



## INTEGRATING THE HUMAN FACTOR AND ENVIRONMENTAL NEEDS IN THE DESIGN OF A NEW PRODUCT

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**Abstract:** Nowadays, to ensure the durability of their activities, companies have to innovate continuously. However, designing and development of multi-physical mechanical systems or products, namely integrating different fields of science and technology, has the purpose to make them "intelligent", "reliable" and "ecological". Moreover, to be able to obtain a winning product, the company managers should be innovative. The technology, but also the needs and the desires of the users, can achieve innovation. Changing people's beliefs is a critical part of the business when a new product appears. In this perspective, our article intends to determinate how to better involve the users in the design process. Communication is a dynamic process, in a permanent transformation. The aim of our work is to show the challenge of managing innovation led by users. The design of a product, a manufacturing process, a production line continuously drives a team to improve. Putting people first, keeping energy and environment issues in mind: innovation takes up multiple challenges. To achieve this, many skills must be activated: innovative processes, quality, mechanical design, management, logistics. To take into account the environmental aspects is a difficult task, but it's the key to design the best product and to release it on the market at the right time. In order for our work to be placed in a general context of eco-design, it is required that this field of research must be defined. So, before presenting the design, first we must develop the eco-design detail as a response to a necessary integration of the environmental factor. Because of the innovative nature of the project, a first study to indicate the subject of the project has been done. Before starting the design project, it is essential to propose a planning for every stage of the project from the defining of needs to the creation of CAD models. The first stage consists of defining the users's needs of the product. This could be done by collecting all the necessary information to get a clear vision about the project. The next stage is the functional analysis; its purpose is to define the functions of the future product by analysing its different lifecycle situations. After that, in the creativity phase the design team starts to find solutions and pick the best one. Finally, the solution is described and evaluated using a set of predefined specifications. Based on this evaluation, several modifications are imported to the design. The research in industrial, technological and scientific engineering represents the purpose of our work.

**Key words:** Design, lamp, light, 3D, modeling

### 1. INTRODUCTION

Since ancient times, people have invented various things to make their lives easier. The discovery of fire was a colossal step in the evolution of mankind. The fire gave not only warmth, but also light. No one knows how long it has been since man first used a wick in a pot of animal fat, but it is certain that primitive plains have been found in limestone rocks or sandstone, dating from around 8000 BC, [1]. In Iran, pottery was found thousands of years old. It is fundamental for the light to be seen, to work, to contemplate, to admire – it plays an important role in our personal and professional lives, [2, 3]. The luminaires create sensations, atmosphere and feelings: an inspired choice can make a decisive contribution for creating a special image from the point of view of interior design in a room, [3 – 4].

The market for lighting devices is very large and presents a very diverse range of models. In order to make a division of our product we chose to offer more uses besides the main one, namely lighting. The 3-in-1 nightstand lamp gives the buyer the possibility to charge his phone, to listen to the desired music by simply connecting the phone, to know in real time what the clock is and can program his alarm clock according to the schedule, [3]. Innovation forces, all companies modernize and offer consumers unmatched satisfaction. The proposed product is classified in the category of means of satisfying needs and experience together with abstraction capacity can help to enroll the product in the novel category, [2].

The utility of the product implies the satisfaction of certain needs as well as, in this case, the need for lighting. But starting from this main need for lighting, there were also other secondary needs that we chose to satisfy with a single product. Following these needs of people, we have come to the conclusion that, by designing a single product, we can create a satisfying light, listen to your favorite music, benefit from a wireless phone charge and eliminate the need for a wake-up clock, [5 – 6].

Starting from the utility of the product we get into the sphere of its destination. In the case of luminaires, they have different destinations, from street lighting to the lighting of hard-to-reach and dark areas that require human intervention, [7 – 8]. The nightstand lamp is intended for the space of a room, a space that does not require a strong light source, but which needs a restful light and does not disturb during the entire stay of a man in the place where he should feel best.

This lamp has five ways to adjust the light, which is made possible by the built-in touchpad on the base of the lamp. The light can change depending on the song that is played through the lamp diffuser. Also on the light side, we can talk about the two very important ways that this lamp has, namely simulating sunlight in order to have a much easier and quiet morning wake and comfortable night light that can create a relaxing and restful environment, [9 – 10].

Another important feature of this lamp is the wireless charging of the phone. It can be charged on a specially designed surface that has fast wireless charging (15W power), it can connect with the audio system of the lamp that can play the desired music through the 2 speakers with the power of 3W. In order not to have on the bedside both the lamp and an alarm clock we decided to offer our product and the alarm function to save space, [11 – 14]. The lamp can be used as a wake-up alarm by connecting the phone to it. With the phone connected, the lamp will pick up the alarms set on the device and use the same preset sound on the phone without the need for any other input from the customer, [15 – 17].

Users today are looking for an experience and not only for technology. Products must be acceptable and desirable, and in this regard must be designed with the needs and desires of the end user. To facilitate the integration of the usage, esteem and technique triptych into the product design process, an ergonomist and a product designer are also involved.

## **2. CULTURAL IMPACT: ARCHITECTURAL LIGHTING**

The first stage in the arrangement of the interior is the setting of lights. In order for the chosen furniture and colors to be well highlighted, a well-studied lighting project is required. For this, there is a special branch in interior design. Light has positive or negative effects on the workspace, on the mental state, decisions, safety and perception of things in the environment. Therefore, proper lighting is an important function in the construction of a home, [18 – 20]. For those who do not know, architectural lighting falls into a different category than decoration, as a field between architecture and engineering, its elements being lighting power, direction, functionality of light in a room, energy used, etc. Architectural lighting emphasizes three fundamental aspects in lighting a building or outdoor space. The first aspect is related to the domain of aesthetics, the image of the building after nightfall, its definition by light, both from the outside and from the inside. The second is the ergonomic one: how light helps in the actions we take in the home, the power and purpose that different types of light have in a room. The third is the efficiency of the energy consumed and the certainty that there are no unnecessary losses through extra illumination, [19].

In light of market competition and consumer demand, the industry is looking to improve products to meet consumer needs and increase profits. Understanding the key features of the product allows the industry to minimize the risk of failure when introducing new products to the market.

## **3. LIGHTING BODY DESIGN**

The right choice of lighting system is important both in terms of the efficiency of the lighting installation and in terms of its economy. We have no lights, we have no light. But the term lamp does not refer to the entire lighting unit. Strictly speaking, the term lamp refers only to the artificial light source used to generate light, for example incandescent lamp, energy-saving lamp or fluorescent compact lamp. There are many different types of lamps, distinguished by the way they generate light, by geometry, by the power consumed in Watts, and by the characteristics of the light produced, [18].

By design and standards, then construction and technological modernization, the bodies and, in particular, the component lamps are characterized by the regulated and necessary parameters to meet. For a comfortable environment, efficient technologies with minimal energy costs and consumption must be promoted and visual comfort achieved. Energy efficiency is pursued with energy saving bulbs: double the power of the lighting and reduce the electricity bill by half, [15].

#### 4. NEW PRODUCT LAUNCH

The launch of new products is extremely expensive and therefore must be treated with great care. By the time a product was launched on the market, it already has a real history. This starts from identifying a need that is still not fully met, going through the analysis of a relevant positioning, continuing with the development of the product, packaging and name, and ending with the generation of a communication strategy.

Because innovation is no longer optional, creating new products is a difficult task and relatively few ideas prove to be good enough to achieve commercial success. Any marketing activity must have research as its starting point. It is not possible to launch a product, to adopt a market strategy, to conquer new market segments without having previously conducted a thorough research of all the factors, variables that can influence and ensure the success of that activity, [16, 19]. The research actions in this case aim at a product launch. The necessary resources, the opinions of potential customers about the new product should be known in advance, as well as the profits and revenues that the product will obtain.

#### 5. PRODUCT MODELING

The first stage consists of defining the users's needs of the product. This could be done by collecting all the necessary information to get a clear vision about the project.

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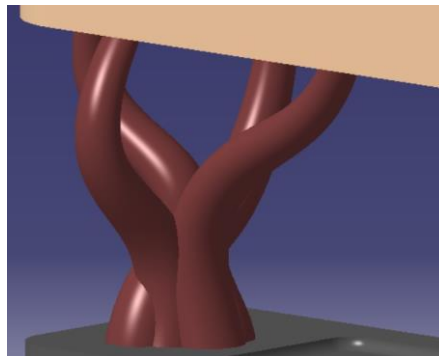


Fig. 1. Trunk - Bonsai

In order to design the lamp design we used the 3d modeling software Catia v5. This program allowed us to shape the vision designed by our team, and then improve the functional and aesthetic characteristics of the product. We started from the idea of creating a lamp that would have the shape of a bonsai and started modeling with the tree trunk, [19 – 21]. After making several sections with the help of the command „solid multisection”, the trunk has acquired the desired shape.

The next step was to make the stand on which the lamp was to stand. This process was a more difficult one because we wanted to keep the minimalist design of the stand. At the same time, it had to incorporate the wireless charging space, the power pot and the touchpad through which the customer would set the light intensity. That's why we opted for a simple stand with a rectangular cut-out that can accommodate any phone and a touch-sensitive seat with five light intensity indicators.

The last part of the modeling process consisted in making the luminaire. It had to have a simple shape, but reminiscent of the crown of a bonsai tree. We choose as a solution an elliptical shape because it is sufficiently minimalistic and can easily accommodate both the LED strips required for lighting and the two speakers of the sound system. Similar to bluetooth speakers, we have integrated a control panel at the top of the lamp to facilitate customer interaction with the bluetooth system. This panel contains the on/off button and volume buttons for adjusting the sound intensity.

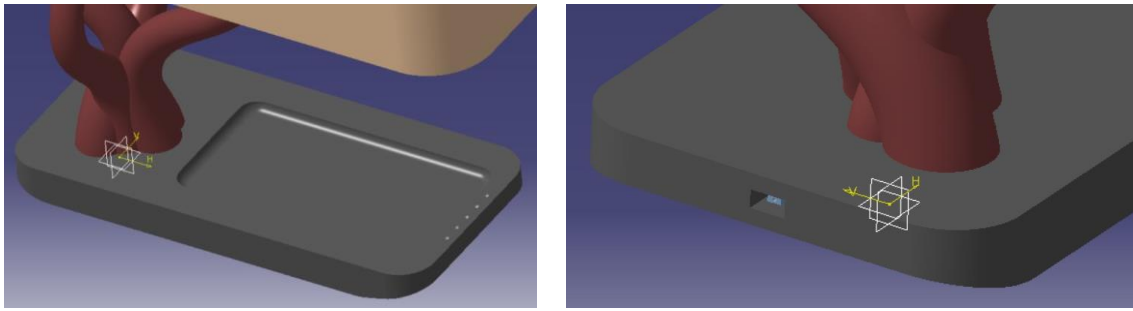


Fig. 2. Stand and changing port



Fig. 3. Luminaire with built-in audio system

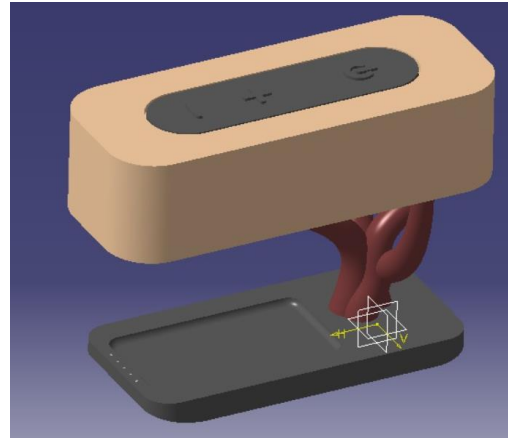


Fig. 4. The proposed lamp

After finishing the 3D model we made a few reps in order to be able to see how the lamp will look in different spaces. The materials used to make the lamp are of the highest quality and have recycling properties. One of the first materials used and the one with the highest share of the product component is recycled plastic, which is used precisely to encourage the reduction of pollution.

Another material used is ABS, which is also a plastic with different properties such as: cheap, rigid, strong and impact resistant. This material is very structurally robust, which is why it is also used in the lamp component. Its use is common in 3D printing because it is durable, easy to process, easy to grinding, soldering and painting.

Another important feature is its thermoplastic character that has to do with how the material responds to heat. Thermoplastics become liquid at a certain temperature (105°C in the case of ABS). They can be heated to their melting point, cooled and reheated again without significant degradation. Instead of burning, thermoplastics such as ABS liquefy, which allows them to be easily injected and then recycled afterwards, [22].



Fig. 5. The proposed lamp in various situations

For the “tree trunk” that represents the supporting element of the lamp, we used aluminum for being a durable, but at the same time an inexpensive material. In addition to being a ductile and malleable material and can be obtained forms with high complexity, aluminum also has a corrosion resistance being covered with a protective oxide layer. Like other materials, the aluminum used to create the lamp is aluminum recovered from waste. This recovery is an important source of raw material for the secondary metallurgy of aluminum and occurs by melting aluminum desks in furnaces of different types. As for its recycling, we can say that unlike plastics, aluminum can be recycled indefinitely without degrading at all.

## 6. CONCLUSIONS

The utility of this product is to satisfy the human need to have light in the room in which he sleeps. Besides this primordial need, the nightlight has other utilities such as: charging the wireless phone, alarm function, but also playing the favorite songs by each owner of this lamp. The goal of our paper is to show the challenge of innovation management in manufacturing businesses, and in particular user-led innovation. The presented product is a novel product, being one of the sensational inventions in the field. The unidirectional lamp features a new, safe and ideal technology to gradually light an entire room according to the owner's personal needs. Product that possesses the attributes of a quality product, namely: utility and aesthetics as well as ergonomics, originality, actuality, etc.

Reliability is the totality of the qualities of a technical system that determines its ability to operate without faults within a given time frame under certain conditions. Therefore, by conducting a product analysis in this regard, it was concluded that the product shows increased reliability due to its stable aluminum structure, but also due to the component elements made of recycled plastic materials.

Ergonomics is the relationship that is established between man and product when they come into contact. The 3-in-1 bedside lamp is designed in such a way as to respect long-lasting ergonomics, so that the holder is not uncomfortable with the design of the lamp and is not disturbed by its attributes. Aesthetics has as main objective the analysis of the beautiful light for which a bonsai-shaped lamp design was used because these trees grow and grow in an aesthetic form. Also, "bonsai" in Japanese means "gardening" which refers to both physical and spiritual care and instills relaxation, good mood and harmony in the buyer.

Designed unidirectional lamp is an activity of creating a useful and aesthetic product at the same time. The design can have different levels. The level at which the unidirectional lamp is designed is – product design – which implies a product conception at the same time as the technical design, being the common result of the work of the mechanical designers of the technologies of the designer and the marketing specialist. Product design has covered the entire design cycle from market study to product decommissioning. Technical solutions are new solutions in a creative vision that take into account those established for other products. The designed product can be classified as long-lasting products, bought less often in which price – quality – brand factors have a decisive influence on the purchase.

The purpose of this project was to create a unidirectional lamp product design equipped with the remote control, fulfilling the purpose of the design activity, namely the "product". There are already known in the market of interior design products one-touch lamp systems, sensor lamps and mini-luminaires for the keyboard and book shelves or dark dishes. Our exploratory study on an industrial project highlights the complementarity of the paper's research during the co-creativity project, to integrate all the elements of the life situation. Moreover, our result shows that during the creativity process the proposed product has an unique design.

## 7. REFERENCES

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