point of profit, namely the customer. To manage such a distribution network on resources which are in dire straits are neither seen as economically viable nor feasible. *Thus, the partial outsourcing decision is discarded.*

7.4 LICENSING OF INTELLECTUAL PROPERTY

The idea of licensing is appealing as it enables a new enterprise, as the one being developed in this thesis, to find its way into business and into the market by alternative channels – other than purely its own. Also, licensing is the most common path to commercialization by a patent holder (Mendes, 2011).

By licensing out the right to manufacture an innovation, or parts of it, by contract one achieves immediate steps towards a market launch much faster than could it have ever been able to do prior to the decision, whilst evading a large portion of the intensive capital investments needed in order to go live. Furthermore, Kollmer and Dowling (2004) argue that licensing enables start-up companies to use it as their main commercialization channel and thereby extinguish the need for full integration, even in a strategic time horizon.

In these cases, when licensing to already existing corporations with highly developed supply channels, one basically draws up a contract granting the firm the right to manufacture and distribute. By doing so, one gains access to an already established network. Subsequently, as the licensee has evaluated the license to be of value there is also likely to be demand. The contracts of the licenses can be drawn up by stating performance objectives to be obtained by the licensee. Usually it entails listing pre market entry milestones and post market entry sales targets for the licensee to comply with. If any of these terms under which the contract has been drawn up and signed are not fulfilled or honored the rights to the license cease to be valid. This, in turn, serves as a powerful asset in bringing a product into the market by the means of someone else. Additionally, it provides protection against less serious players and ensures that a launch is not dragged out in time due to a second hand party with an alternative agenda (Mendes, 2011).

The obvious issue regarding licensing is the natural dilemma of actually having something worth patenting and in the elongation being so appealing to others that they effectively move in and pursue it. However, that is a concern dealt with in the early stages of product development and more specifically in the market research phase.

The relatively low capital intensity and the freedom to turn to any speculator with a keen interest make this option both a viable and a probable path on which to proceed. Through the licensing one obtains royalties as a sort of return on exploitation by the licensee. The fairly simplistic nature of a license and its flexibility to apply performance objectives for a licensee to comply with makes this the most interesting option at hand. Lastly, the continuous cash flow generated by the license is one that is appealing, as opposed to assigning the patent for a lump sum.

7.5 ASSIGNMENT OF INTELLECTUAL PROPERTY

Another possible way to venture is by assigning the patent. By assignment of a patent one transfers the ownership of a patent over to another party. By doing so, one receives a lump sum for the assignment and the deal is done. As opposed to a license, an assignment is irrevocable and therefore not possible to take back or reclaim. The apparent difference between an assignment and a license is thus that in the case of a license there is a continuous return cash flow whereas, in the case of an assignment there is merely a lump sum transaction and the rights to the patent is turned over.

This option is also an alternative; however it is viewed as the last one. In addition, if one receives an offer of assignment it would suggest that the patent at hand possibly is worth a great deal in terms of economic proportions or strategic importance, which may very well turn into economic importance in a later stage.



8. EXPLORING ENVIRONMENTAL IMPACT

8.1 A COMPARATIVE STUDY OF AN EXISTING SOLUTION AND THE PROTOTYPE

An important dimension to consider when developing a product is its impact on the environment. It has further come to the authors' attention, through a focus group and a survey, that an environmentally friendlier product would attract customers while at the same time benefit the environment as it is less environmentally stressing. The usual way to go about this would be to conduct a life cycle analysis (LCA); this was also the intention from the start. However, it soon dawned on the authors that there was not enough information in order to make the LCA relevant and informational. Hence, the decision was made to conduct a comparative study, where elements of a LCA were present and concentrated on the relevant information that a product at this stage can hold.

This section concentrates on the effects of a chosen material of a certain quality on the environment. Key words such as primary energy and global warming potential (GWP) is the result of the analysis. Hence, no time has been spent evaluating the impact from the use phase of the product. This is, however, an area that could be looked into. Primary energy refers to the resources needed to manufacture a certain mass while the GWP quantifies the effect on global warming from having produced the same mass.

To clarify, GWP is a way to quantify the relative radiative forcing impact of a particular greenhouse gas. This measure is done over different time horizons but the 100-year time horizon is standard and it is used if not any other indication is given. The measure is performed by multiplying the mass of a given substance with the relative coefficient so that it can be compared in i.e. CO₂ emissions. In this analysis predefined CO₂ equivalents are used and in order to attain the specific impact it is multiplied by the mass of the components. This gives a specific evaluation on the environmental impact from a GWP point of view (IPCC, 1995).

8.2 SCOPE & GOAL OF THE COMPARATIVE STUDY

The scope of the comparative study is of one existing solution and the one being developed by the authors. The aim of the comparative study is to identify and point out relevant sectors in which the prototype and the existing solution differ from one another.

Due to the fact that little is known concerning the means of production for the prototype, as well as definite dimensions and final choice of material, the study is focused on the areas in which the both subjects are thought to diverge. Furthermore, to be able to find these areas, the starting point is the prototype, as its nature is the one constricting the study. It is further assumed that all other areas not brought up in this study are the same for the prototype as for the existing solution.

From the previous statement of the scope of the study, one challenge is to acknowledge the appropriate accuracy and magnitude of the data, in order to achieve a relevant comparison that will point out the areas of importance. Hence, it is not the intention of the analysis to be extensive in the sense that it ventures in all-embracing decimal "deep-sea diving", but merely a general comparative study from which it is possible to conclude benefits and drawbacks.

Consequently, input data referring to choice of material and volume used will result in output parameters cost and environmental impact. By putting the output parameters in contrast to each other, the basic impact will be revealed. However, one must bear in mind that the study does not take into account the manner in which the

prototype is to be used. For instance, at first glance, it seems as though the prototype utilizes more resources in terms of material use, hence the cost would normally be higher.

Despite the fact that the prototype generates higher depletion of resources on an individual basis it is not true when one considers the usage and entire need of the consumer. To clarify, when installing one single unit of the existing product, one is destined to make use of it at a permanent place, even though no one is currently in use. On the other hand, by installing the prototype, you achieve the same place specificity but can exercise the freedom of relocation for “Solution S” to any other “Solution R” in the vicinity. As a result, the need for an excess number of outlets thus is reduced and fewer resources are depleted as environmental impact is directly stemmed from the individual need of the consumer.

8.3 INVENTORY ANALYSIS OF COMPARATIVE PARAMETERS

A Life Cycle Inventory analysis (LCI) gathers essential parameters and figures for the study to process. This is a step taken from the process of a Life Cycle Assessment (LCA). Without a LCI, there would be no foundation for the analysis and no substance in findings and conclusions. Hence, it quantifies raw material and energy requirements for a product (EPA, 2011). The LCI is used in this comparative study as it would have been used in a LCA, although somewhat more concentrated.

Figures from material consumption are found to be the most evident to compare given that the actual situation involves a prototype and the only concrete means of measurement is deduced thereof. The mixture of ABS and PC is assumed to be 60% ABS and 30% PC. The remaining 10% is typically composed of additives (Boyd, 2011). The additives are not taken into account in this study.

Initially, figures on how much primary energy each of the materials deplete per kilogram were established and put in Table 10. Also, the effect on global warming was researched and entered into Table 10, in order to give an indication of the impact on global warming.

TABLE 10 FIGURES ON THE DIFFERENT POLYMERIC TYPES AND BRASS (BOYD, 2011)

Material	Primary energy (MJ/kg)	Global Warming Potential (kg CO ₂ eq/kg)	Location
ABS	95,3	3,76	Europe
PC	113	7,62	Europe
Brass	94,3	5,0	Europe

The analysis starts off by looking at the prototype. Then it turns to the existing solution and finishes off by a comparison of the both solutions put in a context of having three outlets. Please note that component material and composition is found in Appendix F.

8.3.1 LCI ANALYSIS OF THE PROTOTYPE

The prototype consists of several components; amongst them are “Solution R” and “Solution S”.

The total material composition of the prototype is further presented in Table 11 and to clarify, as a pie chart in Figure 18. Following the materials composition analysis of the prototype is the evaluation of its environmental impact, Table 12.

TABLE 11 FIGURES ON MATERIAL COMPOSITION OF THE PROTOTYPE.

Material	Mass (g)
ABS (60%)	37,1
PC (30%)	18,5
Brass	44,5

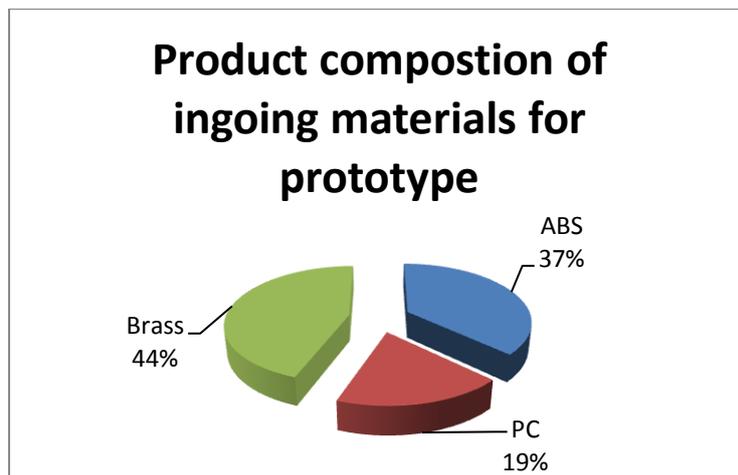


FIGURE 18 MATERIAL COMPOSITION OF INGOING MATERIALS FOR THE PROTOTYPE.

TABLE 12 THE ENVIRONMENTAL IMPACT OF THE PROTOTYPE.

Material	Mass (kg)	Primary energy (MJ)	Global Warming Potential (kg CO2eq)	Location
ABS	0,0371	3,5356	0,1394	Europe
PC	0,0185	2,0905	0,1409	Europe
Brass	0,0445	4,1963	0,2225	Europe

8.3.2 LCI ANALYSIS OF THE EXISTING SOLUTION

The existing solution is one unit consisting of an outlet that may be mounted in sequence.

The material composition of the reference is represented in Table 13 while the environmental impact is put forward in Table 14. The composition of materials is shown in Figure 19.

TABLE 13 MATERIAL COMPOSITION OF THE EXISTING SOLUTION.

Material	Mass (g)
ABS (60%)	41,8
PC (30%)	20,9
Brass	17,6

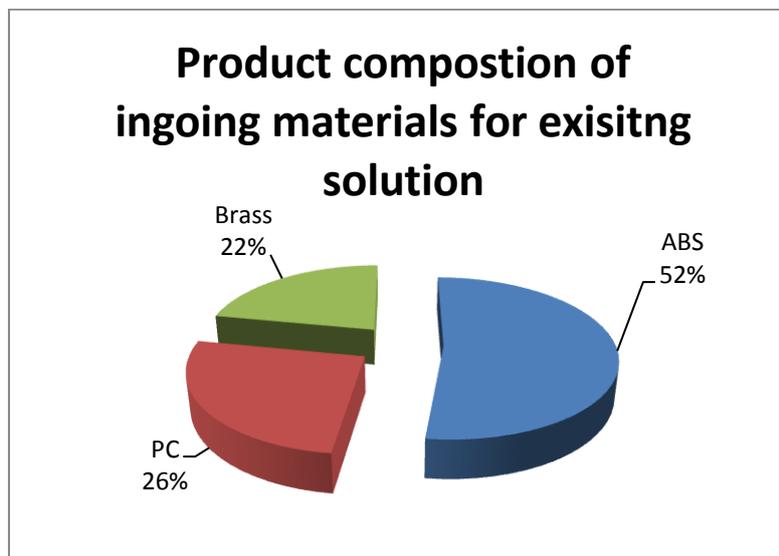


FIGURE 19 PRODUCT COMPOSITION OF INGOING MATERIALS FOR THE EXISTING SOLUTION.

TABLE 14 ENVIRONMENTAL IMPACT OF THE EXISTING SOLUTION.

Material	Mass (kg)	Primary energy (MJ)	Global Warming Potential (kg CO ₂ eq)	Location
ABS	0,0418	3,9854	0,1572	Europe
PC	0,0209	2,3628	0,1593	Europe
Brass	0,0176	1,6597	0,0880	Europe

8.3.3 COMPARISON OF THE PROTOTYPE & THE EXISTING SOLUTION

The prototype, for comparative reasons, is assumed to consist of three “Solution R” and three “Solution S”, see Appendix F. The existing solution, to which the prototype is to be compared to, is assumed to be made up by three outlets, see Appendix F. This is an assumption that is made based on the authors’ perception of a common power strip.

8.3.3.1 PROTOTYPE

The total material composition of the prototype is represented in Table 15 and further portrayed as a pie chart in Figure 20. The environmental impact is put forward in Table 16.

TABLE 15 THE TOTAL MATERIAL COMPOSITION OF THE PROTOTYPE WHEN THREE UNITS ARE ASSUMED FOR COMPARATIVE PURPOSE.

Material	Mass (g)
ABS (60%)	111,3
PC (30%)	55,7
Brass	133,6

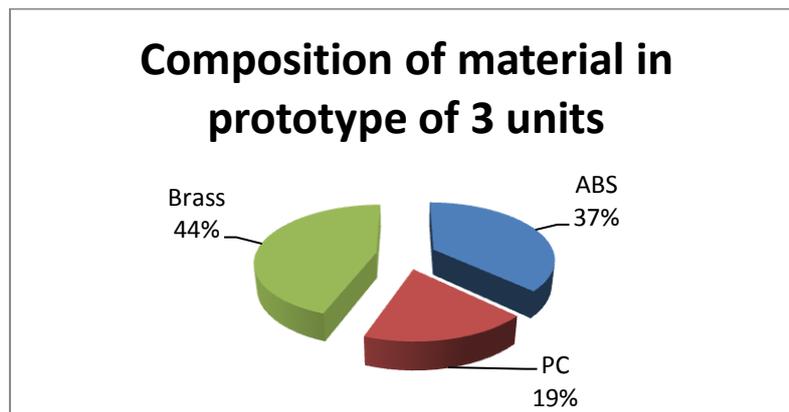


FIGURE 20 MATERIAL COMPOSITION OF ONE COMPARATIVE UNIT OF THE PROTOTYPE.

TABLE 16 ENVIRONMENTAL IMPACT OF THE PROTOTYPE.

Material	Mass (kg)	Primary energy (MJ)	Global Warming Potential (kg CO ₂ eq)	Location
ABS	0,1113	10,6069	0,4185	Europe
PC	0,0557	6,2941	0,4244	Europe
Brass	0,1336	12,5985	0,6680	Europe

8.3.3.2 EXISTING SOLUTION

The existing solution is comprised of three outlets, which is considered to be a common power strip for everyday use. Table 17 shows the power strip material composition and Figure 21 displays the figures in a pie chart. Lastly, the environmental impact is laid out in Table 18.

TABLE 17 MATERIAL COMPOSITION OF ONE POWER STRIP WITH THREE OUTLETS.

Material	Mass (g)
ABS (60%)	125,6
PC (30%)	62,8
Brass	52,9

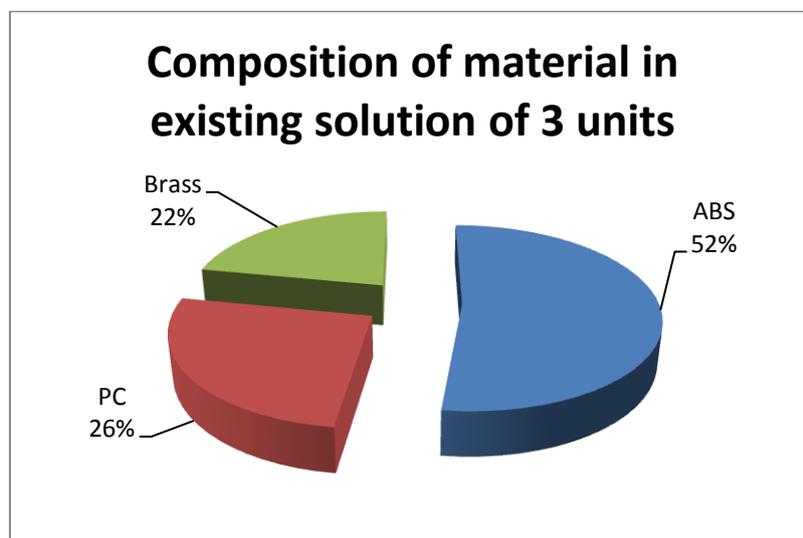


FIGURE 21 MATERIAL COMPOSITION OF ONE COMPARATIVE UNIT OF THE POWER STRIP.

TABLE 18 ENVIRONMENTAL IMPACT OF ONE COMPARATIVE UNIT OF A POWER STRIP.

Material	Mass	Primary energy (MJ)	Global Warming Potential (kg CO ₂ eq)	Location
ABS	0,1256	11,9735	0,4724	Europe
PC	0,0628	7,0987	0,4787	Europe
Brass	0,0529	4,9885	0,2645	Europe

8.3.3.3 GRAPHICAL REPRESENTATION OF THE ENVIRONMENTAL IMPACT FROM THE COMPARISON

Figures 22 and 23 compare the prototype to the existing solution in the environmental context. Figure 22 displays the global warming potential from the both solutions, while Figure 23 portrays the primary energy needed in order to produce the material.

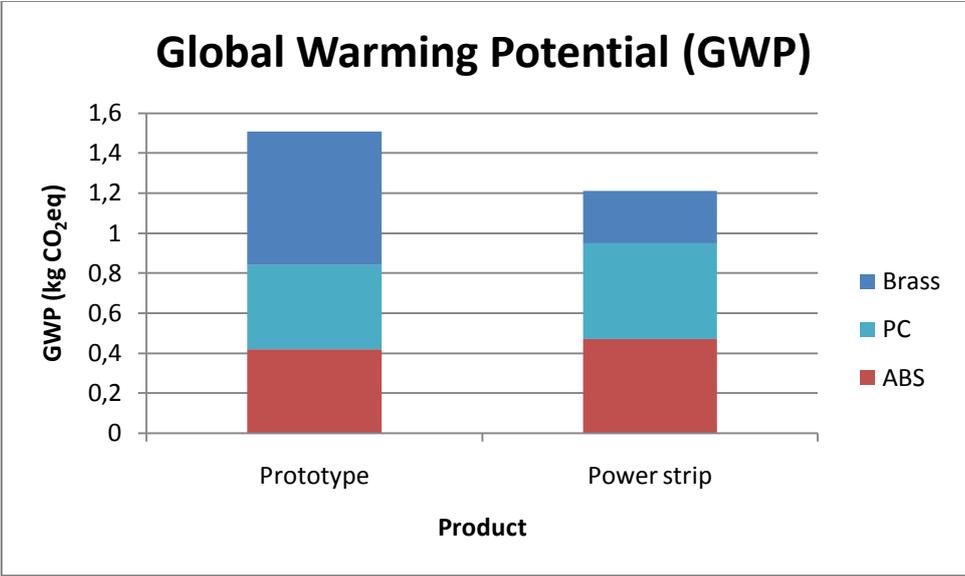


FIGURE 22 COMPARISON OF GWP BETWEEN PROTOTYPE AND EXISTING SOLUTION.

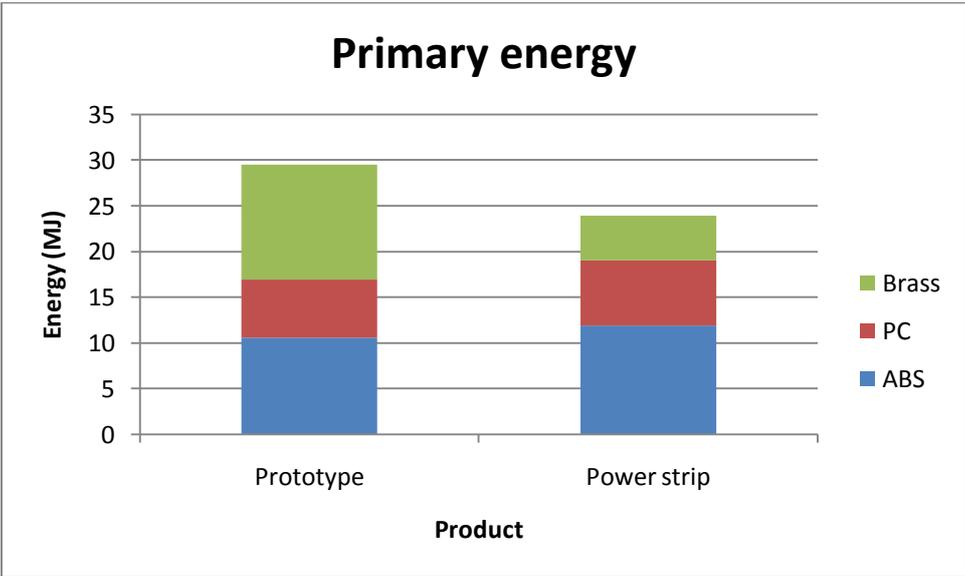


FIGURE 23 COMPARISON OF PRIMARY ENERGY USED IN PRODUCTION.

It is evident that the prototype would, in the present design, have a more significant impact than the existing solution. However, it is imperative to underline the fact that due to the possibility of modularization tailored to the specific need of the customer it most probably will result in fewer “unnecessary” units. By this, it is suggested that as opposed to the situation of today, where a customer needs to at least purchase two outlets in order to gain an additional one, it is possible to reduce the number of outlets as the customer only will procure the number really needed. This statement however, does not have any scientific empiric data in order to validate it. Hence, it will be an issue to clarify in future work.

8.4 END-OF-LIFE ASSESSMENT FOR THE PRODUCT

The European Union has, in its ambition to control the environmental impact of the production of products and goods, adopted a model for waste management strategies called The Waste Hierarchy, Figure 24.

8.4.1 THE ELEMENTS OF THE WASTE HIERARCHY

8.4.1.1 DISPOSAL

In the model, the least favorable form of waste management is in the bottom of the waste hierarchy pyramid. Here we find *Disposal*, which means that when a product's lifecycle has come to an end we throw it away and it is of no use to us anymore. This way of handling the waste causes a lot of problems. For example, there is great risk that toxic material is released into the environment. According to the European Commission (2010) "the airtight conditions of landfill sites mean that materials, in particular biodegradable waste, cannot decompose fully, and in absence of oxygen, give off methane, a dangerous greenhouse gas." The European Union has a legislation that obliges the European member states to reduce their disposal.

8.4.1.2 ENERGY RECOVERY

The second least favorable form of waste is *Energy Recovery*. Here the product is actually of some use to us even after its lifetime is ended. The waste can for example be used for producing electricity by incineration. The problem here is the risk to process the wrong material which will release toxics into the environment. Also incomplete burning can cause damage to the environment.

8.4.1.3 RECYCLING

A better way in which to handle waste is *Recycling*. When recycling, a lot of the material from the natural environment can be reduced. Also, by recycling there is no need for disposal, and also the risk with incineration is eliminated. According to the European Commission (2010), for example the recycling of aluminum cans, saves about 95% of the energy compared to making a new can from raw material. The system however put a lot of responsibility on the households as well as the companies. The households are expected to sort their waste, and the producing companies have a producer responsibility which makes them responsible for the product throughout the entire lifecycle.

8.4.1.4 REUSE

The next level in the waste hierarchy is *Reuse*. By reusing both whole products and parts of products there is less need for producing new products, and parts of products. This of course saves energy and material from the natural environment, and also reduces the pollution.

8.4.1.5 MINIMIZATION

The second highest level in the hierarchy is *Minimization*. By minimizing the material needed in the product as well as the energy consumption, the impact on the environment is decreased. Minimization is also of direct interest to the producer since both material and energy is directly linked to costs.

8.4.1.6 PREVENTION

The highest and most desirable level in the hierarchy is *Prevention*. The reason is that if a product is not produced it can certainly not cause any of the problems discussed in the previous sections.

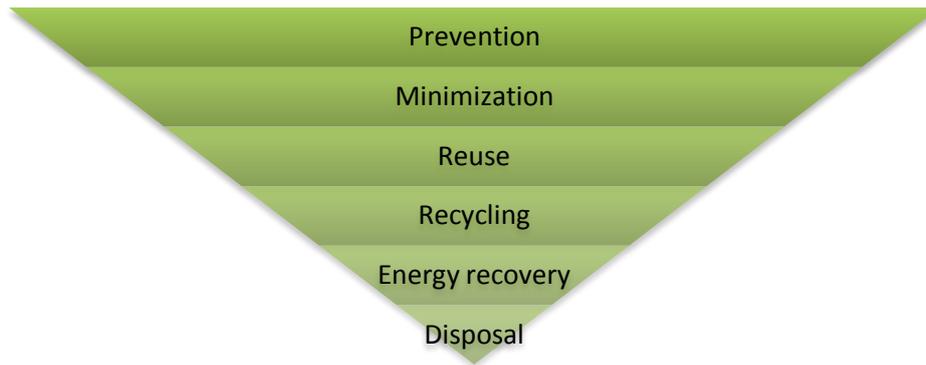


FIGURE 24 A GRAPHICAL REPRESENTATION OF THE WASTE PYRAMID WHERE ALL THE ELEMENTS ARE REPRESENTED (EUROPEAN COMMISSION, 2010).

8.5 PRODUCER RESPONSIBILITY

As the prototype will serve as the initial block for a future business, it is found by the authors to be of the utmost importance to think about what happens after the product has served its purpose or reached the end of its life. The responsibility for one's products as a producer, when they have served their purpose, is one dimension that needs to be addressed. This is regulated by law in Sweden and is called "*Producer Responsibility*" (Renova, 2011).

8.5.1 THE PROTOTYPE'S RELEVANCE IN THE WASTE HIERARCHY

As far as *disposal* of the product is concerned, there is always a possibility for the user to choose this course of action without any regard for more viable options that serve the environment in a better way. When it comes to *energy recovery*, it usually means incineration of the goods to extract the energy. It further implies that toxic fumes and other hazardous waste generated from the incineration need to be taken care of to avoid further negative impact on the environment.

One first viable option is *recycling*, which has been a useful way of taking care of waste in the past. However, when it comes to plastics one needs to both separate the different types of plastics into a homogenous group and clean it before any recycling process may take place.

As *recycling* is a process that has frequently been used in the past to relieve the environment from negative impact a preferable approach would be to *reuse* the parts instead of putting them through processing in order to make them once again operational. However, when entering into this type of return flow one has to consider how to recover the used parts. If the producer aims to reuse them or if another player is to make use of them there has to be some sort of return flow or other distribution network put in place. The situation with the prototype is that the user may use and reuse the product at different locations given the need of the user. One rarely utilizes all outlets in the home, and by being able to move the outlets to where they are used will in turn reduce overproduction of outlets never used and thereby spare the environment.

Minimization applies to our prototype by offering the customers the possibility to tailor their own need for outlets as opposed to a predefined number of outlets installed. Thus, outlets may be purchased when need arise.

The optimal approach would be for the product, as opposed to depleting resources, to *prevent* such resources to be depleted in the first place. To some extent this is true for the developed product as it prevents an exceeded number of outlets and switches to be produced. Hence, the environment is spared slightly when comparing to today's situation.



9. OUTCOME & OUTLOOK

In this chapter the outcome of this master thesis project is presented and discussed. In addition, the conclusions drawn are put forward along with suggestions on how to proceed with the innovation project in the future.

9.1 RESULTS & DISCUSSION

This master thesis has produced a number of results in two main areas; the product and the business activities. It further was made up by a joint venture of two different Master programs, which assisted in giving a broader view on the task at hand. Therefore, this section will start off by offering the reader general reflections and connection to both of the authors' educational background.

From a Production Engineering point of view the thesis was continuously challenging as it was directed towards entrepreneurship and product development, two areas in which a Production Engineer traditionally is not too familiar with. As a Production Engineer one had to draw on skills such as strategic positioning and direction as well as guidance in choice of manufacturing process. The intention of this project, from an academic aspect, was to continue exploring new areas of knowledge in order to get a holistic view on both the process of product development with the added ingredient of entrepreneurship, in order to broaden the education further.

On the other hand, from a Product Development Engineering point of view, this master thesis being an entrepreneurially driven product development project, one of the reasons for this is that entrepreneurship is a missing part in the Product Development masters program at Chalmers, and by realizing this project several aspects have been handled that is not a part of the education. However, the product development process itself has essentially been the same as the previous projects during the education, and the skills obtained in the education are of great help in different aspects of implementing a project like this. This master thesis has given an understanding of the extensive number of activities that are involved in realizing a project from idea to a commercial product.

9.1.1 THE PRODUCT

The product development process has resulted in a final chosen concept, which has been verified against known existing solutions. This verification showed that the innovation that founds the basis for this project is a better solution than the existing ones, and that it is worth further investigations. Based on the chosen concept, a CAD model was created, and then also a physical model. Both the CAD model and the physical model are important when discussing with different actors, giving them a better understanding of how the actual product will appear and function in reality. They also are forming a basis for decisions about how to produce the product. We have decided that the most probable technique for production is injection molding, and that the material will be a blend of ABS and PC. This is the most common way to produce power strips today, and we see no reason to make experiments in this area, not for the time being anyway.

9.1.2 THE BUSINESS ACTIVITIES

The pathway to commercialization is viewed as primarily patenting the technology as a first step and subsequently licensing out the rights to speculators in order for them to exploit the innovation to gain either a competitive advantage or to take a larger portion of the market in which they reside. The choice of licensing, as

opposed to assigning the patent, secures a future continuous cash flow from which further product development and refinement is to be financed.

The process of filing for a patent is comprised of two main parts. Initially, a primary investigation is to be made in order to verify that the innovation is, in fact, an innovation and possible to patent. Secondly, based on the result of the primary investigation – either yes or no, one proceeds by filing for a patent or in the worst case needs to re-innovate.

Almi has agreed to fund the preliminary investigation, which is the first step towards filing for a patent.

9.1.3 WHO IS THE CUSTOMER?

As far as the customer is concerned it has been recognized that private persons ageing from 15 to 75 years of age is the primary target group, independent of gender. This however, needs to be further confirmed or alternatively modified based on established marketing methods.

9.1.4 STRATEGY OF CHOOSING BUSINESS PARTNERS

When it comes to partners it is imperative that they are chosen meticulously as they influence the development, direction and business results of the venture. Both partners in the sense of co-developers, such as business incubators, as well as strictly business directed associates such as suppliers and customers are core building blocks in the foundation of start-ups. They all contribute and co-exist in the pursuit of customer satisfaction and organizational growth.

9.1.5 BUSINESS DIRECTION

The business direction is aimed at realizing a product based on an innovation that subsequently will be subject to a patent. In the elongation the goal is to make business on the intellectual property by either licensing out rights to other players in the market or more radically to assign the patent if the offer is right. The reason to this chosen path is because of the capital intensity at this early stage is extremely high, hence not feasible. It is therefore difficult to manage business in another way at the present time.

9.2 CONCLUSION

This master thesis has thrown the authors out in discoveries of new and exciting areas of different nature. The entrepreneurial approach and the possibility to end up with something that might lead to a foundation of a future business have been the main driving force. By supporting the different processes by accepted methods the work has been structured and efficient, and helped the decision making throughout. The authors realize that the knowledge gained throughout the education at Chalmers is of great help in quickly understanding how to approach and solve different problems, and also to evaluate and make decisions upon different results.

The project started with an idea and wish of making an everyday issue for millions of people easier to handle. The aim was to verify the substance of the idea; (1) if it is what the customer want, (2) if it is technically feasible, and (3) whether or not it could form the basis for a future business. In consideration of the limitations that had to be done to accommodate all different aspects into the limited amount of time, the answer to the first two questions is yes. If it can form the basis of a future venture is too early to say. The patent application process is ongoing and the result is still uncertain. But when talking to different experts (Chalmers Innovation, a Patent Bureau, Almi) they assess that there is a market value and potential in the idea.

Finally, the main conclusion to be drawn is that a project like this takes a lot of time. There are a lot of different areas to cover, and a lot of work has been done that not is shown in this report. You have to be passionate to drive a project like this, be interested in the entrepreneurship, be creative, and also dare to expose yourself and your project to different experts.

In short, the most significant conclusions drawn:

- The innovation has business potential. This, coming from business developers and business incubators.
- The innovation is recognized as fulfilling customer needs that are poorly met today, or not met at all, by the existing products on the market today.
- As no new technology was developed for the product it is therefore most probably technically feasible.
- At the present time, due to the financial scarcity, the venture is directed towards licensing as opposed to owning production facilities.

9.3 FUTURE WORK

If the project is to be carried on in the future, there are some main activities that require special attention. First of all we need to raise money in some way to finance the filing for patent. Hopefully Almi will agree on further funding for such activities. More on, we would like help from a business incubator or similar that can both help us with the financing and, more importantly, the business development and the realization of the project.

When it comes to realizing the product itself, there are a lot of things to get in place. We need to make a proper market investigation to really verify that there is a market for the product. When this is done and we hopefully can draw the same or similar conclusions as before, we need to make sure that all the requirements are met. This is of utmost importance when it comes to the requirements according to laws and regulations. There are, as previously mentioned, a lot of different technical requirements that have to be fulfilled. Hence, it is imperative for future work to ensure that regulations are fulfilled and to obtain necessary certification in order to embark upon an exciting journey with a bright future ahead.

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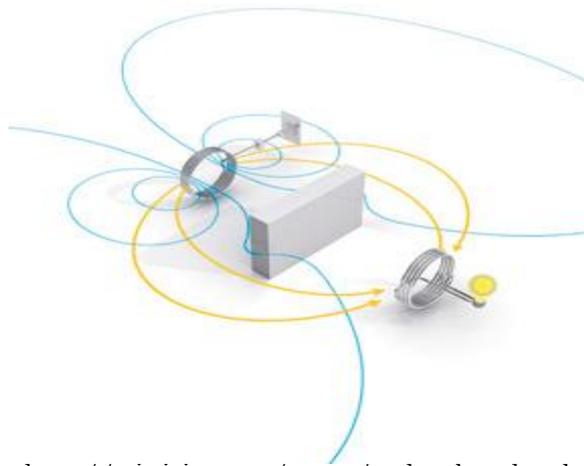
APPENDIX A - WITRICITY

WiTricity

– *Wireless electricity transfer*

by

Stefan G Eriksson



<http://witricity.com/pages/technology.html>

A project submitted in partial fulfilment of the
requirements for the degree of

Master of Science Production Engineering

&

Civilingenjör Maskinteknik

Chalmers University of Technology

2011

ABSTRACT

The problems connected to the necessity of cords to transfer electricity from a source to a, or in some cases multiple, point(s) of use are increasing as the number of our daily utilities, which utilizes electricity, increase. The apparent chaos in the electric field, when it comes to outlets and plugs, is merely evidence of that the world would benefit greatly from having a unified standard when it comes to plugs and outlets. This paper examines and puts forward the idea of having electricity transferred wirelessly, which is a patented technology based on MIT research.

The approach of this paper is first and foremost to enlighten the reader of its existence and relevance for the future to come and what may be seen as the main benefits and areas of application. The information for this paper was sourced from scientific papers published by the research team behind the technology at MIT, as well as other scientific publications putting the technology in different contexts. In addition, a wide range of relevant online sources were consulted to confirm certain data concerning the situation of outlets and plugs in the world today.

The findings of this paper relate to the stage in which the technology at the moment finds itself. In fact, there are applications today, however somewhat minor, that are commercialized based on wireless electricity transfer (WiTricity). However, since the technology is still in its infancy one might assume that it actually is a costly one. Despite the rather dim outlook on today's possibilities and uses the paper puts forward a range of areas in which this technology most certainly will make an impact, both on a minor and on a major scale. The example of the electrically powered vehicle is brought up as an example and areas of actualization is highlighted when introducing WiTricity into the context. In addition, power cords will become more or less obsolete as they are no longer required when transferring electricity from a source to the point of use.

Conclusions drawn from the research are mainly that of the possibilities being enormous but the question is how long the world will have to wait for this new technology in order for it to mature and find its place in the world as well as in the books of technologies that brought mankind one step closer to a "green" society. Moreover, by maneuvering out today's consumption of batteries in favor of a lighter option, one also protects and saves resources better needed elsewhere.

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BACKGROUND

Ever since the 1800s and the commercialization of electricity, mankind has constantly developed the manner in which it transfers electricity. It has, however, constantly been the case that to be able to move this medium of power one has been obliged to do so with conductors, which physically connected the source of power to the point of use. The shape and form of these conductors have changed and progressed during the years.

WIRING

The very first wiring methods to conduct electricity in buildings were bare conductors or, at best, conductors covered with cloth as insulation see Figure 1. This meant that indoor wiring exposed its surroundings to an elevated risk of short-cuts or, even worse, fire and injury or death. The safer rubber armored conductors were taken into practice as early as the beginning of the 1900s and 20 years later the polymer insulated cables for building wiring were introduced.²



FIGURE 1 CONDUCTOR INSULATED WITH CLOTH.

<http://www.wednesdayjournalhomes.com/homes.php?article=89>

PLUG AND SOCKET TYPES

In addition to the development of the conductors used to transfer the energy from source to point of use there was also, at the same time, development in the area of standards for the socket and plug, still used today, to connect the source to the point of use.

Interestingly more or less every nation that took part in this development did so in its own way. Hence, today, there are currently 13 different types of plugs and outlets used in the world, see Figure 2. Recent efforts have strived to homogenize the different types of plugs used in different areas to reach a common standard but to make such a change is not done overnight as every household and building connected to the power grid would need to physically exchange their outlets.^{3,4,5}

² http://en.wikipedia.org/wiki/Electrical_wiring

³ <http://users.telenet.be/worldstandards/electricity.htm#plugs>

⁴ <http://www.kropla.com/electric2.htm>

⁵ <http://electricaloutlet.org/>

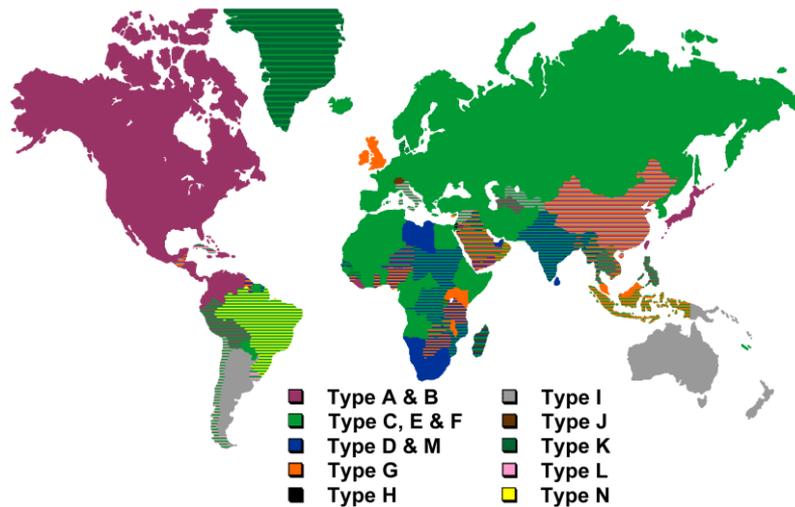


FIGURE 25 THE DIFFERENT TYPES OF PLUGS AND OUTLETS USED IN THE WORLD.

<http://users.telenet.be/worldstandards/electricity.htm#plugs>

DIFFERENT POWER GRIDS

As if the plug and outlet diversity was not enough to complicate the situation, there is also a difference in the power used in different grids depending on in what part of the world one has in focus, see Figure 3. In Europe and the majority of the world 220 and 240 Volts are used whereas in the large portion of the Americas and the whole of Japan one encounters a voltage between 100 and 127 volts. Historically, Europe too, like the Americas and Japan, had 120 Volts but chose to increase the voltage due to factors of efficiency and loss reduction. The reason why the US did not follow the transformation was because of the immense cost that it would bring to the table as the average US house, at the time, had home appliances as fridges and washing-machines, which was not the case in Europe.⁶

⁶ <http://users.telenet.be/worldstandards/electricity.htm#voltage>

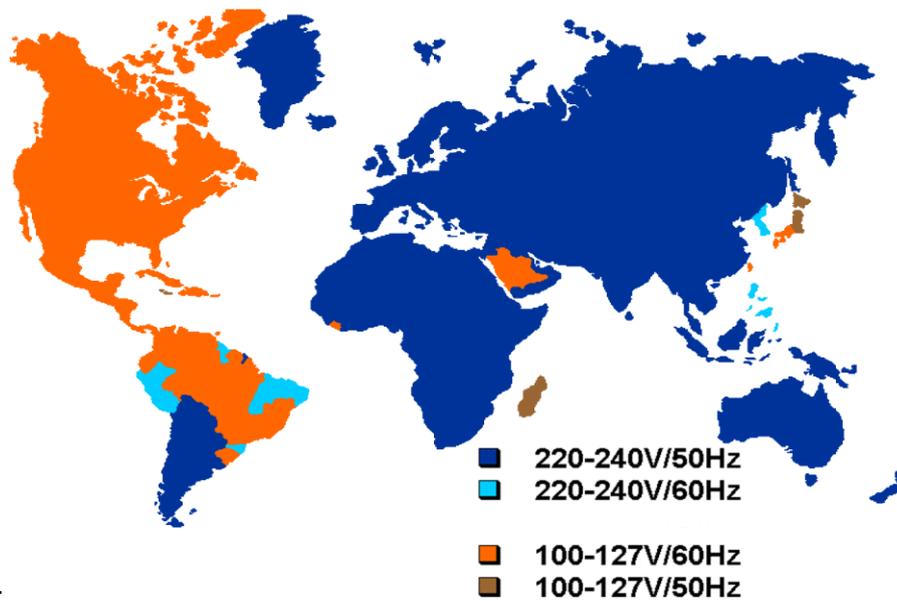


FIGURE 3 POWER GRID DIFFERENCES IN THE WORLD

<http://users.telenet.be/worldstandards/electricity.htm#plugs>

In this actual web of grids and plugs one might sense an urge of standardization to facilitate for both the constant users (population) and the temporary users (tourists). Moreover, one would think that there is an interest for companies in the electrical business sector to convert to a standard in order to more easily spread their products without having to take into account the different power grids and plugs.

However, this might be yesterday's news. An idea that turned into a scientific research project at MIT and later on ended up in the founding of an enterprise could assist in making this reality. In the elongation one may get a glimpse of future applications for this patented technology that could come to change the world as we know it.

WITRICITY

GENERAL COMPANY INFORMATION

In 2005, a team of physicists at The Massachusetts Institute of Technology (MIT), led by Professor Marin Soljačić, developed a theoretical basis for a new type of wireless electric power transfer (WiTricity). However, it took almost two years before the team could validate their theories by performing experiments. They put on a show when an experiment, made public, displayed a 60 watt light bulb being lit from a source of energy which was located over 2 meters away.

The technology, and phenomenon, is based on wireless power transfer via strongly coupled magnetic resonances⁷. They managed to show and prove their theories that electric power can be wirelessly transferred from a source to its receiver as a function of the geometry, distance and electrical properties of the specific devices utilized. The technology runs devices like computers, TVs, mobile phones and other common electronics and home appliances.

With this new knowledge, and future promising technology, WiTricity Corp. (see Figure 4) (wireless electricity) was founded by Professor Soljačić and a number of his colleagues from MIT. WiTricity is the sole licensee of this intellectual property, owned by MIT. This, in turn, means that they have exclusive rights to this technology by the patent owned by MIT.

As a result of Professor Soljačić's discovery, he was recognized with a MacArthur Fellowship, also known as "Genius Grant" in 2008.



FIGURE 4 THE HEADQUARTERS OF WITRICITY CORPORATION

<http://witricity.com/pages/company.html>

TECHNOLOGY

The WiTricity technology, innovated and developed by WiTricity Corporation, is defined by the creators themselves as:

"Transferring electric energy or power over distance without wires."⁸(Figure 5)



FIGURE 5 WIRELESS ELECTRICITY TRANSFER DEMONSTRATED BY THE RESEARCH TEAM AT MIT. [HTTP://WWW.WITRIC.COM/](http://www.witric.com/)

The technology itself is not quite as simple as the previous quote might imply. Some may even argue that such technology already exists in different areas of society. However, this is, in fact, *the* technology of the future based on already known physics and electrical as well as magnetic phenomena combined in a new fashion to solve some of present time's most annoying daily problems – the issue of cord, outlet and plug configuration.

⁷ Kurs et al. (2007). Wireless Power Transfer via Strongly Coupled Resonances. Science, vol 317, p.83

⁸ <http://www.witricity.com/pages/technology.html>

In short, the technology is portrayed by WiTricity as:

“WiTricity power sources and capture devices are specially designed magnetic resonators that efficiently transfer power over large distances via the magnetic near-field⁹.”

From the above quote it is evident that the technology functions on a sender-receiver basis, where it is imperative that there is both a source and a capture device in order for the technology to function as intended. Furthermore, the technology is, as stated earlier, comprised of a set of well known phenomena and to be able to appreciate or at least grasp the broad picture it is of the essence that the different sub functions that make up the technology as a whole are to be put forward and, in short, explained to ensure the reader’s conception.

ELECTRICITY

Electricity can simply be explained as a flow of electrons, normally transferred by wire from source to the point of use.

MAGNETISM

Magnetism is a phenomenon by which attractive and repulsive forces are generated between objects of magnetic nature. In short, magnetism arises due to relative movement of electrical charges.

ELECTRO MAGNETISM

Electro magnetism is the field in which the magnetic and the electrical phenomena come together. A product of this union is induction.

MAGNETIC INDUCTION

The phenomenon of magnetic induction is basically a varying magnetic field that is able, due to the varying of the field, to generate voltage. To make the field vary one utilizes the alternating current.

ENERGY/POWER COUPLING

One form of energy/power coupling is magnetic coupling, which occurs when the magnetic field of one object interacts with a second object by inducing an electric current in or on that object. As a result of this interaction, electric energy can be transferred from a power source to a point of use, normally a device. The finesse is that a magnetic coupling does not require any physical contact between the source and the user of that energy.¹⁰

RESONANCE

⁹ <http://www.witricity.com/pages/technology.html>

¹⁰ <http://www.witricity.com/pages/technology.html>

Resonance is a phenomenon in oscillating or vibrating systems, which entails that even a subtle periodic exterior disturbance close to the system's own frequency can cause the system's oscillating amplitude, acceleration and energy to radically increase.¹¹

RESONANT MAGNETIC COUPLING

Magnetic coupling is, following from the previous explanation on resonance, when two objects interact by exchanging energy through their varying or oscillating magnetic fields. Conversely, resonant coupling arises when the natural frequencies of both objects are roughly identical. Hence, resonant magnetic coupling occurs when both objects experience roughly the same oscillating frequency while at the same time sharing a magnetic field that varies. This may be viewed in Figure 6.

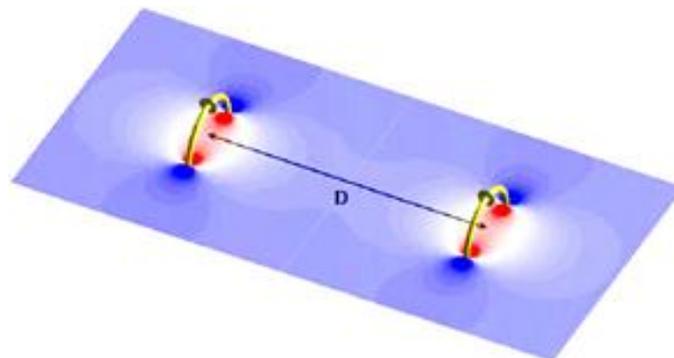


FIGURE 6 TWO IDEALIZED RESONANT MAGNETIC COILS, IN YELLOW. THE BLUE AND RED AREAS ILLUSTRATE THEIR MAGNETIC FIELDS. THE COUPLING OF THEIR RESPECTIVE MAGNETIC FIELDS IS INDICATED BY THE CONNECTION OF THE COLOR BANDS.¹²

<http://witricity.com/pages/technology.html>

To sum up, the technology is based on the combination of the preceding physical phenomena. What is interesting is that known physics have been looked at with a new set of eyes. In addition, when Professor Soljačić set out on this mission he was sincerely annoyed by having to connect his cell phone to a power cord in order to have it recharged.

¹¹ <http://sv.wikipedia.org/wiki/Resonans>

¹² <http://www.witricity.com/pages/technology.html>

WITRICITY TECHNOLOGY

The previous run through of electrical and magnetic phenomena leads us up to the point of understanding the underlying basic physics of wireless electricity transfer. Although the first, rather simple, definition of the technology seemed easy enough to grasp one quickly discovers, when venturing into the “nitty gritty” of the sub systems and scientific foundation at interplay in an application such as this, the complexity in making a system like this functional, not to mention the brilliance in revealing such an innovation.

With the background and basic theory given prior to this section we are now able to describe and explain the functionality of the wireless electricity transfer developed by WiTricity Corporation. WiTricity is thus power sources and capture devices (sender and receiver) that are specially designed magnetic resonators, which efficiently transfer electricity over large distances by the magnetic near field. Moreover, the sources and devices support efficient energy transfer over distances that are far larger than the sources and devices themselves.

In Figure 7, the function of WiTricity is shown through the demonstration of principles when powering a light bulb. The power source, located to the left in the figure, is directly connected to an AC power source. An obstacle, could be a dinner table or a sofa, is placed between the WiTricity source and the WiTricity capture coil. By inducing a magnetic near field (the blue lines) from the power source that can wrap itself around obstacles it enables and facilitates a flow of energy (yellow lines) from the source to the WiTricity capture coil, thus powering the light bulb.¹³

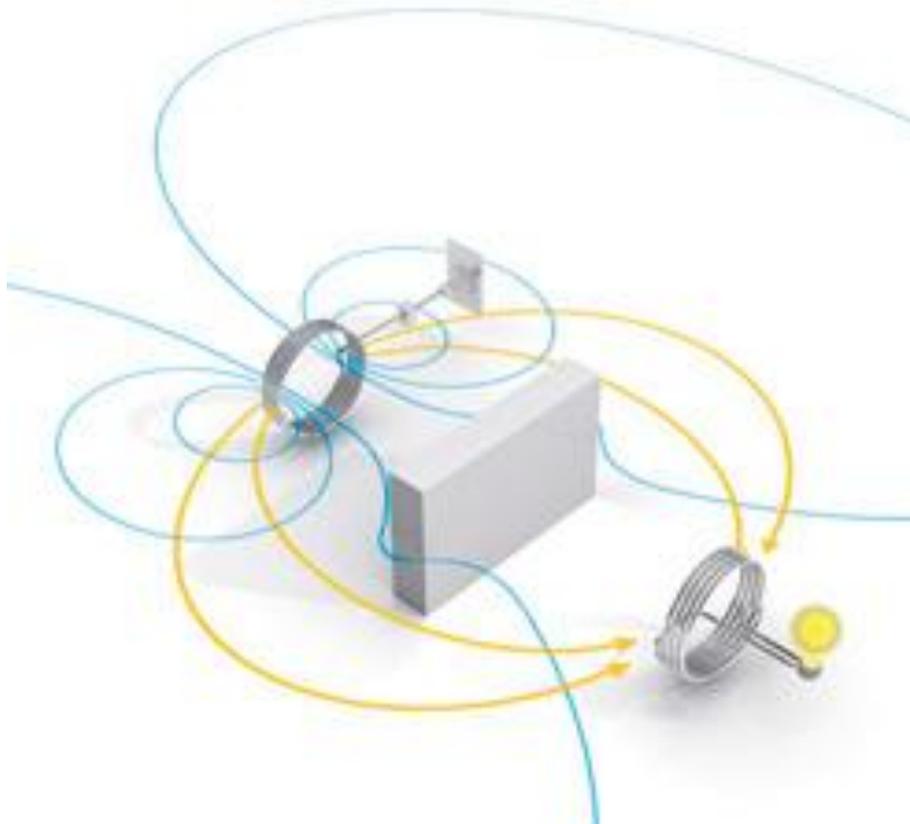


FIGURE 7 THE PRINCIPAL FUNCTION OF WITRICITY, WHERE A MAGNETIC FIELD (BLUE LINES) GENERATED BY THE WITRICITY SOURCE ENABLES ENERGY TRANSFER (YELLOW LINES) AROUND AN OBSTACLE IN ORDER TO POWER A LIGHTBULB CONNECTED TO THE WITRICITY CAPTURE DEVICE.

¹³ <http://www.witricity.com/pages/technology.html>

APPLICATIONS

This highly interesting technology, which is still being developed for daily use, has a range of extremely handy fields of application. One could generalize by assuming that everywhere where electric power cords are being used today will there be a natural substitution. Moreover, not only could this technology come in handy to make our daily lives simpler and more mobile, but it most certainly will play a key role as to enact as a gate opener towards powering vital technologies for the future.

As previously mentioned, the most obvious application would be its effect on the utility of power cords. With this technology well developed, there is hardly any need for cords as the main means of transferring electricity from source to point of use. This, in turn, would suggest that a significant portion of the resources previously being exhausted in order to produce and distribute these goods would experience a needed cutback from today's resource exhaustive behavior. In addition, as the use of cords would be on the decline, consequently the mobility and flexibility of mankind and her instruments would be on the rise.

A spinoff effect of this fact is that there will no longer be a need for different outlets and sockets in the world. Today, as presented in the introduction of this paper, there are 13 different types of sockets and outlets in the world. Some countries even have more than one type, which complicates things even further. And think of all the headaches you will avoid when travelling the world, either in business purpose or pleasure. There will consequently be no need for power adaptors in the long run. In addition, when purchasing electronic goods in other parts of the world, one usually needs to convert the plug installed on the equipment to the one being used back home in order to use it. Upon arrival of WiTricity you can quite simply travel without having to put a thought on issues like this and purchase goods where it is the most propitious, without having the slight problem of technical mishaps.

Secondly, the need and use for batteries would most certainly follow the same path as for the cords. The difference, however, is that it will probably take some time to distribute the WiTricity sources in an efficient way as to supply the need and flexibility at first. So, initially batteries would still be used to some extent, primarily to fill out the void created by the infancy and locality of WiTricity. Naturally, there will be areas of use for energy storage for smaller equipment, when being in remote parts of the world. On the whole, one might argue that due to the technology development of WiTricity, there will subsequently be a massive decline in the usage of materials that constitute a battery. As a direct effect of this decline the world's resources will experience some relief in terms of the questions of recyclability and disposal of used and potentially hazardous metals and compounds used in batteries today.

Lastly, one apparent application of WiTricity is the emerging use of the electric car and other electrically powered means of transportation. Drawing on the last exposition of the savings in resources of batteries, as electric vehicles use batteries in order to store energy during the transportation time, it has a multiple effect on this emerging technology. By reducing or eliminating the use of batteries in the electric car (please note that the electric car is used as a generic name for the category of all electric transportation types), one also reduces the weight by an incredible amount. One of the problems with electric cars is just that the batteries needed to power the car are so heavy that they drive up the energy consumption for the same vehicle. Moreover, problems for the electric car have always been the range and the cost of the car itself, as batteries do not come cheap.¹⁴

¹⁴ <http://www.forbes.com/2009/08/18/electric-cars-detroit-business-autos-backseat-driver.html>

WiTricity could in this case be more than a welcome technical solution, as it excludes the heavy and expensive batteries, and consequently brings the prices on these vehicles down by a significant amount. Additionally, as WiTricity operates without cords and with no need for energy storage, the range and energy supply can be ensured continuously, given of course that there are WiTricity sources in the vicinity of your travel. Lastly, as the weight is significantly reduced the mileage on an electrical car will improve considerably.

CONCLUSIONS

By discovering new ways to exploit already known physics the team at MIT, and farther on WiTricity Corp., presented an interesting remedy to the world's cord problem, wireless electricity transfer – WiTricity.

The technology of wireless electric transfer (WiTricity) could most certainly make the need for different outlets and plugs throughout the world redundant as the compatibility of electrical equipment and their power supply no longer adhere to a national or regional standard, which is only one out of thirteen, but to one overall standard where the plus and outlets does not have any use in domestic applications.

WiTricity could open the door to more rapid development of the electric vehicle. This is due to the use of the battery being made superfluous when a continuous flow of energy is powering the vehicle s opposed to a limited power supply that needs recharging.

WiTricity could increase the mileage and range of electric vehicles as it does not require heavy batteries that need to be recharged every now and then. The issue of mileage is one of the main problem areas with the electric car today.

WiTricity could also reduce the cost of an electric vehicle as it basically needs merely a receiver to power up, as opposed to the immense costs of batteries in vehicles of today. It goes without saying that this naturally applies for all applications in which there used to be a battery as power source.

DISCUSSION

As impressive and mind-blowing this technology may seem one should bear in mind that a technology like this is not likely to be commercialized within a five-year period. In fact, we should consider ourselves lucky if we even see a glimpse of it in the decade to come. As a matter of fact, there are gadgets out on the market today based on this principle. It is known as a recharge pad, where one may place his or her cell phone, for instance, in order to recharge it, no cords needed. But to scale it up to a broader audience and to fulfill the purposes presented in this paper, it is most probable to expect such a development in decades to come.

Another aspect not covered in detail in this paper is the health issues connected to such a technology. It is very much the case as for the mobile phones. The impact on human health is not one that usually is easy to predict or foresee. One might argue that the population is still waiting for the repercussions from the use of cell phones, commenced in the mid 90's. In order for this technology to really have an impact and to be acknowledged by the scientific society worldwide, an extensive and thorough investigation of the consequences and repercussions of adapting this technology must be put in place.

As this technology is so new to the scientific society there has been little study of the preceding phenomenon of wireless electricity transfer. This, of course, is one area in which this paper aims to highlight and the fact that papers are thought to be published in the near future of its existence and development so that an extensive use of this technology may come available to consumers and domestic use.

Lastly, the massive influence a technology such as this may have on the world if or when it becomes available is rather astonishing. To be able to power your car, cell phone and your computer without the use of batteries will have an enormous impact on weight and thereby the amount of resources depleted in order to manufacture products. The future is looking both brighter and lighter.

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9. <http://www.forbes.com/2009/08/18/electric-cars-detroit-business-autos-backseat-driver.html> [Accessed 19 March 2011]

FIGURES

Title page: <http://witricity.com/pages/technology.html>

1. <http://www.wednesdayjournalhomes.com/homes.php?article=89>
2. <http://users.telenet.be/worldstandards/electricity.htm#plugs>
3. <http://users.telenet.be/worldstandards/electricity.htm#plugs>
4. <http://witricity.com/pages/company.html>
5. <http://www.witric.com/>
6. <http://witricity.com/pages/technology.html>
7. <http://witricity.com/pages/technology.html>

APPENDIX B – ASPECTS BEFORE DEVELOPMENT

ASPECTS TO CONSIDER BEFORE DEVELOPING PRODUCT

INTERNATIONAL STANDARD IEC 60884-1:2002, THIRD EDITION

The international standard IEC 60884-1 contains general requirements for plugs and socket-outlets for households and similar purposes. This standard is a booklet with several hundreds of pages with information of technical requirements and testing procedures for plugs and outlets. To cover all of these requirements in this master thesis is not feasible, thus only some of the most important ones are presented here. Of course, all requirements in this standard are to be taken into account if the product in focus of this work is to be commercialized. Due to copyright regulations we are not allowed to present but a few of the requirements in this master thesis. For those readers who are interested in the complete standard of IEC 60884-1, this publication can be ordered at www.elstandard.se.

8.1 Accessories shall be marked as follows:

- rated current in amperes;
- rated voltage in volts;
- symbol for nature of supply;

10.1 Socket-outlets shall be so designed and constructed that when they are mounted and wired as for normal use, live parts are not accessible, even after removal of parts which can be removed without the use of a tool.

Live parts of plugs shall not be accessible when the plug is in partial or complete engagement with a socket-outlet.

11.1 Accessories with earthing contacts shall be so constructed that when inserting the plug the earth connection is made before the current-carrying contacts of the plug become live.

When withdrawing the plug, the current-carrying pins shall separate before the earth connection is broken.

13.1 Socket-contact assemblies shall have sufficient resilience to ensure adequate contact pressure on plug pins.

14.2 Pins of portable accessories shall have adequate mechanical strength.

A force of 100 N is exerted on the pin, which is supported as shown in figure 14, for 1 min in a direction perpendicular to the axis of the pin, by means of a steel rod having a diameter of 4,8 mm, the axis of which is also perpendicular to the axis of the pin.

During the application of the force, the reduction of the dimension of the pin at the point where the force is applied shall not exceed 0,15 mm.

After removal of the rod, the dimensions of the pin shall not have changed by more than 0,06 mm in any direction.

14.3 Pins of plugs shall be

- locked against rotation,
- not removable without dismantling the plug,
- adequately fixed in the body of the plug when the plug is wired and assembled as for normal use.

It shall not be possible to arrange the earthing or neutral pins or contacts of plugs in an incorrect position.

14.4 Earthing contacts and neutral contacts of portable socket-outlets shall be locked

against rotation and removable only with the aid of a tool, after dismantling the socket-outlet.

14.12 For rewirable portable accessories and non-rewirable non-moulded on portable

accessories it shall not be possible to remove covers, cover-plates or parts of them intended to ensure protection against electric shock without the use of a tool.

14.19 Combinations of portable accessories and switches, circuit-breakers or other devices shall comply with the relevant individual IEC standards, if a relevant combined product standard does not exist.

14.24 Plugs shall be shaped in such a way and made of such material that they can easily

be withdrawn by hand from the relevant socket-outlet.

In addition, the gripping surfaces shall be designed in such a way that the plug can be withdrawn without having to pull on the flexible cable.

22 Force necessary to withdraw the plug

The construction of accessories shall allow for easy insertion and withdrawal of the plug, and prevent the plug from working out of the socket-outlet in normal use.

Table 16 – Maximum and minimum withdrawal forces

Ratings	Number of poles	Withdrawal forces N	
		Multi-pin gauge	Single-pin gauge
		Maximum	Minimum
Up to and including 10 A	2	40	1,5
	3	50	
Above 10 A up to and including 16 A	2	50	2
	3	54	
	More than 3	70	
Above 16 A up to and including 32 A	2	80	3
	3	80	
	More than 3	100	

APPENDIX C – CUSTOMER NEEDS LIST

<u>Customer statement</u>	<u>Interpreted need</u>
No.	
1 I want no mess with the cords	The product eliminates messy cords
2 I want a discrete solution	The product is discrete
3 I want the plugs and sockets to be smaller	The plugs and sockets are smaller than today
4 I want the same standard all over the world	The product creates a world standard
5 I want it to be cheap	The product is cheap (same price or cheaper than today)
6 I want it to be reliable	The product has a robust design and is reliable
7 I want it to be safe	The product meets all safety regulations
8 I want it to be environmentally friendly	The product is environmentally friendly
9 I want it to be easy to detach the plug/use less force	The product makes it easy to detach the plug
10 I want to extend the power strip with one socket at a time	It is possible to extend the power strip one socket at a time
11 I want to control some sockets with a dimmer and some with a switch	The product allows the user to control separate sockets
12 I want it to be easy to install by electricians	The product is easy to install by electricians
13 I want to be able to attach it to the wall	The product is possible to attach to the wall
14 I want the cords to be thinner	The product has thinner cords
15 I want less cords	The product reduces the number of cords needed
16 I want to be able to fit several adapters next to each other (to big today)	The product makes room for several (bulky) adapters
17 I want the product to have a long life expectancy	The product lasts long

APPENDIX D – TARGET SPECIFICATIONS

Requirements

Metric No.	Need Nos.	Metric	Imp	Unit s	Marginal value	Ideal value	W
1	4	Compatibility with other standards	5	No	1	13	R
2	6	Reliability (no. of failures/year)	5	No	1	0	R
3	7	Safety (no. of injures/year)	5	No	0	0	R
4	17	Minimum consumer time (time from purchase to waste)	5	h	>250.000	>500.000	R

Wishes

Metric No.	Need Nos.	Metric	Imp	Unit s	Marginal value	Ideal value	W
5	10, 15	Minimum no. of cords needed to increase no. of sockets	5	No	<2	0	W
6	2, 3	Discrete appearance	3	Subj.	>3	>5	W
7	3	Maximum dimensions	4	mm	<H:65 D:55 W:65	H: 40 D: 35 W:40	W
8	5	Purchase price	4	SEK	<100	25	W
9	8	Environmental impact	4	GWP	-	0	W
10	9	Maximum force needed to detach the plug from the socket	3	N	70	10	W
11	9	Maximum time to detach the plug	4	s	<2	1	W
12	9	Maximum no. of hands needed to detach the plug	4	No	2	1	W
13	16	Minimum no. of different switches and dimmers that can be attached to the power strip	4	No	1	5	W
14	12	Maximum time for installation by electricians	3	min	5	3	W
15	12	Maximum no. of tools necessary for installation by electricians	3	No	3	3	W
16	14	Cord cross section area	1	mm ²	<28	10	W
17	1	Number of cords the customer needs	4	No	<3	0	W

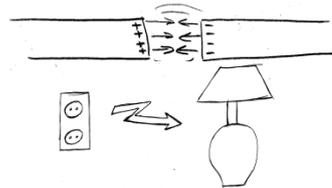
APPENDIX E – THE PRODUCT DEVELOPMENT PROCESS

SOLUTIONS FOR THE SUB-FUNCTIONS: PROBLEM 1

1. Magnetic

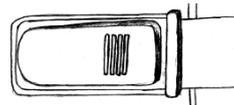
- i. "Magnet" – Permanent
- ii. "Magnet" – Electro magnet

iii. "Cordless"



2. Clips

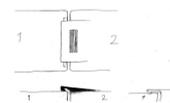
iv. "Handbag"



v. "On the side"



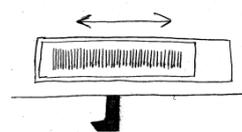
vi. "Push"



vii. "Inside"

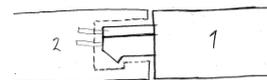


viii. "Computer"

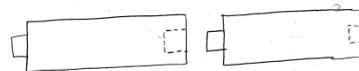


3. Plug

ix. "Hook"



x. "Ordinary"



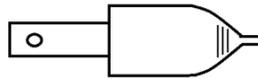
xi. "C19-C20"



xii. "Turn"

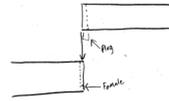


xiii. "Holes"

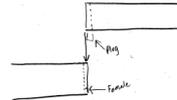


4. Slide

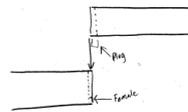
xiv. "Slide"



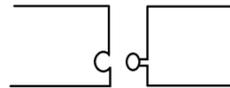
xv. "Slide with clips"



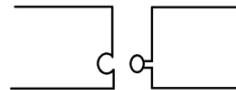
xvi. "Slide with magnet"



xvii. "Slide & Push"



xviii. "Push ball"



5. Glue

xix. "Glue"

xx. "Velcro"

xxi. "Tape"

xxii. "Suckers"



6. Fasteners

xxiii. "Screw"

xxiv. "Rivet"

xxv. "Nail"

xxvi. "Button"

PROBLEM 1

(Pros and cons)

Slide:

- "Solution R" has to extend outside "Solution S" to be able to slide "Solution R" into position
- Hard to make room for the child protection
- + "Solution R" is held in place properly which reduces the risk for "Solution R" coming apart when the plug is pulled

Magnetic:

- + Neat solution that is discrete on the outside
- + Easy to attach/detach "Solution R"
- Untested solution: - How big magnets are needed?
- Is the magnetic field affecting other functions in any way?

Plug:

- + Well tested
- + Possible to handle the different forces occurred by pulling the plug
- The female side is intruding on the volume of "Solution R"
- No distinct sound tell you when "Solution R" is in place

Clip:

- + Distinct sound tells when "Solution R" is in place
- + Possible to handle the different forces occurred by pulling the plug
- Risk of fractures/cracks
- An extra operation is needed when detaching "Solution R" from each other

Glue:

- + Takes "no " space
- Hard to detach
- Uncertain function

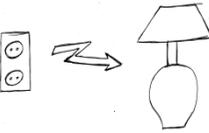
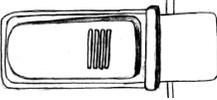
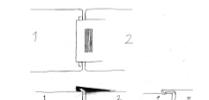
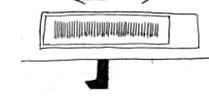
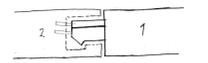
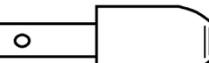
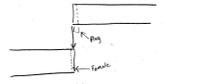
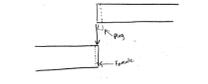
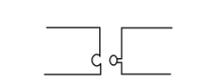
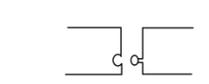
Fasteners:

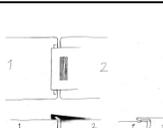
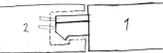
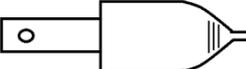
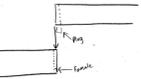
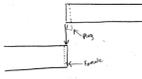
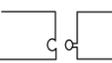
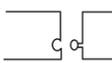
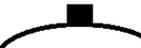
- + Standard components
- Not adapted for the construction

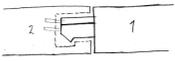
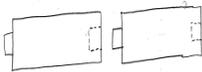
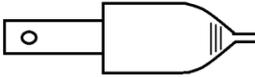
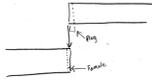
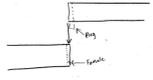
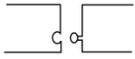
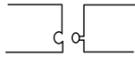
Analysis: The magnetic solution is discarded due to lack of knowledge when it comes to how/if they are affecting other functions in the solution.

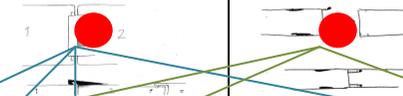
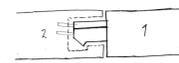
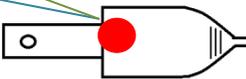
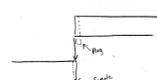
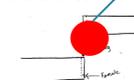
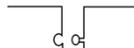
Both the plug and clip are interesting solutions, and particularly a combination of them seem to give a solution that is both well tested and also gives good feedback by its distinct sound.

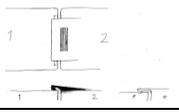
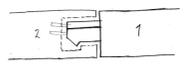
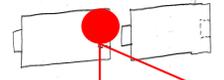
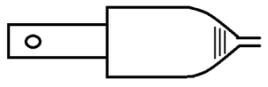
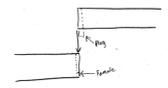
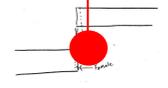
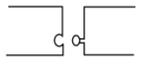
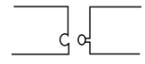
The conclusion is that the plug and clip in combination is further investigated as a final solution for "Problem 1".

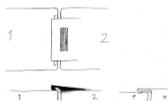
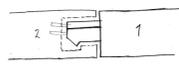
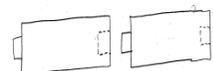
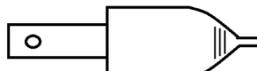
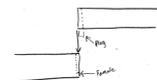
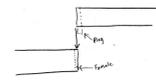
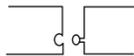
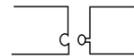
Number Criteria	1	2	3	4	5	6
A) Magnetic	Permanent 	Electro 				
B) Clips						
C) Plug						
D) Slide	Slide 	Slide with clips 	Slide with magnet 	Slide & Push 	Push ball 	
E) Glue	Glue	Velcro	Tape			
F) Fasteners	Screw	Rivet	Nail	Button		

Number Criteria	1	2	3	4	5	6
A) Magnetic	Permanent 	Electro 				
B) Clips						
C) Plug						
D) Slide	Slide 	Slide with clips 	Slide with magnet 	Slide & Push 	Push ball 	
E) Glue						
F) Fasteners						

Number	1	2	3	4	5	6	
Criteria							
A) Magnetic							
B) Clips							
C) Plug							
D) Slide	<p>Slide</p> 	<p>Slide with clips</p> 			<p>Slide & Push</p> 	<p>Push ball</p> 	
E) Glue							
F) Fasteners							

Number	1	2	3	4	5	6
Criteria						
A) Magnetic						
B) Clips						
C) Plug						
D) Slide	Slide 	Slide with clips 		Slide & Push 	Push ball 	
E) Glue						
F) Fasteners						

Number	1	2	3	4	5	6
Criteria						
A) Magnetic						
B) Clips						
C) Plug						
D) Slide	Slide 	Slide with clips 	Slide with magnet	Slide & Push 	Push ball 	
E) Glue						
F) Fasteners						

Number Criteria	1	2	3	4	5	6
A) Magnetic						
B) Clips						
C) Plug						
D) Slide	<p>Slide</p> 	<p>Slide with clips</p> 		<p>Slide & Push</p> 	<p>Push ball</p> 	
E) Glue						
F) Fasteners						

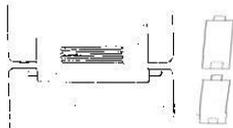
RESULTS FROM THE MORPHOLOGICAL MATRIX: PROBLEM 1

LEVEL A

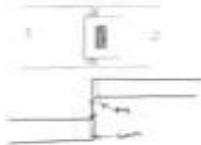
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LEVEL B

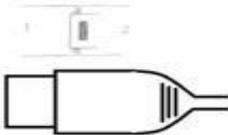
B3 - C2



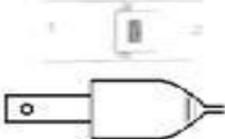
B3 - D2



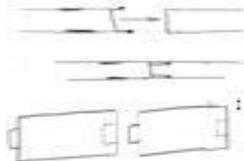
B3 - C3



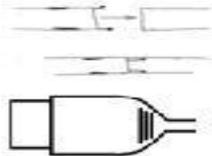
B3 - C5



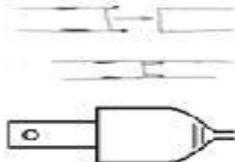
B4 - C2



B4 - C3

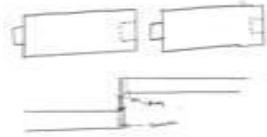


B4 - C5

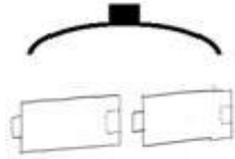


LEVEL C

C2 – D2



C2 – E4



LEVEL D

-

INDIVIDUAL ALTERNATIVES

C1

C2

C3

C4

C5

D1

D2

D4

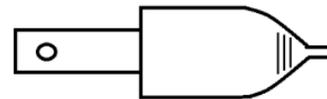
D5

Criteria	Alternative																			
	1	2	3	4	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
	B3-C2	B3-C3	B3-C5	B3-D2	B4-C2	B4-C3	B4-C5	C2-D2	C2-E4	C1	C2	C3	C4	C5	D1	D2	D4	D5		
Modularization	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Use standard components	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Number of parts	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Material adaptation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Time to assemble (installation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Manufacturing cost	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Able to produce in large numbers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Width	1	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Height	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Depth	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Weight	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Compatibility with other standards	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Environmentally friendly	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Safe	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Appearance	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Robust	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0	
User friendly	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Connection is able to withstand >500.000h	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0	
Connection withstands daily use	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Max No. of operations needed for "Performance DR"	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0	
Sum +		9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	
Sum 0		5	5	5	5	5	5	5	5	6	8	8	8	8	8	8	8	8	8	
Sum -		6	6	6	6	6	6	6	6	5	3	3	3	3	3	3	3	3	3	
Net value		3	3	3	3	3	3	3	3	4	6	6	6	6	6	6	6	6	6	
Ranking		3	3	3	3	3	3	3	3	2	1	1	1	1	1	1	1	1	1	
Further development		NO	NO	YES																

KESSELRING PROBLEM 1

Criteria	Solution																				
	w	Ideal		1 (C1)		2 (C2)		3 (C3)		4 (C4)		5 (C5)		6 (D1)		7 (D2)		8 (D4)		9 (D5)	
		v	t	v	t	v	t	v	t	v	t	v	t	v	t	v	t	v	t	v	t
Modularization	5	5	25	4	20	4	20	4	20	4	20	4	20	4	20	4	20	4	20	4	20
Use standard components	4	5	20	3	12	4	16	4	16	2	8	4	16	2	8	2	8	3	12	3	12
Number of parts	3	5	15	4	12	4	12	4	12	3	9	4	12	4	12	3	9	4	12	4	12
Material adaptation	3	5	15	5	15	5	15	5	15	3	9	5	15	5	15	5	15	5	15	5	15
Time to assemble (installation)	4	5	20	4	16	4	16	4	16	2	8	4	16	4	16	3	12	4	16	4	16
Manufacturing cost	4	5	20	3	12	4	16	3	12	3	12	4	16	4	16	3	12	4	16	4	16
Able to produce in large numbers	5	5	25	3	15	4	20	4	20	3	15	4	20	4	20	4	20	4	20	4	20
Width	3	5	15	4	12	4	12	3	9	2	6	4	12	4	12	3	9	3	9	4	12
Height	3	5	15	4	12	4	12	3	9	2	6	3	9	4	12	3	9	3	9	3	9
Depth	3	5	15	4	12	4	12	3	9	2	6	3	9	4	12	3	9	3	9	3	9
Weight	2	5	10	4	8	4	8	3	6	3	6	4	8	4	8	3	6	3	6	4	8
Environmentally friendly	4	5	20	4	16	4	16	3	12	3	12	4	16	3	12	3	12	4	16	4	16
Safe	5	5	25	4	20	4	20	3	15	3	15	4	20	4	20	4	20	4	20	4	20
Appearance	4	5	20	4	16	4	16	2	8	4	16	4	16	4	16	3	12	4	16	4	16
Robust	4	5	20	4	16	3	12	4	16	3	12	3	12	4	16	3	12	4	16	2	8
User friendly	5	5	25	4	20	4	20	3	15	3	15	4	20	4	20	3	15	4	20	4	20
Connection is able to withstand >500.000 hrs	5	5	25	5	25	5	25	5	25	4	20	5	25	4	20	3	15	5	25	5	25
Connection withstands daily use	5	5	25	5	25	5	25	5	25	5	25	5	25	5	25	4	20	5	25	5	25
Maximum number of operations needed for "Performance DR"	5	5	25	5	25	5	25	5	25	4	20	5	25	5	25	4	20	5	25	5	25
Requires space in "Solution R"	5	5	25	2	10	2	10	2	10	2	10	4	20	3	15	3	15	4	20	4	20
Total		100	405	79	319	64	328	55	295	45	250	81	332	79	320	66	270	79	327	79	324
Rel. total		1	1	0,79	0,79	0,64	0,81	0,55	0,73	0,45	0,62	1,80	1,33	1,76	1,28	1,47	1,08	1,52	1,21	1,20	1,20
Mean		5	19,1	3,88	14,6	4,00	15,2	3,44	13,1	2,81	10,9	3,88	14,8	3,88	14,7	3,25	12,5	3,75	14,5	3,75	14,3
Rank		-	-	6	6	2	2	7	7	9	9	1	1	5	5	8	8	3	3	4	4
Further development		-	-	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO

C5



XV

PROBLEM 2

A. Magnetic

i. "Magnet"



ii. "Electro magnet"

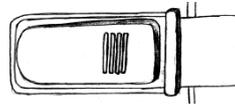


iii. "WiTricity"



B. Clips

iv. "Handbag"



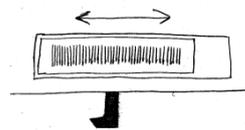
v. -

vi. "Push"

vii. "Inside"



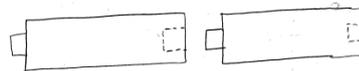
viii. "Computer"



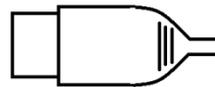
C. Plug

ix. -

x. "Ordinary"



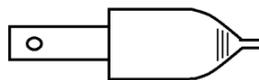
xi. "C19-C20"



xii. "Turn"

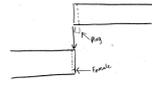


xiii. "Holes"

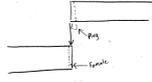


D. Slide

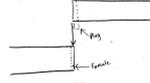
xiv. "Slide"



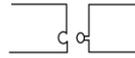
xv. "Slide with clips"



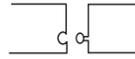
xvi. "Slide with magnet"



xvii. "Slide & Push"



xviii. "Push ball"



E. Glue

xix. "Glue"

xx. "Velcro"

xxi. "Tape"

xxii. "Suckers"



F. Fasteners

xxiii. "Screw"

xxiv. "Rivet"

xxv. "Nail"

xxvi. "Button"

PROBLEM 2

Some of the different solutions presented under “Problem 2” are now analyzed in order for being used in “Problem 2”. But some modifications of the pros and cons are done because of the different conditions. Slide is excluded due to the fact that one has to slide “Solution S” in place from the end of “Solution R” and therefore “Performance IS” is removed.

Magnetic:

- + Neat solution that is discrete on the outside
- + Easy to attach/detach “Solution S”
 - Untested solution:
 - How big magnets are needed?
 - Is the magnetic field affecting other functions in any way?

Plug:

- + Well tested
- + Possible to handle the different forces occurred by pulling the plug
- The female side is intruding on the volume of “Solution R”
- No distinct sound tell you when “Solution S” is in place

Clip:

- + Distinct sound tells when “Solution S” is in place
- + Possible to handle the different forces occurred by pulling the plug
- An extra operation is needed for “Performance DR”

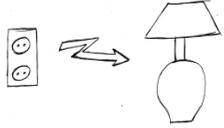
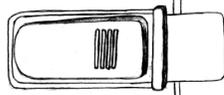
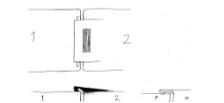
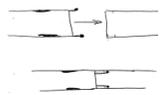
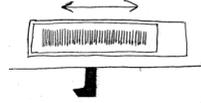
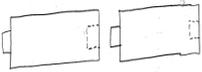
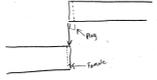
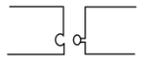
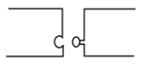
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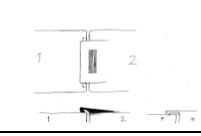
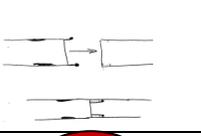
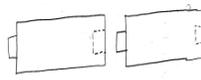
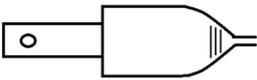
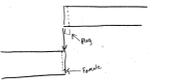
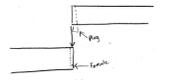
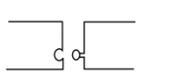
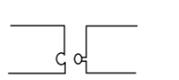
The same conclusions are drawn about the magnetic connection as in the section “Problem 1”. That is, it is discarded due to lack of knowledge about the magnets implications on other functions.

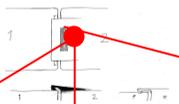
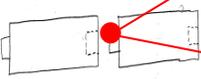
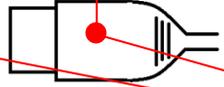
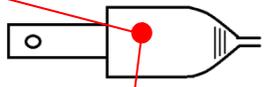
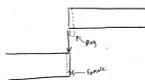
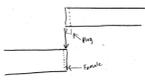
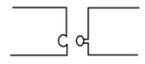
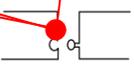
Here the combination of a plug and a clip is a promising solution. The weakness of no distinct sound listed under “Plug” is compensated by its contradistinction under “Clip”. This leaves two negative aspects by combining the two solutions, “intrusion of the volume of “Solution R” and “extra operation”.

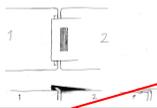
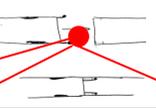
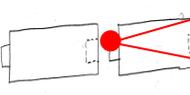
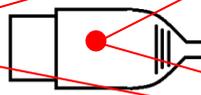
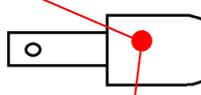
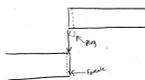
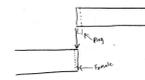
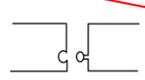
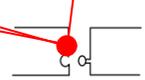
The extra operation needed to detach “Solution S” seems like a small price to pay for having a reliable function and making sure that “Solution S” does not come lose when the plug is pulled.

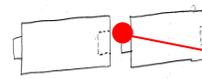
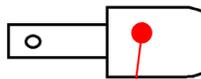
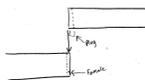
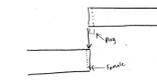
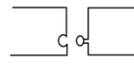
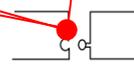
The aspect of “intrusion of volume of “Solution R”” on the other hand is much more worrying. In order to make the final product sellable on the market, the size is of utmost importance. The product must not be regarded as big and cumbersome by the customer, and the size is also one of criteria in the requirement list. So the fact that the “Plug” solution is requiring a lot of volume in “Solution R” is of great concern. On the other hand, the solution is well tested and reliable, and should therefore be investigated further. Also, because “Solution R” is intended to achieve “Performance RS”, the cavity in “Solution R” is to be designed in line with the plug and “Solution S” already used today.

Number Criteria	1	2	3	4	5	6
A) Magnetic	Permanent 	Electro 				
B) Clips						
C) Plug						
D) Slide	Slide 	Slide with clips 	Slide with magnet 	Slide & Push 	Push Ball 	
E) Glue	Glue	Velcro	Tape			
F) Fasteners	Screw	Rivet	Nail	Button		

Number	1	2	3	4	5	6
Criteria						
A) Magnetic	Permanent 	Electro 				
B) Clips						
C) Plug						
D) Slide	Slide 	Slide with clips 	Slide with magnet 	Slide & Push 	Push Ball 	
E) Glue						
F) Fasteners						

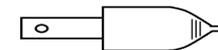
Number Criteria	1	2	3	4	5	6
A) Magnetic						
B) Clips						
C) Plug						
D) Slide	 Slide	 Slide with clips		 Slide & Push	 Push Ball	
E) Glue						
F) Fasteners						

Number Criteria	1	2	3	4	5	6
A) Magnetic						
B) Clips						
C) Plug						
D) Slide	<p>Slide</p> 	<p>Slide with clips</p> 		<p>Slide & Push</p> 	<p>Push Ball</p> 	
E) Glue						
F) Fasteners						

Number Criteria	1	2	3	4	5	6
A) Magnetic						
B) Clips						
C) Plug						
D) Slide	<p>Slide</p> 	<p>Slide with clips</p> 		<p>Slide & Push</p> 	<p>Push Ball</p> 	
E) Glue						
F) Fasteners						

Criteria	Alternative															
	1 (Existing)	2 (B3- C2- D5)	3 (B3- C3- D5)	4 (B3- C5- D5)	5 (B4- C2- D5)	6 (B4- C3- D5)	7 (B4- C5- D5)	8 (C2- D5)	9 (C3- D5)	10 (C5- D5)	11 (C3)	12 (C5)	13 (D1)	14 (D2)	15 (D4)	16 (D5)
Modularization	REFERENCE	+	+	+	+	+	+	+	+	+	0	0	0	0	0	0
Use standard components		-	-	-	-	-	-	-	-	-	0	0	-	-	-	-
Number of parts		-	-	-	-	-	-	-	-	-	0	0	0	-	+	+
Material adaptation		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Time to assemble (installation)		-	-	-	-	-	-	0	0	0	0	0	0	-	0	0
Manufacturing cost		-	-	-	-	-	-	-	-	-	-	0	-	-	0	0
Able to produce in large numbers		-	-	-	-	-	-	-	-	-	0	0	0	0	0	0
Width		0	0	0	0	0	0	0	0	0	+	0	0	0	+	+
Height		0	0	0	0	0	0	0	0	0	+	0	0	0	+	+
Depth		0	0	0	0	0	0	0	0	0	+	0	0	0	+	+
Weight		-	-	-	-	-	-	-	-	-	+	0	+	-	+	+
Compatibility with other standards		-	-	-	-	-	-	-	-	-	0	0	-	-	-	-
Environmentally friendly		0	0	0	0	0	0	0	0	0	0	0	0	-	0	0
Safe		0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
Appearance		-	-	-	-	-	-	-	-	-	0	0	0	-	0	0
Robust		-	-	-	-	-	-	+	+	+	0	0	0	-	+	+
User friendly		-	-	-	-	-	-	0	0	0	0	+	0	0	0	0
Connection is able to withstand >500.000h		-	-	-	-	-	-	0	0	0	0	0	0	-	0	0
Connection withstands daily use		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maximum number of operations needed for "Solution DR".		-	-	-	-	-	-	0	0	0	0	0	0	-	0	0
Sum +	0	1	1	1	1	1	1	2	2	2	4	1	1	0	6	6
Sum 0	0	7	7	7	7	7	7	11	11	11	15	19	16	9	12	12
Sum -	0	12	12	12	12	12	12	7	7	7	1	0	3	11	2	2
Net value	0	-11	-11	-11	-11	-11	-11	-5	-5	-5	3	1	-2	-11	4	4
Ranking	4	7	7	7	7	7	7	6	6	6	2	3	5	7	1	1
Further development		NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	NO	NO	YES	YES

Criteria	w	Solution									
		Ideal		1 (C3)		2 (C5)		3(D4)		4 (D5)	
		v	t	v	t	v	t	v	t	v	t
Modularization	5	5	25	3	15	3	15	3	15	3	15
Use standard components	4	5	20	4	16	4	16	2	8	2	8
Number of parts	3	5	15	4	12	4	12	3	9	3	9
Material adaptation	3	5	15	4	12	4	12	4	12	4	12
Time to assemble (installation)	4	5	20	4	16	4	16	4	16	4	16
Manufacturing cost	4	5	20	2	8	4	16	3	12	3	12
Able to produce in large numbers	5	5	25	4	20	4	20	3	15	3	15
Width	3	5	15	4	12	4	12	4	12	4	12
Height	3	5	15	4	12	4	12	4	12	4	12
Depth	3	5	15	4	12	4	12	4	12	4	12
Weight	2	5	10	4	8	4	8	4	8	4	8
Compatibility with other standards	5	5	25	2	10	3	15	2	10	2	10
Environmentally friendly	4	5	20	3	12	3	12	3	12	3	12
Safe	5	5	25	2	10	4	20	4	20	4	20
Appearance	4	5	20	3	12	3	12	3	12	3	12
Robust	4	5	20	3	12	4	16	4	16	3	12
User friendly	5	5	25	4	20	4	20	4	20	4	20
Connection is able to withstand >500.000h	5	5	25	4	20	4	20	4	20	4	20
Connection withstands daily use	5	5	25	4	20	4	20	4	20	4	20
Maximum number of operations needed for "Performance DR".	5	5	25	4	20	4	20	4	20	4	20
Required space in "Solution R"	5	5	25	2	10	4	20	4	20	4	20
Total		105	430	72	289	80	326	74	301	73	297
Rel. total		1	1	0,69	0,67	0,76	0,76	0,93	0,92	0,91	0,91
Mean		5	19,4	3,4	12,9	3,8	14,5	3,4	13,0	3,4	12,8
Rank		-		4		1		2		3	
Further development				NO		YES		NO		NO	



APPENDIX F – EXPLORING ENVIRONMENTAL IMPACT

PROTOTYPE

The prototype consists of several components. Table 2 presents the material composition of “Solution R” whilst Table 3 deals with the material composition of “Solution S”.

TABLE 2 FIGURES ON MATERIAL COMPOSITION OF “SOLUTION R” THE PROTOTYPE.

Down	Material	Volume (cm ³)	Density (g/ cm ³)	Mass (g)
Box	ABS/PC	22,0	1,065	23,4
Lid	ABS/PC	3,2	1,065	3,4
Child protection	ABS/PC	1,8	1,065	<u>1,9</u>
Subtotal ABS/PC				28,7
Metal prong (L) (2 pcs)	Brass	1,3	8,4	10,9
Metal prong [®] (2 pcs)	Brass	1,2	8,4	10,1
Earth prong	Brass	0,7	8,4	<u>5,9</u>
Subtotal brass				26,9
Subtotal				55,6

TABLE 3 COMPOSITION OF “SOLUTION S” THE PROTOTYPE

UP	Material	Volume (cm ³)	Density (g/ cm ³)	Mass (g)
Top	ABS/PC	16,9	1,065	18,0
Child protection	ABS/PC	3,1	1,065	3,3
Top bottom	ABS/PC	11,1	1,065	<u>11,8</u>
Subtotal ABS/PC				33,1
Earth prong 1	Brass	0,4	8,4	3,3
Earth prong 2	Brass	0,3	8,4	2,5
Holder (2 pcs)	Brass	1,4	8,4	<u>11,8</u>
Subtotal brass				17,6
Subtotal				50,7

EXISTING SOLUTION

FIGURES ON MATERIAL COMPOSITION OF THE EXISTING SOLUTION.

Single	Material	Volume (cm ³)	Density (g/ cm ³)	Mass (g)
Top	ABS/PC	16,9	1,065	18,0
Child protection	ABS/PC	3,1	1,065	3,3
Top bottom	ABS/PC	11,1	1,065	11,8
Housing	ABS/PC	34,4	1,065	<u>36,6</u>
Subtotal ABS/PC				69,7
Earth prong 1	Brass	0,4	8,4	3,3
Earth prong 2	Brass	0,3	8,4	2,5
Holder (2 pcs)	Brass	1,4	8,4	<u>11,8</u>
Subtotal brass				17,6
Subtotal				87,3

COMPARISON

The prototype, for comparative reasons, is assumed to consist of three “Solution R”, see Table 11, and three “Solution S”, see Table 12. The existing solution, to which the prototype is to be compared to, is assumed to be made up by three “Solution S”, see Table 15. This is an assumption that is made, based on the authors’ perception of a common power strip.

PROTOTYPE

TABLE 11 FIGURES ON MATERIAL COMPOSITION OF THREE “SOLUTION R” OF THE PROTOTYPE

DOWN (3)	Material	Volume (cm ³)	Density (g/ cm ³)	Mass (g)
Box	ABS/PC	66	1,065	70,2
Lid	ABS/PC	9,6	1,065	10,2
Child protection	ABS/PC	5,4	1,065	<u>5,7</u>
Subtotal ABS/PC				86,1
Metal prong (L) (2 pcs)	Brass	3,9	8,4	32,7
Metal prong [®] (2 pcs)	Brass	3,6	8,4	30,3
Earth prong	Brass	2,1	8,4	<u>17,7</u>
Subtotal brass				80,7
Subtotal				166,8

TABLE 12 FIGURES ON MATERIAL COMPOSITION OF THREE "SOLUTION S" OF THE PROTOTYPE

UP (3)	Material	Volume (cm ³)	Density (g/ cm ³)	Mass (g)
Top	ABS/PC	50,7	1,065	54,0
Child protection	ABS/PC	9,3	1,065	9,9
Top bottom	ABS/PC	33,3	1,065	<u>35,5</u>
Subtotal ABS/PC				99,4
Earth prong 1	Brass	1,2	8,4	10,0
Earth prong 2	Brass	0,9	8,4	7,6
Holders (2 pcs)	Brass	4,2	8,4	<u>35,3</u>
Subtotal brass				52,9
Subtotal				152,3

EXISTING SOLUTION

The existing solution is comprised of three outlets, see Table 15, a common power strip for everyday use

TABLE 15 FIGURES ON MATERIAL COMPOSITION OF TA POWER STRIP WITH THREE OUTLETS.

Power strip (3)	Material	Volume (cm ³)	Density (g/ cm ³)	Mass (g)
Top	ABS/PC	50,7	1,065	54,0
Child protection	ABS/PC	9,3	1,065	9,9
Top bottom	ABS/PC	33,3	1,065	35,5
Housing	ABS/PC	103,3	1,065	<u>110,0</u>
Subtotal ABS/PC				209,4
Earth prong 1	Brass	1,2	8,4	10,1
Earth prong 2	Brass	0,9	8,4	7,6
Holders (2 pcs)	Brass	4,2	8,4	<u>35,3</u>
Subtotal brass				52,9
Subtotal				262,3

APPENDIX G – PLASTICS MANUFACTURER

E-MAIL FROM PLASTICS MANUFACTURER

Hej, jag har som hastigast titta på filerna och kan konstatera följande.

Dessa produkter är något vi kan köra men vi kan ha svårt med att hitta kapacitet i rätt maskin.

Verktygsmässigt kanske man kan köra alla detaljer i samma verktyg vilket gör att verktygskostnad går att hålla nere.

Skulle tro att ett verktyg med ett formrum per detalj skulle hamna runt 100.000 SEK.

Detaljerna måste anpassas för formsprutning med släppvinklar och vissa justeringar på godstjocklekar, (som är väldigt ojämn på den stora detaljen.)

Detaljer körda i 25.000 batcher hamnar på ca 2,50 – 2,75 per sats(med alla 4 detaljer).

Montering ingår då ej, detta är något man får titta på närmare, beroende på vilka moment som behövs.

Hoppas ni kommer längre med denna uppskattning som vi gjort till er.

Skulle ni ha några frågor så hör av er.

APPENDIX H – ANSWERS ON SURVEY

ANSWERS ON SURVEY

PERSON 1

Vad anser du om dagens eluttag, grenkontakter, och sladdar?

Skitkvalité och dåligt utbud. Verkar som alla kommer från samma skitfabrik, och hittar inte någonstans avvikande modeller.

Vad anser du om inköpspris på ovanstående artiklar?

Ok.

Är du beredd att betala mer för ett miljövänligt alternativ? (Miljövänligt material, mindre materialåtgång, mindre energiåtgång)

Hur mycket?

Jag är beredd att betala ~50% mer för det.

Tycker du att det skulle vara bra med produkter som inte tar så mycket plats?

Om ja på ovanstående: Skulle du vara beredd att betala mer för en sådan (mindre) produkt? Hur mycket?

Jag är beredd att betala 300% mer för det.

Tycker du ett snyggare utseende på ovanstående produkter skulle motivera ett högre pris (även om storleken är som nuvarande)?

Om ja på ovanstående: Skulle du vara beredd att betala mer för en sådan (snyggare) produkt? Hur mycket?

Jag är beredd att betala 300% mer för det. Dvs typ 70 SEK.

Försök att förklara vad du anser vara ett snyggare alternativ till dagens produkter.

Obrutna linjer. Stilrena linjer. INGEN IDIOTISK SWITCH. Håll med mer genomarbetade säkerhetslås. Jordning gjord med kvalitet. Konsistena färgval.

Hur upplever du problematiken med adaptrar vid resor utomlands?

Vad tycker du man borde göra åt det?

Det funkar.

Skulle en enhetlig världsstandard motivera ett högre pris på ovanstående artiklar?

Ja.

Hur mycket?

100%. dvs 19 SEK.

Har du någon gång upplevt säkerhetsproblem med nuvarande produkter?

Om ja på ovanstående:

Vad hände?

Säkerhetslåsmekanismen till hålen av tveksam kvalitet. Blockerar ofta fastän jag trycker i kontakt på korrekt sätt. Jag får använda våld och misshandla säkerhetsmekanismen som säkerligen är mindre tillförlitlig efteråt.

Vad tycker du bör göras åt det?

Höja kvalitén. Importera till sverige mer än 1 modell från 1 fabrik. Använd olika tillverkare som konkurrerar med varandra. Reglera marknaden så att den inte degenererar till monopol av ett eller annat slag. Se till att demokratin tar plats på den internationella arenan. Vi behöver demokrati som står över den nationella nivån. När man röstar borde man rösta på följande:

Land

Kontinent

Globalt

(Kommuner kan avskaffas)

Om man har demokrati på global nivå, kan man reglera de multinationella företagen och tillse att konkurrens/marknadsekonomin upprätthålls och inte degenererar till monopolsituationer.

Köper du ofta grenkontakter som är försedda med strömbrytare?

Nej.

Har du några tankar eller önskemål om detta?

Jag hatar dem. Använder aldrig strömbrytare på grenkontakter. De är dessutom otroligt fula och tar plats.

Skulle du önska att det fanns grenkontakter försedda med t.ex. dimmer?

Nej, fy bövelen vad vidrigt.

Finns det fler alternativ (förutom grenkontakter och dimmer) som du skulle önska fanns på en grenkontakt?

Jag vill att de skall vara uppkopplade på nätet och innehålla sensorer. De borde finnas varianter där det sitter en modul med processor och wifi-krets. Sensorer. Switchar. Programvara som kopplar upp sig på nätet. Sedan kan man registrera sig på ett konto i en web-portal hos tillverkaren och kolla upp kWh-konsumtion, nuvarande ampere-förbrukning, etc. Man kan stänga av och på enskilda "grenar".

Vad skulle jag vara beredd att betala för det?

500 kronor.

Upplever du något problem med att ta ur/sätta i stickproppen i ett eluttag:

Ur väggen?

Nej.

Ur en grenkontakt?

Ja. Det är ofta problem med säkerhetslåssystemet på de grenkontakter som kommer från den där fabriken som tillverkar alla grenkontakter som importeras till sverige.

PERSON 2

Vad anser du om dagens eluttag, grenkontakter, och sladdar?

Eluttag: OK, men inte så flexibelt (väggmontage).

Grenkontakter: Onödigt stora för de allra flesta apparater.

Sladdar: Naturligtvis överdimensionerade de också i många fall, men om allt från 2 kW värmefläktar till väckarklockor ska ha samma anslutning är det inte mycket att göra åt.

Vad anser du om inköpspris på ovanstående artiklar?

Billigt.

Är du beredd att betala mer för ett miljövänligt alternativ? (Miljövänligt material, mindre materialåtgång, mindre energiåtgång)

Hur mycket?

Ja, ca 25 %.

Tycker du att det skulle vara bra med produkter som inte tar så mycket plats?

Om ja på ovanstående: Skulle du vara beredd att betala mer för en sådan (mindre) produkt? Hur mycket?

Ja, ca 50%.

Tycker du ett snyggare utseende på ovanstående produkter skulle motivera ett högre pris (även om storleken är som nuvarande)?

Om ja på ovanstående: Skulle du vara beredd att betala mer för en sådan (snyggare) produkt? Hur mycket?

Försök att förklara vad du anser vara ett snyggare alternativ till dagens produkter.

Nej.

Hur upplever du problematiken med adaptrar vid resor utomlands?

Vad tycker du man borde göra åt det?

Skulle en enhetlig världsstandard motivera ett högre pris på ovanstående artiklar? Hur mycket?

Inte så krångligt, ofta är det bara en adapter som behövs, och man har inte många prylar med sig som behöver ström.

Men naturligtvis hade en världsstandard varit bättre, men det får nog drivas av fördelar för producenterna istället för konsumenter.

Har du någon gång upplevt säkerhetsproblem med nuvarande produkter?

Om ja på ovanstående:

Vad hände?

Vad tycker du bör göras åt det?

Nej.

Köper du ofta grenkontakter som är försedda med strömbrytare?

Har du några tankar eller önskemål om detta?

Skulle du önska att det fanns grenkontakter försedda med t.ex. dimmer?

Finns det fler alternativ (förutom grenkontakter och dimmer) som du skulle önska fanns på en grenkontakt?

Nej, har en eller två. Plus några trådlösa. Och ett antal timrar.

Upplever du något problem med att ta ur/sätta i stickproppen i ett eluttag:

Ur väggen?

Ur en grenkontakt?

Nej.

PERSON 3

Vad anser du om dagens eluttag, grenkontakter, och sladdar?

Stora, fula tröga/svåra att ta ur ibland.

Vad anser du om inköpspris på ovanstående artiklar?

Vet ej.

Är du beredd att betala mer för ett miljövänligt alternativ? (Miljövänligt material, mindre materialåtgång, mindre energiåtgång)

Hur mycket?

Ja, 20-25%.

Tycker du att det skulle vara bra med produkter som inte tar så mycket plats?

Ja, självklart.

Om ja på ovanstående: Skulle du vara beredd att betala mer för en sådan (mindre) produkt? Hur mycket?

Vet inte 20-30%.

Tycker du ett snyggare utseende på ovanstående produkter skulle motivera ett högre pris (även om storleken är som nuvarande)?

Ja.

Om ja på ovanstående: Skulle du vara beredd att betala mer för en sådan (snyggare) produkt? Hur mycket?

20-30%

Försök att förklara vad du anser vara ett snyggare alternativ till dagens produkter.

Smidigare, mindre, lättare att dölja.

Hur upplever du problematiken med adaptrar vid resor utomlands?

Tröttsamt.

Vad tycker du man borde göra åt det?

Ett enhetligt system.

Skulle en enhetlig världsstandard motivera ett högre pris på ovanstående artiklar? Hur mycket?

Ja, 20-30%.

Har du någon gång upplevt säkerhetsproblem med nuvarande produkter?

Nej, inte vad jag kan komma på.

Om ja på ovanstående:

Vad hände?

Vad tycker du bör göras åt det?

Köper du ofta grenkontakter som är försedda med strömbrytare?

Ibland.

Har du några tankar eller önskemål om detta?

Bra att kunna stänga av strömmen till just den kontakten.

Skulle du önska att det fanns grenkontakter försedda med t.ex. dimmer?

Ja.

Finns det fler alternativ (förutom grenkontakter och dimmer) som du skulle önska fanns på en grenkontakt?

Upplever du något problem med att ta ur/sätta i stickproppen i ett eluttag:

Ur väggen?

Om det är gamla väggkontakter som följer med ut ur väggen när man drar ur en stickpropp.

Ur en grenkontakt?

Tröga och osmidiga, speciellt jordade kontakter.

PERSON 4

Vad anser du om dagens eluttag, grenkontakter, och sladdar?

De är klumpiga, tråkigt utförande

Vad anser du om inköpspris på ovanstående artiklar? lågt

Är du beredd att betala mer för ett miljövänligt alternativ? ja (Miljövänligt material, mindre materialåtgång, mindre energiåtgång)

Hur mycket? 25%ytterligare ca

Tycker du att det skulle vara bra med produkter som inte tar så mycket plats? ja

Om ja på ovanstående: Skulle du vara beredd att betala mer för en sådan (mindre) produkt? Hur mycket? ja, totalt 25%

Tycker du ett snyggare utseende på ovanstående produkter skulle motivera ett högre pris (även om storleken är som nuvarande)?

Något

Om ja på ovanstående: Skulle du vara beredd att betala mer för en sådan (snyggare) produkt? Hur mycket? totalt 25%

Försök att förklara vad du anser vara ett snyggare alternativ till dagens produkter.

Mer diskret, rundade former

Hur upplever du problematiken med adaptrar vid resor utomlands? För många

Vad tycker du man borde göra åt det?

universal

Skulle en enhetlig världsstandard motivera ett högre pris på ovanstående artiklar? Hur mycket? ???????

Har du någon gång upplevt säkerhetsproblem med nuvarande produkter?

nej

Om ja på ovanstående:

Vad hände?

Vad tycker du bör göras åt det?

Köper du ofta grenkontakter som är försedda med strömbrytare? nej

Har du några tankar eller önskemål om detta?

Skulle du önska att det fanns grenkontakter försedda med t.ex. dimmer? som alternativ

Finns det fler alternativ (förutom grenkontakter och dimmer) som du skulle önska fanns på en grenkontakt?

Timer

Upplever du något problem med att ta ur/sätta i stickproppen i ett eluttag:

Ur väggen? ja,

för hårda i bland

Ur en grenkontakt? ja, för hårda i bland

PERSON 5

Vad anser du om dagens eluttag, grenkontakter, och sladdar?

Efter krav om jordning har lösningarna blivit klumpigare. Sladdarna grövre och svårare att gömma undan...

Vad anser du om inköpspris på ovanstående artiklar?

Är ofta en lockvara hos IKEA, Elgiganten, Expert... Kunderna har blivit bortskämda. Flergrensuttag med strömbrytare klumpiga, men praktiska.

Är du beredd att betala mer för ett miljövänligt alternativ? (Miljövänligt material, mindre materialåtgång, mindre energiåtgång)

Hur mycket? **Upp till det dubbla, ibland mer, beroende på utseende och funktion.**

Tycker du att det skulle vara bra med produkter som inte tar så mycket plats? **Ja, se ovan.**

Om ja på ovanstående: Skulle du vara beredd att betala mer för en sådan (mindre) produkt? Hur mycket? **Se ovan.**

Tycker du ett snyggare utseende på ovanstående produkter skulle motivera ett högre pris (även om storleken är som nuvarande)? **Ja**

Om ja på ovanstående: Skulle du vara beredd att betala mer för en sådan (snyggare) produkt? Hur mycket? **Sladdlängden spelar in... 100-lapp övre gräns?**

Försök att förklara vad du anser vara ett snyggare alternativ till dagens produkter. **Produkterna ska inte uppmärksammas, bara finnas där med god funktion för lampor, radio, TV, element, julgran etc som är "huvudobjekt" i sammanhanget.**

Hur upplever du problematiken med adaptrar vid resor utomlands?

Onödigt klumpiga. Jobbigt med special.

Vad tycker du man borde göra åt det? **Enhetligt och komprimerat.**

Skulle en enhetlig världsstandard motivera ett högre pris på ovanstående artiklar? **Ja**. Hur mycket? **Svårare att säga eftersom de oftast följer med en annan produkt och är inbakade i priset.**

Har du någon gång upplevt säkerhetsproblem med nuvarande produkter? **Inte ofta.**

Om ja på ovanstående:

Vad hände? **Gamla grejor, sladdbrott.**

Vad tycker du bör göras åt det? **Ingen produkt har väl livstid idag om det inte är kostnadsneutralt!**

Köper du ofta grenkontakter som är försedda med strömbrytare?

Har du några tankar eller önskemål om detta? **Ja av bekvämlighet och ur säkerhetssynpunkt.**

Skulle du önska att det fanns grenkontakter försedda med t.ex. dimmer? **Ja**

Finns det fler alternativ (förutom grenkontakter och dimmer) som du skulle önska fanns på en grenkontakt? **Fler uttag utan att grenkontakten växer ut så mycket...**

Upplever du något problem med att ta ur/sätta i stickproppen i ett eluttag:

Ur väggen? **I är ibland bökigt, för trögt. Adaptrar får ibland inte plats i fleruttag.**

Ur en grenkontakt? **Adaptrar får ibland inte plats i fleruttag.**

PERSON 6

Vad anser du om dagens eluttag, grenkontakter, och sladdar?

Jag är nog ganska nöjd med dagens utbud av elartiklar.

Vad anser du om inköpspris på ovanstående artiklar?

Vet ej då jag är väldigt lite insatt om detta.

Är du beredd att betala mer för ett miljövänligt alternativ? (Miljövänligt material, mindre materialåtgång, mindre energiåtgång)

Hur mycket?

Nej

Tycker du att det skulle vara bra med produkter som inte tar så mycket plats?

Om ja på ovanstående: Skulle du vara beredd att betala mer för en sådan (mindre) produkt? Hur mycket?

Tycker du ett snyggare utseende på ovanstående produkter skulle motivera ett högre pris (även om storleken är som nuvarande)?

Nej

Om ja på ovanstående: Skulle du vara beredd att betala mer för en sådan (snyggare) produkt? Hur mycket?

Försök att förklara vad du anser vara ett snyggare alternativ till dagens produkter.

Hur upplever du problematiken med adaptrar vid resor utomlands ?

Vad tycker du man borde göra åt det?

Skulle en enhetlig världs standard motivera ett högre pris på ovanstående artiklar? Hur mycket?

Har alltid funkat för mig utomlands.

Har du någon gång upplevt säkerhetsproblem med nuvarande produkter?

Om ja på ovanstående:

- Vad hände?
- Vad tycker du bör göras åt det?

Ickejordade uttag är ett problem.

Köper du ofta grenkontakter som är försedda med strömbrytare?

Har du några tankar eller önskemål om detta?

Skulle du önska att det fanns grenkontakter försedda med t.ex. dimmer?

Finns det fler alternativ (förutom grenkontakter och dimmer) som du skulle önska fanns på en grenkontakt?

Jag köper ofta grenkontakter med strömbrytare dock är jag dålig på att stänga dom.

Upplever du något problem med att ta ur/sätta i stickproppen i ett eluttag:

Ur väggen?

Ur en grenkontakt?

Aldrig.

PERSON 7

Vad anser du om dagens eluttag, grenkontakter, och sladdar?

Önskar fler eluttag.

Vad anser du om inköpspris på ovanstående artiklar?

Har ingen aning

Är du beredd att betala mer för ett miljövänligt alternativ? (Miljövänligt material, mindre materialåtgång, mindre energiåtgång)

Hur mycket?

Vet ej vad de kostar annars

Tycker du att det skulle vara bra med produkter som inte tar så mycket plats?

Ja

Om ja på ovanstående: Skulle du vara beredd att betala mer för en sådan (mindre) produkt? Hur mycket?

Kan jag tänka mej

Tycker du ett snyggare utseende på ovanstående produkter skulle motivera ett högre pris (även om storleken är som nuvarande)?

Nej

Om ja på ovanstående: Skulle du vara beredd att betala mer för en sådan (snyggare) produkt? Hur mycket?

Försök att förklara vad du anser vara ett snyggare alternativ till dagens produkter.

Hur upplever du problematiken med adaptrar vid resor utomlands? Har inte haft direkta problem med de

Vad tycker du man borde göra åt det?

Skulle en enhetlig världsstandard motivera ett högre pris på ovanstående artiklar? Hur mycket?

Har du någon gång upplevt säkerhetsproblem med nuvarande produkter?

Ja

Vad hände?

Eluttaget släpper från väggen

Vad tycker du bör göras åt det?

Vet ej

Köper du ofta grenkontakter som är försedda med strömbrytare?

Ja

Har du några tankar eller önskemål om detta?

Skulle du önska att det fanns grenkontakter försedda med t.ex. dimmer?

Skulle va bra

Finns det fler alternativ (förutom grenkontakter och dimmer) som du skulle önska fanns på en grenkontakt?

Upplever du något problem med att ta ur/sätta i stickproppen i ett eluttag:

Ur väggen?

Nej

Ur en grenkontakt?

Ja trögare

PERSON 8

Vad anser du om dagens eluttag, grenkontakter, och sladdar?

Finns en uppsjö av modeller, har inte några synpunkter på att det saknas något. Nej

Vad anser du om inköpspris på ovanstående artiklar?

OK

Är du beredd att betala mer för ett miljövänligt alternativ? (Miljövänligt material, mindre materialåtgång, mindre energiåtgång)

Hur mycket?

Ja, ca 10%

Tycker du att det skulle vara bra med produkter som inte tar så mycket plats?

Om ja på ovanstående: Skulle du vara beredd att betala mer för en sådan (mindre) produkt? Hur mycket?

Ja, 25 %

Tycker du ett snyggare utseende på ovanstående produkter skulle motivera ett högre pris (även om storleken är som nuvarande)?

JA

Om ja på ovanstående: Skulle du vara beredd att betala mer för en sådan (snyggare) produkt? Hur mycket?

10%

Försök att förklara vad du anser vara ett snyggare alternativ till dagens produkter.

Smidigare, mer designat.

Hur upplever du problematiken med adaptrar vid resor utomlands?

Vad tycker du man borde göra åt det?

Ja det är besvärligt att hitta bra universaladaptrar. Dom är oftast klumpiga.

Skulle en enhetlig världsstandard motivera ett högre pris på ovanstående artiklar? Hur mycket?

50%

Har du någon gång upplevt säkerhetsproblem med nuvarande produkter?

NEJ

Om ja på ovanstående:

Vad hände?

Vad tycker du bör göras åt det?

Köper du ofta grenkontakter som är försedda med strömbrytare?

JA

Har du några tankar eller önskemål om detta?

Tycker att det är bra eftersom man kan stänga av samtliga enheter kopplade till kontakten, tex TV/DVD etc.

Skulle du önska att det fanns grenkontakter försedda med t.ex. dimmer?

Finns det fler alternativ (förutom grenkontakter och dimmer) som du skulle önska fanns på en grenkontakt?

Upplever du något problem med att ta ur/sätta i stickproppen i ett eluttag:

Ur väggen?

Nej

Ur en grenkontakt?

Nej

PERSON 9

Vad anser du om dagens eluttag, grenkontakter, och sladdar?

Har inte jätte mycket åsikter men sladdar i allmänhet är jag inget fan av!

Vad anser du om inköpspris på ovanstående artiklar?

Inköpspriset är inget jag direkt uppmärksammat.

Är du beredd att betala mer för ett miljövänligt alternativ? (Miljövänligt material, mindre materialåtgång, mindre energiåtgång)

Hur mycket?

Beredd är jag väl men skall i ärlighetens namn säga att jag inte lägger mer pengar på någon produkt idag bara för att den är miljövänlig.

Tycker du att det skulle vara bra med produkter som inte tar så mycket plats?

Om ja på ovanstående: Skulle du vara beredd att betala mer för en sådan (mindre) produkt? Hur mycket?

Det skulle vara mycket bra och jag skulle absolut kunna betala mer för det! Svårt att säga hur mycket mer, men skulle priset vara mer än det dubbla skulle man kanske tveka.

Tycker du ett snyggare utseende på ovanstående produkter skulle motivera ett högre pris (även om storleken är som nuvarande)?

Om ja på ovanstående: Skulle du vara beredd att betala mer för en sådan (snyggare) produkt? Hur mycket?

Försök att förklara vad du anser vara ett snyggare alternativ till dagens produkter.

Absolut! Priset gäller samma som ovan.

Ett snyggare alternativ för mig är att det smälter in så mycket som möjligt i rummet. Man behöver inte tänka på att det finns där. Stilrent.

Hur upplever du problematiken med adaptrar vid resor utomlands?

Vad tycker du man borde göra åt det?

Skulle en enhetlig världsstandard motivera ett högre pris på ovanstående artiklar? Hur mycket?

Hitta en universal lösning och ja det skulle motivera ett högre pris. Inte mer än det dubbla.

Har du någon gång upplevt säkerhetsproblem med nuvarande produkter?

Om ja på ovanstående:

Vad hände?

Vad tycker du bör göras åt det?

Det slog gnistor från eluttaget i sovrummet när min plattång satt i. Kontakten smälte.

Dock var det nog plattången det var fel på, gammal eller något. Svårt att säga vad man skulle göra åt det.

Köper du ofta grenkontakter som är försedda med strömbrytare?

Har du några tankar eller önskemål om detta?

Skulle du önska att det fanns grenkontakter försedda med t.ex. dimmer?

Finns det fler alternativ (förutom grenkontakter och dimmer) som du skulle önska fanns på en grenkontakt?

Köper sällan grenkontakter för det första, gör jag det så kollar jag inte specifikt om den har strömbrytare men det är ju absolut ett plus.

Dimmer absolut!

Timer kanske. Exempelvis för lampor.

Upplever du något problem med att ta ur/sätta i stickproppen i ett eluttag:

Ur väggen?

Ur en grenkontakt?

Kan vara trögt, inget annars.

PERSON 10

1. Om det menas med sverige, tycker jag att dom är bra. sladdarna kan ju alltid förbättras och bli wireless.
2. Tycker priserna är överkommliga. tyvärr ej så mycket erfarenhet.
3. Nej faktiskt inte.
4. Ja det tycker jag. Absolut mindre sladdar å kontakter som tar plats.
 - a) Skulle verkligen kunna betala mer om jag ansåg att det gav mig mer yta och gör det smidigare. Iaf 2/3 mer.
5. Ja om sladdar/kontakter måste synas så helt klart värt att ha snyggare, säger samma 2/3 mer i pris.
6. Det är självklart ett problem att man inte kan använda sig av sin laddare utan måste hitta en reseadapter.
 - a) sätt en europeisk standard som start.
 - b) helt klart!! Säger det dubbla priset på denna.
7. inte direkt.
8. Det använder jag, ja. a) dimmer kan vara intressant om man bara kopplar in lampor. b) varför inte ha tex fjärrkontroll (smidig)
9. Ja om kontakten är dålig kan man lätt dra sönder den. Inskaffa hållbarare kontakter. Man ska kunna slita ut kontakten.

PERSON 11

Vad anser du om dagens eluttag, grenkontakter, och sladdar?

Dagens eluttag är omoderna och i vissa fastigheter otillgängliga. Det bästa vore om alla fastigheter kunde ha samma tillgänglighet, dvs. en s.k. "Golden standard" borde införas!

Grenkontakter och sladdar är en skymf mot mitt estetiska sinne och används endast i nödfall!

Vad anser du om inköpspris på ovanstående artiklar?

Helt rimliga i samråd med dagens ekonomiska läge.

Är du beredd att betala mer för ett miljövänligt alternativ? (Miljövänligt material, mindre materialåtgång, mindre energiåtgång)

Hur mycket?

Ja men endast tillägg för produktionskostnader!

Tycker du att det skulle vara bra med produkter som inte tar så mycket plats?

Ja

Om ja på ovanstående: Skulle du vara beredd att betala mer för en sådan (mindre) produkt? Hur mycket?

Ja det skulle jag definitivt! Är beredd att göra tillägg för konkurrenskraftiga produkter dvs. kostnader utöver produktionskostnader.

Tycker du ett snyggare utseende på ovanstående produkter skulle motivera ett högre pris (även om storleken är som nuvarande)?

Ja

Om ja på ovanstående: Skulle du vara beredd att betala mer för en sådan (snyggare) produkt? Hur mycket?

Inte mycket kanske 10%

Försök att förklara vad du anser vara ett snyggare alternativ till dagens produkter.

Estiskt tilltalande (kanske mer fokus på den gyllene kvoten samt färgalternativ enligt vanligt färgspektrum), mer tillgänglighet och mer integrerade i hushållet.

Hur upplever du problematiken med adaptrar vid resor utomlands?

Inte nämnvärt men ett enhetligt elsystem i EU och Amerika vore att föredra!

Vad tycker du man borde göra åt det?

Skapa debatt kring miljöaspekterna av att köpa adapters!

Skulle en enhetlig världsstandard motivera ett högre pris på ovanstående artiklar? Hur mycket?

Absolut! Nu talar vi ett tillägg på 30%!

Har du någon gång upplevt säkerhetsproblem med nuvarande produkter?

Nej

Om ja på ovanstående:

Vad hände?

Vad tycker du bör göras åt det?

Köper du ofta grenkontakter som är försedda med strömbrytare?

Ja

Har du några tankar eller önskemål om detta?

Det är bra och känns tryggare när man kan reglera strömåtkomst till diverse hemelektronik!

Skulle du önska att det fanns grenkontakter försedda med t.ex. dimmer?

Ja det skulle vara praktiskt applicerbart i villa och hushåll med ökad inbrottsprevalens.

Finns det fler alternativ (förutom grenkontakter och dimmer) som du skulle önska fanns på en grenkontakt?

Monterbara delar så man kan anpassa dosan till närmiljön!

Upplever du något problem med att ta ur/sätta i stickproppen i ett eluttag:

Ja, ett irritationsmoment utan dess like!

Ur väggen?

Nej

Ur en grenkontakt?

Nej

PERSON 12

Vad anser du om dagens eluttag, grenkontakter, och sladdar?

Fungerar bra för syftet, finns möjlighet att förbättra ordningen på sladdarna med hjälp av någon lösning kanske.

Vad anser du om inköpspris på ovanstående artiklar?

För det mesta rimligt (åtm. på Clas Ohlson).

Är du beredd att betala mer för ett miljövänligt alternativ? (Miljövänligt material, mindre materialåtgång, mindre energiåtgång)

Hur mycket?

Ja ca 20-30 kr mer.

Tycker du att det skulle vara bra med produkter som inte tar så mycket plats?

Ja, tycker däremot att dagens lösningar inte tar så mycket plats.

Om ja på ovanstående: Skulle du vara beredd att betala mer för en sådan (mindre) produkt? Hur mycket?

Nej.

Tycker du ett snyggare utseende på ovanstående produkter skulle motivera ett högre pris (även om storleken är som nuvarande)?

Nej.

Om ja på ovanstående: Skulle du vara beredd att betala mer för en sådan (snyggare) produkt? Hur mycket?

Försök att förklara vad du anser vara ett snyggare alternativ till dagens produkter.

Några flashiga lysdioder och ett enkelt/skalat utseende.

Hur upplever du problematiken med adaptrar vid resor utomlands?

Största svårigheten som jag upplever är var man får tag i adaptrarna samt veta vilken adapter man ska ha med sig till det aktuella landet.

Vad tycker du man borde göra åt det?

Tydlig information vid inköpsstället om att produkterna går att köpas i lokalen samt info om vilken adapter som gäller i vilket land.

Skulle en enhetlig världsstandard motivera ett högre pris på ovanstående artiklar? Hur mycket?

I min mening skulle det inte motivera ett högre pris men det skulle vara välkomnat.

Har du någon gång upplevt säkerhetsproblem med nuvarande produkter?

Nej

Om ja på ovanstående:

Vad hände?

Vad tycker du bör göras åt det?

Köper du ofta grenkontakter som är försedda med strömbrytare?

Ja

Har du några tankar eller önskemål om detta?

Att man tydligt ser när den är av/på.

Skulle du önska att det fanns grenkontakter försedda med t.ex. dimmer?

Kanske då främst om man använder grenkontakten till en lampa eller liknande.

Finns det fler alternativ (förutom grenkontakter och dimmer) som du skulle önska fanns på en grenkontakt?

Möjlighet att förvara sladden på något lämpligt sätt kanske.

Upplever du något problem med att ta ur/sätta i stickproppen i ett eluttag:

Ur väggen?

Kan vara trögt och fumligt om kontakten sitter på obekvämt ställe.

Ur en grenkontakt?

Samma som ovan.

PERSON 13

Vad anser du om dagens eluttag, grenkontakter, och sladdar?

Brå, enkla och utrustade med jordning.

☐ Vad anser du om inköpspris på ovanstående artiklar?

Ett normalt försäljningspris, skiljer inte mycket i pris mellan konkurrenter.

☐ Är du beredd att betala mer för ett miljövänligt alternativ? (Miljövänligt material, mindre materialåtgång, mindre energiåtgång)

o Hur mycket?

Absolut är jag beredd att betala mer för miljövänliga alternativ!

☐ Tycker du att det skulle vara bra med produkter som inte tar så mycket plats?

o Om ja på ovanstående: Skulle du vara beredd att betala mer för en sådan (mindre) produkt? Hur mycket?

Absolut är jag intresserad att komprimera storleken på sladdar och grenuttag.

☐ Tycker du ett snyggare utseende på ovanstående produkter skulle motivera ett högre pris (även om storleken är som nuvarande)?

Ett mer tilltalande yttre gör att jag inte försöker gömma sladdar och dosor lika mycket och det blir smidigare vid planering av vart elektriska maskiner ska stå.

o Om ja på ovanstående: Skulle du vara beredd att betala mer för en sådan (snyggare) produkt? Hur mycket?

10-30% mer än normalpris i butik.

o Försök att förklara vad du anser vara ett snyggare alternativ till dagens produkter.

Smalare sladdar mer tilltalande dosor och elegantare design. Ska passa ihop med en TV eller en design kaffeapparat.

☐ Hur upplever du problematiken med adaptrar vid resor utomlands?

Inte särskilt.

- Vad tycker du man borde göra åt det?

En universaldosa.

- Skulle en enhetlig världsstandard motivera ett högre pris på ovanstående artiklar? Hur mycket?

Absolut, förutsatt att det också är accepterat på alla marknader och inte från tillverkaren.

- ☐ Har du någon gång upplevt säkerhetsproblem med nuvarande produkter?

Ja.

- Om ja på ovanstående:

- ☐ Vad hände?

Kunde inte ladda min mobiltelefon då det var olika spänning i uttag och laddare.

- ☐ Vad tycker du bör göras åt det?

En standardisering på marknaderna, eller en liten transformator som omvandlar oavsett spänning.

- ☐ Köper du ofta grenkontakter som är försedda med strömbrytare?

JA

- Har du några tankar eller önskemål om detta?

Snyggare design, förarbetade med upphängningsanordning på vägg.

- Skulle du önska att det fanns grenkontakter försedda med t.ex. dimmer?

Absolut, om dimmern inte påverkar spänningen till TV som är inkopplad på samma grenkontakt.

- Finns det fler alternativ (förutom grenkontakter och dimmer) som du skulle önska fanns på en grenkontakt?

ett stopp som gör att det inte står i stand by läge. 100% avstängning direkt i vägguttaget.

- ☐ Upplever du något problem med att ta ur/sätta i stickproppen i ett eluttag:

- Ur väggen?

Ja om det inte är jodat!

- Ur en grenkontakt?

Ja om det är olika storlekar på kontakt och grenkontakt och att den ligger på oåtkomliga ställen då man gömmer den för sin generellt accepterade fula design.

PERSON 14

Vad anser du om dagens eluttag, grenkontakter, och sladdar?

T: De är bra sett till syftet med dem. Skulle kunna se lite trevligare ut (Eluttag).

Vad anser du om inköpspris på ovanstående artiklar?

T: Det är nog rimligt, har inte reflekterat för mycket på det. Det behövs så då kostar det vad det kostar.

Är du beredd att betala mer för ett miljövänligt alternativ? (Miljövänligt material, mindre materialåtgång, mindre energiåtgång)

T: Ja, det hade jag vart.

Hur mycket?

T: Vet inte riktigt men 20-30% mer hade inte vart något problem. Bra att kunna hålla nere energikostnaden.

Tycker du att det skulle vara bra med produkter som inte tar så mycket plats?

T: Absolut, ju diskretare desto bättre.

Om ja på ovanstående: Skulle du vara beredd att betala mer för en sådan (mindre) produkt? Hur mycket?

T: Samma som tidigare fråga ang pris.

Tycker du ett snyggare utseende på ovanstående produkter skulle motivera ett högre pris (även om storleken är som nuvarande)?

T: Ja.

Om ja på ovanstående: Skulle du vara beredd att betala mer för en sådan (snyggare) produkt? Hur mycket?

T: Som tidigare nämnts, skulle inte ha några problem att betala 20-30% mer än dagens kostnad.

Försök att förklara vad du anser vara ett snyggare alternativ till dagens produkter.

T: Ett snyggare alternativ hade vart att själv kunna välja utseende för el, gren och sladdar. För att bäst passa där det skall vara.

Hur upplever du problematiken med adaptrar vid resor utomlands?

T: Kan vara problematiskt när man glömmer av att kolla om de har Nationella eluttag eller liknande.

Vad tycker du man borde göra åt det?

T: Standardiera

Skulle en enhetlig världsstandard motivera ett högre pris på ovanstående artiklar? Hur mycket?

T: Nej, om de befintliga tas ur bruk och ersätts av en Världsstandard så borde det ligga runt den befintliga kostnaden. Beror ju ifs på vad dessa nya erbjuder som de gamla inte gjorde.

Har du någon gång upplevt säkerhetsproblem med nuvarande produkter?

T: Ja.

Om ja på ovanstående: Vad hände?

T: Kortslutningar pga av fukt(använts i badrum), gnistor.

Vad tycker du bör göras åt det?

T: Göra att de tål att vara i våtutrymmen. Även att de inte slår gnistor när man stoppar in stickproppen.

Köper du ofta grenkontakter som är försedda med strömbrytare?

T: Ja.

Har du några tankar eller önskemål om detta?

T: Just den funktionen är väldigt bra, tycker den fungerar som den är.

Skulle du önska att det fanns grenkontakter försedda med t.ex. dimmer?

T: Det hade vart en bra funktion.

Finns det fler alternativ (förutom grenkontakter och dimmer) som du skulle önska fanns på en grenkontakt?

T: Inte vad jag kan komma på.

Upplever du något problem med att ta ur/sätta i stickproppen i ett eluttag:

T: Ja

Ur väggen?

T: Inte så mycket vad gällande detta.

Ur en grenkontakt?

T: Ofta är det väldigt svårt att få i stickproppen. Skapar lite frustration☹. Det skall gå smidigt!

APPENDIX I – FOCUS GROUP RESULTS

FOCUS GROUP 7/3 2011

Linn Johansson
Fredrik Stensson
Aaron Castillejo
Calle Johansson

EXISTING SOLUTIONS

PRO

- + On/Off ⇒ miljö.
- + behovsanpassad (modul)
- + USB

CON

- Stor
- Klumpig
- Samlar damm
- För djup socker
- Full stickpropp
- Svårt att dölja
- Svårt att dra ut/sätta i
- Olika standarder
- För tjock med transmodulator etc.

Resultat:

~~De~~ Fokus låg på modul byggande och att miljövänlighet kan vara viktigt för att nå ut till människor.

Requirements & Needs.

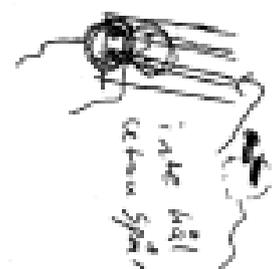
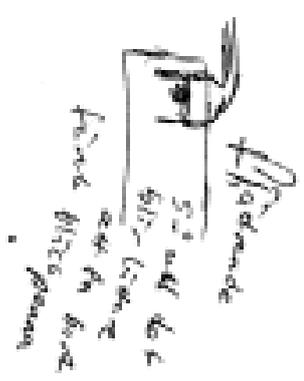
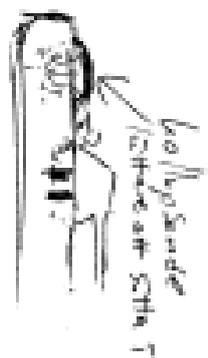
Aarón

- ✓ Would be perfect to have it wire less
- ~~or at least~~ cables are a shit!
- In my case I came with American products to Sweden so to have both or more adaptors in one would be nice. Nowadays most electronics are designed for all kinds of currents.
- Should be easy to move in the house as you never know when you will change decoration.
- It should have multiple plug-places as a TV usually has DVD plus speakers plus video games.
- When cleaning the house is jobbigt to move all the cables or to disconnect them to have a better cleaning.
- could be ~~a wall~~ included in the wall as the wall → 

- It would be nice that the product looks nice and that they don't look all the same.
- The idea with the cable inside the wall is good (isuttig) but it would be nice to have more than one plug.
- To extend the amount of plugs when possible is a good idea.
- To be able to know what is plugged is a good idea. Most of the time I have to pull the cables to know what is what.
- If it had a decorative shape you could actually use it in your desk.
- To add the plugs in different directions it would be nice. But I think they should stick to the wall and not only in the floor.

CalMe

En Soom for Wadsworth hummer Oct 2nd's Dec 4/1
~~USB loading~~



figs for Wadsworth Soom in Wadsworth hum Wadsworth Soom switches for numbers, "Green"

fredrik

Fula / stora

trögt att dra ut kontakter/stickpropp
därmed sämre
illigt att koppla in många olika varianter.
idéer

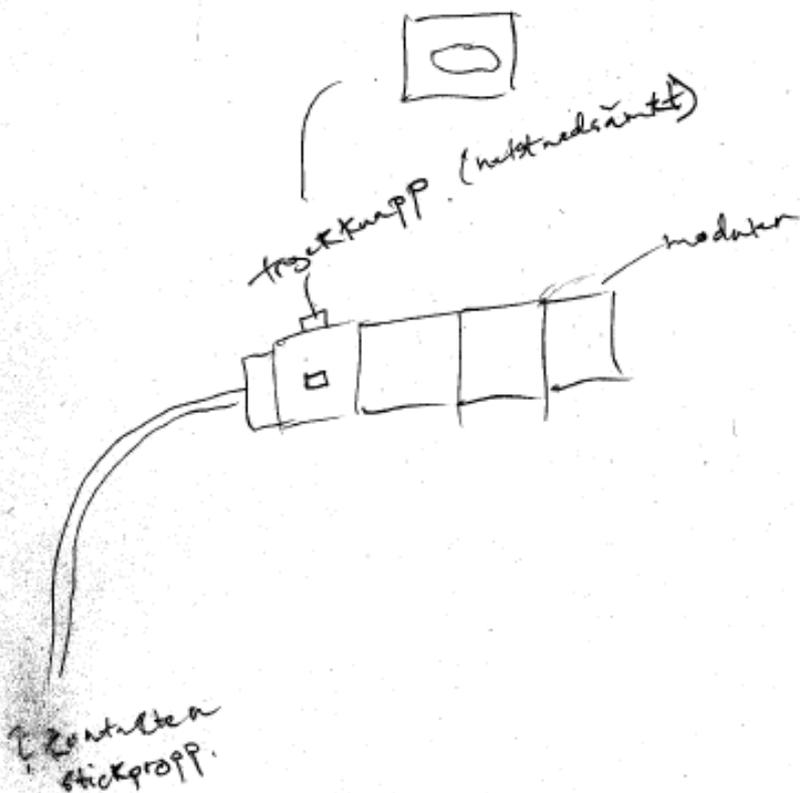
gå byggbara moduler för att
kunna anpassa hur många kontakter
önskas, "lego"

☹ ☹ ☹

Kan utökas för att passa andra tändstämningar.
Stulle dock säga att det inte varit
speciellt mycket problem med denna
kompatibilitet

Jag gillar USB gränssnittet använder det ^{att} mer
för att ledna saker, tar mindre plats
och mindre enheter.

Fredrik



3 vägs qrom

Linn

- x stor + klumpig
- x samlar damm
- x hållen är djupa så laddare m m
qdr mlt i



x Den Småberg
För mlt ner
Ffackare sladdar.

x Odling för äldre uttag...
Stora prupper är för stor

- x Vanligt problem är stora sturkeklar
- x "Vad kända" sladdarna passar mlt. För öka och handla om.
- e Svårt att dela.
- x Svårt att få i värdet blir att man blir visch (s)?
- x vissa kött utomlands har oftast 1 mt 2 extra
som ofta är upp till

x Koper något utomlands som mlt passar + Sverige.

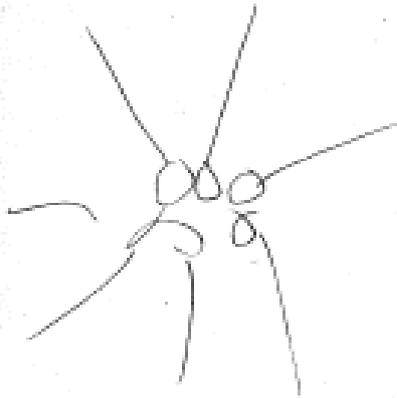
x Vissa lågen heter qdr prupper med dessa
kännetecken som till värdet lik
Vardagsrum + kök e vardagsrum



der vi använder mest elektricitet. Så ett antal vatt/lampor

Bra om den är att man sparar energi de all
ström byts och mlet står i stand by läge.

x Blir mycket löpande sladdar som samlar damm, = brand fara. ▽



Selen är en samlig form på vägen.

Brä efter som sladdarna kommer bort från golvet.

(om man hänger upp den) Rund form är bra för att passa.
Små/stora kontakt.

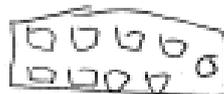
Dock väldigt ful. Kunde kanske minska någon form av ledar som delar det på ett ok sätt.

x Ser ut som sladd som går till värd.



"Klick varianten"

Var ganska smidig då man enkelt får exakt det som man behöver.



"Vrid varianten"

Och så smart om man vill dela sladdar åt olika håll.

Andra kommer stora/fula

"Kursen får sladdarna att se som stötpare ut."

APPENDIX J – ADVISORS, INVESTORS & INCUBATORS

<http://www.teknikdalen.se/319.php>

<http://www.entrepreneurskapital.com/>

<http://www.drivhuset.se/>

<http://www.chalmersinvest.se/>

<http://www.holding.gu.se/>

<http://www.industrifonden.se/>

<http://www.innkap.se/>

http://www.kthchalmerscapital.se/eng/index_eng.html

[http://taz.vv.sebank.se/cgi-](http://taz.vv.sebank.se/cgi-bin/pts3/pow/wcp/index.asp?ss=/pow/wcp/templates/sebarticle.cfmc.asp%3FDUID%3DDUID_0BE722599C8D)

[bin/pts3/pow/wcp/index.asp?ss=/pow/wcp/templates/sebarticle.cfmc.asp%3FDUID%3DDUID_0BE722599C8DF305C1256CFE00306D4D%26controlleraction%3D0%26xsl%3Den](http://taz.vv.sebank.se/cgi-bin/pts3/pow/wcp/index.asp?ss=/pow/wcp/templates/sebarticle.cfmc.asp%3FDUID%3DDUID_0BE722599C8DF305C1256CFE00306D4D%26controlleraction%3D0%26xsl%3Den)

<http://www.startinvest.se/>

<http://www.svca.se/home/index.asp?sid=370&mid=1>

APPENDIX K – ACTIVITIES LIST

It is of interest that activities completed throughout the development process are disclosed to the reader. These activities are of such nature that to bring elements of entrepreneurship and business direction to the thesis. Throughout the thesis the authors have contacted different players for support and information in order to develop, both personally and within the framework of the thesis. Further, the authors have attended several conferences, meetings and informal get-togethers in order to learn about different processes and widen their knowledge base. Activities participated in are:

1. Drivhuset

Drivhuset is a non-profit business advisor that aims to aid persons at an early stage of a business venture. Here, advice regarding partner contracts and information on who to turn to in cases of development was found out.

2. Patent bureau

Initial information of intellectual property and strategies were put forward and served as starting point for the venture.

3. Nyföretagarcentrum (NFC)

NFC is an organization that assists new or already established companies to develop further. The assistance is of advisory and expertise counsel with possibilities of financial aid. Information on how to start a business was received during two seminars at different locations and dates.

4. Chalmers innovation (CI)

The authors turned to CI to evaluate their business idea and to receive feedback on the idea in general. As a result of two consultations the authors have now an application for funding a novelty verification pending at Almi, a connection which was set up by CI. The result of the novelty check will serve as material for decision making in the future. The authors have attended two consultations at CI.

5. Almi företagspartner Väst AB (Almi)

Almi is an organization that aims to assist in making sure that a larger number of business ideas are commercialized and are successful in the future. The authors turned to Almi to apply for funding for novelty verification. At the present time the authors have been granted funding of a preliminary investigation in order to verify if the innovation is in fact an innovation and if it is patentable.

6. Patent search

One of the main threats to building a business on the innovation described in this master thesis is the existence of an already valid patent in this area. The authors have spend several days in searching for existing patents at the Swedish Patent and Registration Office, PRV, looking through somewhere between 1000 and 2000 patents. Different key words have been used and the results have been checked quickly. Approximately 5 patents of interest have been found, and these are attached to the application sent to Almi.

7. Scandinavian E-Business Camp 2011

A day's event for the e-commerce sector was participated in as to get inspiration for future work.

APPENDIX M - CANVAS

CANVAS – PRIVATE PERSON

Key partnerships <ul style="list-style-type: none"> • DIYs • Plastics supplier • Metal supplier • Assembly • Logistics 	Key activities <ul style="list-style-type: none"> • Production • Problem solving • Platform 	Value propositions <ul style="list-style-type: none"> • X • Y • Z Fulfills customer need: 1, 4, 8, 10, 11, 12, 15, 16.	Customer relationships <ul style="list-style-type: none"> • www • Self service 	Customer segments <ul style="list-style-type: none"> • Private persons (Age 15-75)
	Key resources <ul style="list-style-type: none"> • Human • Physical (manufacturing) • IP 		Channels <ul style="list-style-type: none"> • DIYs • Offices • E-commerce • Electric shops 	
Cost structure <ul style="list-style-type: none"> • Fixed costs <ul style="list-style-type: none"> ○ Office ○ Tools • Variable costs Number of products		Revenue streams <ul style="list-style-type: none"> • Transactional 		

CANVAS – ELECTRICIANS

Key partnerships <ul style="list-style-type: none"> • Plastics supplier • Metal supplier • Assembly • Logistics 	Key activities <ul style="list-style-type: none"> • Production • Problem solving • Platform 	Value propositions <ul style="list-style-type: none"> • Time reduction <ul style="list-style-type: none"> ○ Fast deployment 	Customer relationships <ul style="list-style-type: none"> • www • Self service 	Customer segments <ul style="list-style-type: none"> • Electricians
	Key resources <ul style="list-style-type: none"> • Human • Physical (manufacturing) • IP 		Channels <ul style="list-style-type: none"> • Wholesaler • www 	
Cost structure <ul style="list-style-type: none"> • Fixed costs <ul style="list-style-type: none"> ○ Office ○ Tools • Variable costs Number of products		Revenue streams <ul style="list-style-type: none"> • Transactional • Free distribution of 1st "Solution R" ==> revenue from sales of: <ul style="list-style-type: none"> ○ "Solution S" ○ Additional "Solution R" ○ Other units 		