



## PROPOSAL OF A SYSTEMATIC FOR PRODUCT PLANNING GUIDED BY USER'S ATTRACTIVENESS

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### ABSTRACT

The product planning phase is important for the success of the enterprise and seeks to answer the following question: what will be developed according to the company's strategies? This process will increase the probability of developing products more attractive to consumers, increasing the chances of market and technology success. Based on literature review about attractiveness, this paper presents the systematic for product planning guided by user's attractiveness (SiPPA). It provides activities, tools and guidelines to the product ideation considering attractive factors from the categories like semantics and symbolism, Gestalt principles and usability. The systematic proposed has been applied in two cases of new product planning and the results were evaluated.

**KEYWORDS:** Product planning, user's attractiveness, visual perception.

### INTRODUCTION

The visual aspect, commonly called image, is the interpretation of the brain on a set of fragments as lines, colors and movements. This way, the attractiveness of a product is related to the visual properties perceived by the consumer [1]. And often, consumers need to make choices between brands, which differ both in quality and

cost, as in visual properties. The visual properties guide the visual attention, which constitute a strong influence on the choices made by consumers when buying products [2].

Therefore, it is up to designers to develop objects in a functionally adequate way, with the application of technical knowledge; however, they must also have attractive attributes, to be attractive to the consumer. There are already a lot of accumulated knowledge and established methodologies to solve the technical aspects of the product. Nevertheless, the existing knowledge about the visual aspects and features necessary for the products to be classified as visually attractive is not systematized and integrated to the product development process, which renders its proper application difficult [3].

The product development process has, as an important stage, the product planning, which consists in characterizing promising product ideas based on opportunities identified by the strategic and competitive studies of the organization. The importance of this phase is related to the need of organizations to take part in increasingly competitive markets. The main result of this phase is the product idea, which must be clearly communicated to support the decision process [4].

The paper presents the systematic to the product planning guided by attractiveness in the session 3 based on literature review, in the session 2. The contents that were considered to

propose the systematic include: semantics and symbolism, Gestalt principles and usability. The systematic was applied in two cases of product planning to develop ideas of new washing machines for two market segments. The results of the planning team are presented in the session 4 and 5. At the end (section 6) considerations are presented about the systematic application and the product ideas.

**LITERATURE REVIEW**

Product planning is a process to support the establishment of projects to be developed in a given period of time. The results are presented as product ideas and technologies related to trends and demands of the market and business strategies. This view is demonstrated in Figure 1, taking into account the relationships with strategic and project planning phases.

There are publications that present the phases, activities, methods and tools to systematically perform product planning [5-7]. However, contents about attractiveness have not been considered in those approaches.

In today's market, needs like cost and performance are met by a range of brands and companies. Therefore, the characteristics that affect consumer preferences are the attractive factors, related to the visual aspects [2]. These factors are perceived first, and the decision to like or dislike the product happens in the first moments of observation [3]. If a person decides not to like a product in its first visual contact that opinion will hardly change later.

At the time of purchase, consumers first look for a product that meets their needs and expectations, content addressed by semantics and symbolism; and then check the aesthetics of the product, which can be implemented, for example, by the Gestalt principles. Chosen the most appropriated product, the consumer will usually try to interact with it. If this initial interaction is positive, the consumer will probably purchase the product [3].

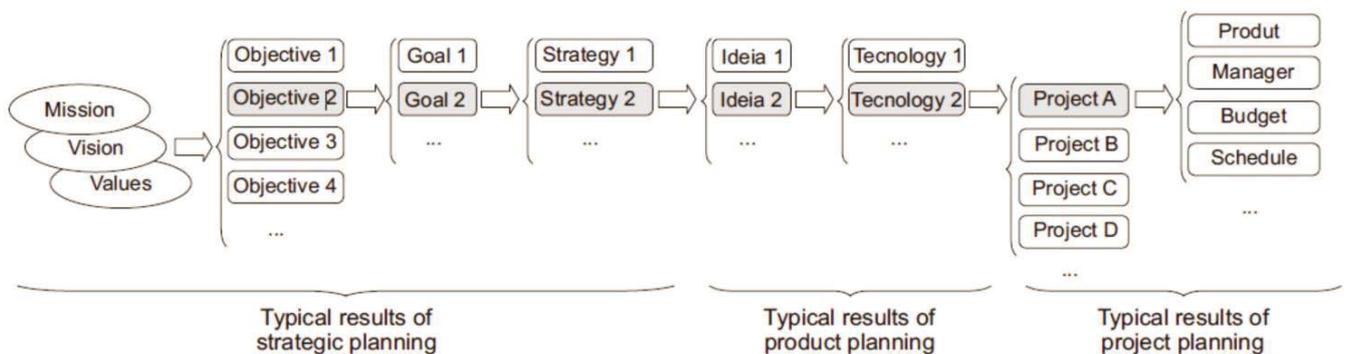
The contents of attractiveness can be implemented on product planning through of principles and guidelines based on concepts and characteristics of subjects, which are summarized bellow as semantics and symbolism, Gestalt principles and usability.

Semantics consist to express the purpose of the product by the visual form. It is implemented through design elements like lines, textures, shapes; for example, products made to move quickly should have smooth aspect and aerodynamic design; products for hard work should have sturdy and strong aspect [1].

Symbolism consists in considering personal values, social and cultural on the product, that reflect a self-image. All material goods of a person or group, such as home, furniture, electronics, cars, clothing, jewellery, including the places they frequent, are part of a set of things that constitute a visual image that is projected in others [1].

The Gestalt principles consist in a set of rules that can facilitate obtaining a product with attractive characteristics, because the human

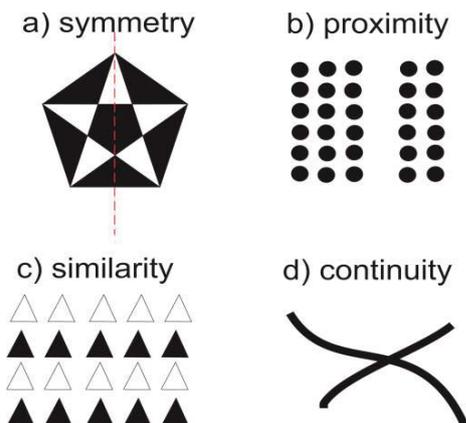
Figure 1: Relationship between typical results of strategic, product and project planning [2].



vision has a predisposition to recognize certain patterns [1]. The main Gestalt principles are (figure 2):

- a. symmetry: the human being has the ability to perceive symmetry, and it makes the image more pleasant;
- b. proximity: objects and figures which lie close together, tend to be perceived as a single set;
- c. similarity: objects or figures that have a shape or form similar to each other tend to be seen as a pattern; and
- d. continuity: the perception tends to provide continuity, path or extension to the components of the image.

Figure 2: Examples of Gestalt principles [1].



Usability considers the user's interaction with the product, which has fundamental importance in the consumer perception of its functionalities. The expression of usability helps the user to

anticipate how to interact with the product [8].

Characteristics such as controls available, type of task to be performed and frequency of use are very important. For example, the choice of symbols to represent functions have to be done carefully since it is necessary to respect cultural differences, be easy to understand, avoid risks, among others [9].

The objective of this work is consider the contents of attractiveness in the product planning phase through means to aid the planning team work. The basic idea of the systematic is to propose activities and tools that incorporate the attractiveness contents. This process was developed and the resultant systematic is shown in the next section.

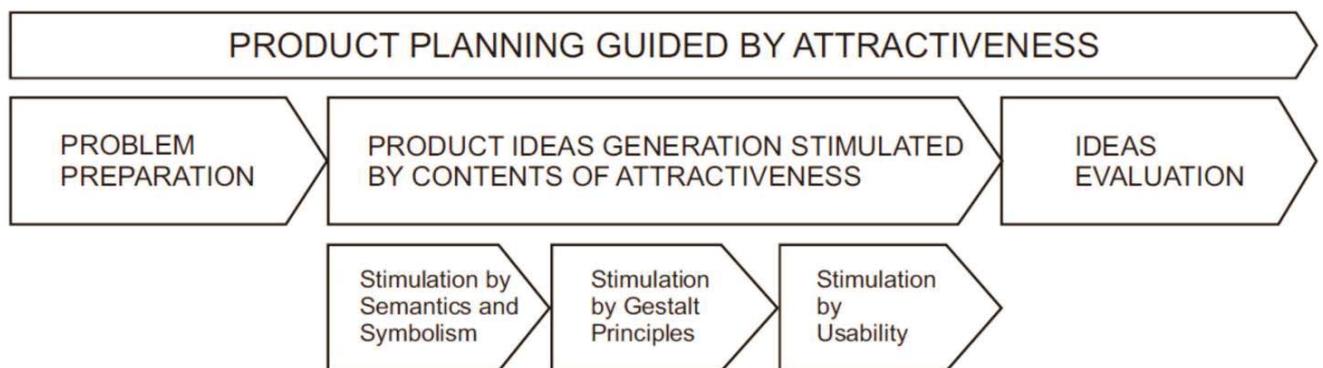
### THE SYSTEMATIC FOR PRODUCT PLANNING ORIENTED BY ATTRACTIVENESS

For the systematic development, were considered the study and the organization of information related to product planning and relevant contents of visual attractiveness, resulting in activity sequencing and proposed methods and tools to support the implementation of activities. The systematic proposal aims to guide step by step the product planning guided by attractiveness, aligned to market information.

It consists of the sequence of activities as shown in Figure 3.

The process is divided into three phases including problem preparation, product idea generation stimulated by contents of attractiveness and ideas evaluation.

Figure 3: Overview of the systematic SIPPA.



In the phase of **problem preparation**, the problem and the planning horizon are defined and a target market and its needs are identified. The main result of this phase is a form describing the planning problem, target market segments and user requirements.

The phase of **idea generation** is stimulated by content of attractiveness. It contains three stages of stimulation to aid the creative process and guided the team to meet attractiveness

content in generating ideas. Each stage of stimulation makes use of a visual panel. It is the main tool to promote the stimulation of the team members.

Each visual panel is prepared prior to the session and presented to the team members. Specific questions to aid the stimulation process are displayed together with the visual panels, as shown in figure 4a, 4b and 4c.

Figure 4a: Example of Semantics and Symbolism Visual Panel and questions to stimulate the team.

SEMANTICS AND SYMBOLISM		Types of stimulation questions
 <p>The judgment on the operation is made by the visual appearance transmits to the consumer.</p>	 <p>The product participates in a building process of the user image to others. The symbolic image is built by incorporating lifestyle, group values and emotions in the product. It is important to the user what the product represent.</p>	<p>-How should the product be to express that attends the user needs?            -Whats does the product have to look like to meet its goals?            -How does the product have to be to convey the consumer that it woks properly?            -What can be done so the product embodies the lifestyle of the user and their group values?            -.....</p>
 <p>The product must express visually that meets user needs.</p>		

Figure 4b: Example of Gestalt Visual Panel and questions to stimulate the team.

GESTALT			Types of stimulation questions
<p><b>SIMPLICITY</b></p>  <p>The simplicity of form creates visual harmony</p>	<p><b>SYMMETRY</b></p>  <p>The use of symmetry makes the image balanced and pleasant</p>	<p><b>CONTINUITY</b></p>  <p>Continuity is the visual perception of form without interruptions in its visual fluidity</p>	<p>-What can be modified, added or reinvented to have simplicity?            -For the product meets the symmetry law, what can be adapted or rearranged?            -In order to the product meets similarity, what can be unsubstituted or inverted?            -For the product meets the proximity law, what can be deleted, added or reinvented?            -...</p>
<p><b>SIMILARITY</b></p>  <p>Similar forms tend to be seen as a pattern, promoting the unification of all</p>	<p><b>PROXIMITY</b></p>  <p>Nearby forms tend to be perceived as a single set</p>		

Figure 4c: Example of Usability Visual Panel and questions to stimulate the team.



In the first stage the ideas are generated through brainstorming stimulated by content of semantics and symbolism. In the sequence, the ideas are evaluated through a multicriteria matrix. The ideas selected in the first stage are used to be improved or stimulate new ideas in the second stage. In the second stage the Gestalt principles are presented to the team to stimulate the next brainstorming. In the third stage, after the presentation of usability content, the ideas selected in second stage are improved through brainstorming stimulated by usability content and then are selected the best ideas to be, finally, evaluated in the last phase.

In the phase of **final evaluation**, the ideas are confronted against needs and requirements defined for the market segment. The result is a report describing each new product ideas to be used to include in product planning through technology roadmap.

### APPLICATION OF THE SYSTEMATIC – CASE 1

The application of the systematic was performed in a case study [10]. This procedure allows a broad and detailed knowledge of the object of study and can be interpreted as a pilot study to other cases [11]. Eight people formed the planning team: five mechanical engineers, one mechanical designer and two product

designers. All participants already had some experience with product development. The technology roadmap that was used for the definition of planning problem [12] is partially represented in figure 5.

Information about market considers the planning problem of a new washing machine to two new market segments: ECO and PREMIUM.

### Results of Problem Preparation Phase

The phase of problem preparation is constituted of two activities: define the problem and horizon of planning; and identify the needs and segments of market. These activities are performed based on information of the roadmap.

The team should analyze information and summarize the results of phase.

For a simple map and a relatively well known problem, these activities are not difficult to perform and it is important to uniformize information between team members. In the present case, the results were: planning a new generation of washing machines; horizon of planning: 3 years; needs: have good performance, be durable, be agile, be economical, smaller size, be silent, be sustainable, be comfortable and have water reuse systems; and market segments: ECO (appreciate performance and economy) and PREMIUM (appreciate comfort, agility and exterior design).

Figure 5: Partial view of the technology roadmap used in the application.

**Product Line:** washing machine  
**Goal:** planning the new generation of washing machines

Monitoring the external environment of the company		Attributes proposed	2012	2015
			Opportunities for future business	
MARKET Evolution of the company competitive environment	Evolution of market demand	- Customer needs, changes and market trends - Market potential (market growth expectation)	Performance, Economy (ECO) Confort, Agility, Exterior Design (PREMIUM)	Saving Money and Resources ↓ Machine size
	Other trends and events	Social Political Economical - Social and environmental trends - Social trends	Reducing expenses with water, electricity and soap Choose product for it relationship cost/price	Exemption of unnecessary costs ↑ Water price Possession paradig
		Legislation	- Changes in laws and regulations on national and interantional trade	Controlling the discharge of liquid waste
	Evolution of technology offer	- Obsolescence of current technology - New products with new technologies - Emerging technologies	Adjustment of temperature, water quantity and washing time	Redution of water consumption Water reuse systems

### Results of Idea Generation Phase

The idea generation phase is performed through brainstorming sessions in three stages of stimulation: semantics and symbolism, Gestalt principles and usability.

After the idea generation in each brainstorming session, the resulting ideas are evaluated through a multi criteria matrix. The criteria are based on each subject of attractiveness, as:

- Semantics and symbolism: apparent operation, identification with the consumer and lifestyle incorporation
- Gestalt principles: symmetry, similarity, proximity and continuity
- Usability: appropriate functions, easy access to the buttons and clear display

The main ideas that were developed in this phase are presented in appendix A.

### Results of Idea Evaluation Phase

The final evaluation of the generated ideas is evaluated in relation to the market segment. Thus, a multi criteria decision make method is used, having as criteria those used to describe the segments in first phase. This way, notes are assigned to the ideas with respect to each criteria and, after calculating the total value of each idea, are selected for each target segment those which suit better the segment, comparing the results obtained.

For the ECO segment, the criteria were performance and economy, and for PREMIUM segment were confort, agility and exterior design.

From the analysis of the ideas under these criteria, models 1 and 2 were selected for the ECO market, and model 3 for PREMIUM market as presented in Figure 6.

Figure 6: Graphical representation of the ideas.



After final evaluation the ideas are described in a report of new ideas, important for the company have all information necessary for the idea development. In the reports, the idea is graphically presented, along with a brief description of its operation and the target segment, which attends. For the ideas presentation, the team used the Sketchbook Pro software [13].

With the resulting ideas, the product plan can be now completed using the technology roadmap positioning the ideas in the time according to the requirements that were considered. This actualization is partially presented in the appendix B.

## APPLICATION OF THE SYSTEMATIC – CASE 2

The second case study was developed considering the same problem as case 1. Twelve engineering student formed the planning team. All participants already had some experience in product design process. In this case, the technology roadmap presented in Figure 5 [12] was also used to introduce the study.

### Results of Problem Preparation Phase

In this case, the two activities of the problem preparation phase (define the problem and horizon of planning; and identify the needs and market segments) were also performed based on the information of the roadmap. The team analysed information and summarize the results of phase.

Considering the market segments: ECO (appreciate performance and economy) and PREMIUM (appreciate comfort, agility and exterior design), the following characteristics was described important for the next generation (to be launch in 3 years): have good performance, be economical, be comfortable, be agile, be sustainable, smaller size, be silent and have water and soap reuse systems.

### Results of Idea Generation Phase

Like the first case study, this idea generation phase was developed applying stimulation using visual panel and brainstorming sessions.

In first step were generated 21 ideas applying a brainstorming session stimulated by semantics

and symbolism. In the sequence, the design team selected 5 ideas using a multi criteria decision make method, with the following criteria: apparent operation, aesthetic potential and identification with the consumer.

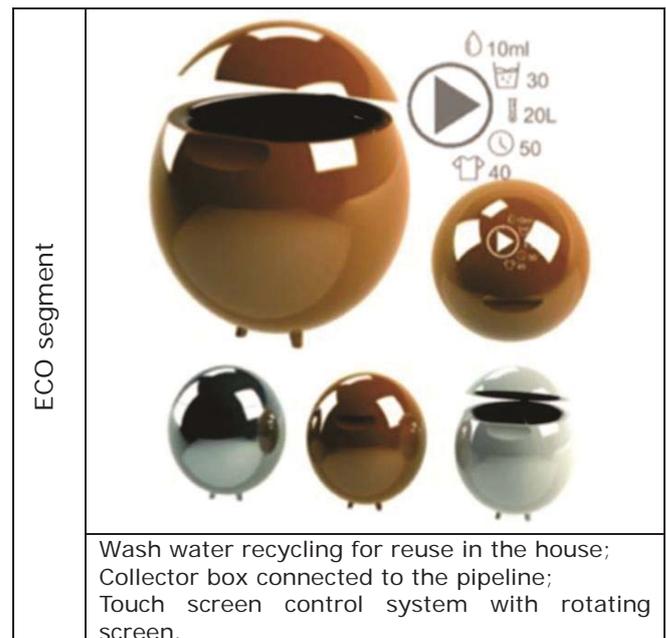
The second step involved the ideas generation stimulated by Gestalt principles, so the 5 ideas selected in the first step were evolved in 14 ideas. In the sequence, the team selected 3 ideas with a multi criteria matrix using as criteria: symmetry, similarity, proximity and continuity.

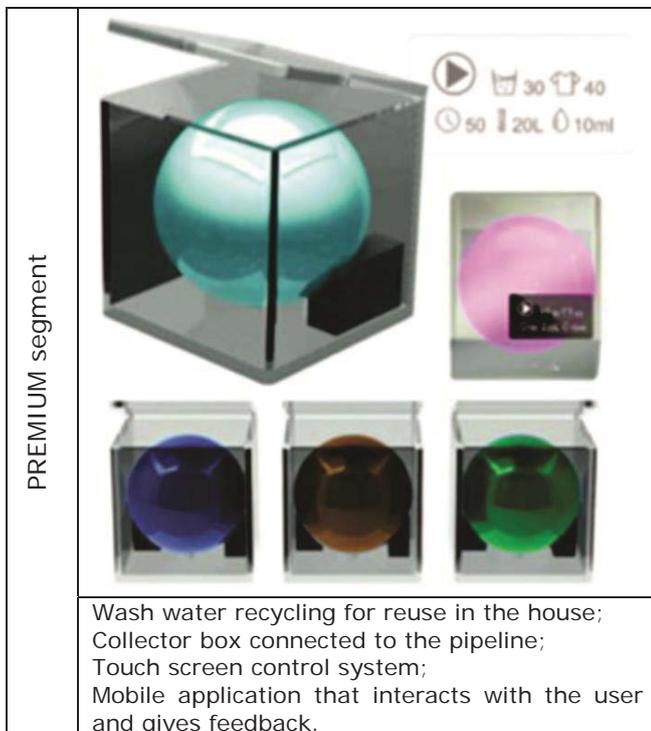
In the last step, the 3 ideas were evolved in 7 ideas stimulated by usability approach. In the sequence, 3 ideas were selected by the criteria: appropriate functions, easy access to the buttons and clear display.

### Results of Idea Evaluation Phase

The final evaluation of the generated ideas is evaluated in relation to the market segment, i.e., considering the ECO and PREMIUM segment. From the analysis of the ideas under these criteria, model 1 were selected for the ECO market, and model 2 for PREMIUM market as presented in Figure 7. These resulting ideas were positioned on the technology roadmap used for product planning. This actualization is partially presented in the appendix C.

Figure 7: Final ideas of case 2.





## CONCLUSION AND OUTLOOK

The application of the systematic was important to evaluate the proposed activities and obtain feedback on the understanding and implementation of each phase. The team was stimulated and motivated by tools proposals, allowing the ideas characterization regarding the attractiveness attributes.

In the first phase of the systematic proposed was developed a form to support the problem preparation. The information presented for the team in first and second application were the same (definition of the problem, target segments and user requirements). It was possible identify some differences in the form of written requirements. The first team detailed more the information, which are probably because the first team has more experience and higher education than the second team.

In the second phase, the number of ideas generated between steps was also similar, with the format of the results of each step taken in the same way. First, the ideas were described considering its function and product appearance features related to meeting the needs expressed

orally by the participants. In the second stage, most of the ideas were drawn and described with respect to their aesthetic characteristics and formal aspects, until you reach a firm idea regarding functioning, formal, usage and controls.

In the third phase, the evaluation of ideas regarding the market segment was taken under the same criteria, considering that both teams described the target segments in the same way. The fulfillment of the reports and positioning of ideas in the Technology Map was also made similarly.

Regarding to the final results, it is expected that each team get different results, influenced by the area of knowledge, experience, creativity and team practice field. However, using these contents in a systematic way, it allows the results to be guided by the user attractiveness.

After the application, some participants expressed their opinion about the systematic, as can be seen bellow:

*"The methodology proposed is interesting, since it is possible to follow a logical sequence of steps to characterize the product."*

*"The systematic helps to focus subjective ideas questions about the product."*

*"I think this systematic is very possible because its cover various contents and support to obtain final product conception."*

*"The systematic is very interesting because the idea of a new product is being improved along the process, reaching a tangible and well characterized idea."*

The results clearly showed that there was an evolution of ideas with brainstorming sessions and that the contents of attractiveness were actually considered in the ideas generated. Thus, it is concluded that the proposed tools in the form of brainstorming sessions, visual panels, questions for stimulation and criteria of evaluation are appropriate to promote the development of ideas more attractive to the user and better support the product planning.

The systematic proposal applies to each product line within a company. Note that the systematic was proposed in a generic way and according to the companies that will use it, the tools and suggested methods have to be suitable to their needs, their goals and their ability.

Another aspect to note refers to the team profile set to perform product planning in the company. Clearly, the most qualified and the greater the knowledge of the team on the market and business as a whole, the higher the quality of the final results generated.

### ACKNOWLEDGMENTS

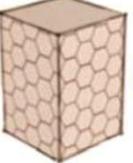
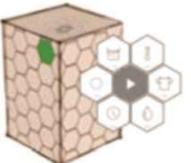
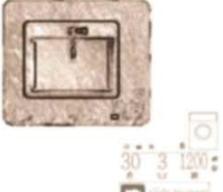
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## APPENDIX A

### IDEAS SELECTED AND EVOLVED IN EACH BRAINSTORMING SESSION

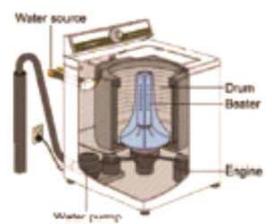
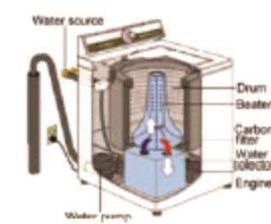
Ideas of 1st Stage	Ideas of 2nd Stage	Ideas of 3rd Stage
<p><b>First Idea</b></p> <ul style="list-style-type: none"> <li>- Water reuse with a carbon filter</li> <li>- Machine doesn't look like a washing machine</li> <li>- Chrome finish RED/BLACK/BLUE</li> <li>- ECO emblem</li> </ul> <p><i>Reasons by attractiveness contents</i></p> <ul style="list-style-type: none"> <li>- This idea expresses to the user characteristics of sustainability and economy</li> <li>- Represent the user image with modern colors and eco emblem</li> <li>- Meets the aim of water reuse</li> </ul>	<ul style="list-style-type: none"> <li>- Organical forms</li> <li>- Similarity between the body and cover</li> <li>- Continuity in body shape and cover, without separation</li> <li>- Controls in a corner of another color</li> </ul> 	<ul style="list-style-type: none"> <li>- Soap automatic feeder</li> <li>- Power button in the lid</li> <li>- The lid opens and turn the machine on</li> <li>- When squeeze power button light the other buttons on</li> <li>- Information view: amount of water, temperature, washing time, washing type</li> </ul> 
<p><b>Second Idea</b></p> <ul style="list-style-type: none"> <li>- Water reuse with a carbon filter</li> <li>- Heat reuse with photovoltaic cells</li> <li>- Visible cells looking like a honeycomb expressing sustainability</li> </ul> <p><i>Reasons by attractiveness contents</i></p> <ul style="list-style-type: none"> <li>- Visible photovoltaic cells that express to the user sustainability</li> <li>- Conveys to consumers that works economically and sustainably</li> </ul>	<ul style="list-style-type: none"> <li>- Rectangular machine</li> <li>- Honeycomb in the entire structure to have similarity and symmetry</li> <li>- Buttons on the cover in a honeycomb format.</li> </ul> 	<ul style="list-style-type: none"> <li>- Cell to open and turn on in another color (green when turned on)</li> <li>- Touchscreen buttons on the cover in honeycomb shape</li> <li>- Power button on the middle with others buttons around</li> </ul> 
<p><b>Third Idea</b></p> <ul style="list-style-type: none"> <li>- Camouflaged in the bathroom</li> <li>- Water reuse from the sink with carbon filter</li> <li>- Integrates with the furniture</li> <li>- Cell phone App - iWash</li> </ul> <p><i>Reasons by attractiveness contents</i></p> <ul style="list-style-type: none"> <li>- Expresses to the user that meets your needs for comfort and smaller size</li> <li>- Incorporates lifestyle and values interacting with the user via cell phone</li> </ul>	<ul style="list-style-type: none"> <li>- Closet' machine</li> <li>- Rectangular. Matching with the furniture of the bathroom</li> <li>- Similar forms between the machine, the sink and the sink board</li> </ul> 	<ul style="list-style-type: none"> <li>- Touchscreen buttons on the sink board</li> <li>- Programming via cell phone</li> <li>- Side door opening with "slide to open"</li> <li>- Shows washing time, type of washing, amount of water</li> </ul> 

## APPENDIX B

### PARTIAL VIEW OF TECHNOLOGY ROADMAP WITH IDEAS GENERATED IN CASE 1

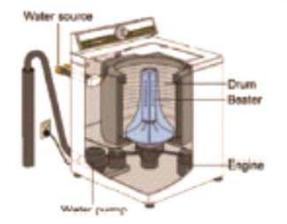
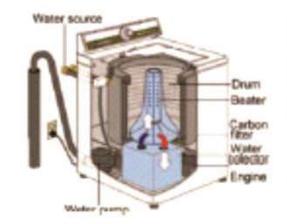
**Product Line:** washing machine

**Goal:** planning the new generation of washing machines

Monitoring the external environment of the company		Attributes proposed	2012	2015	
		Opportunities for future business			
<b>MARKET</b> Evolution of the company competitive environment	Evolution of market demand	<ul style="list-style-type: none"> <li>- Customer needs, changes and market trends</li> <li>- Market potential (market growth expectation)</li> </ul>	Performance, Economy (ECO) Confort, Agility, Exterior Design (PREMIUM)	Saving Money and Resources  Smaller places ↓ Machine size	
	Other trends and events	Social Political Economic	<ul style="list-style-type: none"> <li>- Social and environmental trends</li> <li>- Social trends</li> </ul>	Reducing expenses with water, electricity and soap Choose product for it relationship cost/price	Exemption of unnecessary costs ↑ Water price Possession paradig
		Legislation	<ul style="list-style-type: none"> <li>- Changes in laws and regulations on national and interantional trade</li> </ul>	Controlling the discharge of liquid waste	Incentive for water reuse
	Evolution of technology offer	<ul style="list-style-type: none"> <li>- Obsolescence of current technology</li> <li>- New products with new technologies</li> <li>- Emerging technologies</li> </ul>	Adjustment of temperature, water quantity and washing time	Redution of water consumption  Water reuse systems	
<b>BUSINESS</b> Competitive Strategy EPA	Objectives/Competitive Strategy (ways) Strategic Goals		<div style="border: 1px solid black; padding: 5px; display: inline-block;"> <b>MISSION:</b> To achieve global leadership in the commercialization of innovative products and services, profitably, solving real problems to make personal and professional lives of our consumers more pleasurable.           </div> <div style="display: inline-block; vertical-align: middle; margin-left: 20px;"> <div style="border: 1px solid black; padding: 5px; display: inline-block;"> <b>Actions:</b> development of new technologies and change of consumers habits           </div> </div>		
<b>PRODUCT</b> Evolution of product portfolio	Evolution product map	Strategies of product development			
	Product family map	Market Segment	PREMIUM Market	ECO Market	
		Product Plataforma	Plataform 1	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 5px;">MODEL 1</div> <div style="font-size: 20px;">→</div> <div style="border: 1px solid black; padding: 5px;">MODEL 2</div> </div> <div style="margin-top: 10px; display: flex; justify-content: space-around;"> <div style="border: 1px solid black; padding: 5px;">MODEL 3</div> </div>	
Plataform 2					

**APPENDIX C**
**PARTIAL VIEW OF TECHNOLOGY ROADMAP WITH IDEAS GENERATED IN CASE 2**
**Product Line:** washing machine

**Goal:** planning the new generation of washing machines

Monitoring the external environment of the company		Attributes proposed	Opportunities for future business		
			2012	2015	
MARKET Evolution of the company competitive environment	Evolution of market demand	<ul style="list-style-type: none"> <li>- Customer needs, changes and market trends</li> <li>- Market potential (market growth expectation)</li> </ul>	Performance, Economy (EÇO) Confort, Agility, Exterior Design (PREMIUM)	Saving Money and Resources  Smaller places ↓ Machine size	
	Other trends and events	Social Political Economical	<ul style="list-style-type: none"> <li>- Social and environmental trends</li> <li>- Social trends</li> </ul>	Reducing expenses with water, electricity and soap Choose product for it relationship cost/price	Exemption of unnecessary costs ↑ Water price Possession paradig
		Legislation	<ul style="list-style-type: none"> <li>- Changes in laws and regulations on national and interantional trade</li> </ul>	Controlling the discharge of liquid waste	Incentive for water reuse
	Evolution of technology offer	<ul style="list-style-type: none"> <li>- Obsolescence of current technology</li> <li>- New products with new technologies</li> <li>- Emerging technologies</li> </ul>	Adjustment of temperature, water quantity and washing time	Redution of water consumption Water reuse systems	
BUSINESS Competitive Strategy EPA	Objectives/Competitive Strategy (ways) Strategic Goals		MISSION: To achieve global leadership in the commercialization of innovative products and services, profitably, solving real problems to make personal and professional lives of our consumers more pleasurable.  Actions: development of ne technologies and change of consumers habits		
PRODUCT Evolution of product portfolio	Evolution product map	Strategies of product development			
	Product family map	Market Segment		PREMIUM Market	
		Product Plataforma	Plataform 1	ECO Market	
	Plataform 2		MODEL 1 MODEL 2		