

Volley Shoes Design Analysis with a Total Ergonomic Approach

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Abstract

Today the development of volleyball in the country is quite rapid, this is indicated by the increasing number of existing communities. Therefore, it is necessary to have a shoe design that can support the movement of volleyball in addition to being able to provide comfort and increase the performance of athletes. Unfortunately, despite the development of sports volleyball in soil water enough fast, however, development design of volleyball shoes did not experience significant development. This can be seen from the many complaints about the use of shoes on the market today. One of the problems that exist in the design of volleyball shoes, among others, is the complaint of feeling hot in the interior shoe because not enough presence ventilation on the upper part of shoes, and shoe soles are less flexible so that they are not able to support the jumping movement and there is no significant protection for the athlete's ankles when landing after jumping. Meanwhile, the shoes used by athletes do not fully provide a sense of comfort and cannot fully support volleyball movements. Some of the problems that arise are due to the lack of conducted analysis stages planning. Because that for getting design result shoe volleyball which truly good must through stages design which Correct. Besides, to provide comfort and satisfaction to the wearer in the analysis product should use approach ergonomics total (PET), through SHIP and appropriate technology (TTG).

Keywords

volleyball shoes; total ergonomics approach; SHIP; appropriate technology; product design stages; user demands



I. Introduction

In life, humans use to design a lot to facilitate activities. Design is an effective tool to improve the quality of a product to increase its competitiveness of the product. Besides, humans as designers as well as users want the resulting product design to support activities, provide comfort and be in accordance with trends. The tendency for new trends to emerge has resulted in changes in product design in accordance with the increasing demands of users. Human Resources (HR) is the most important component in a company or organization to run the business it does. Organization must have a goal to be achieved by the organizational members (Niati et al., 2021). Development is a change towards improvement. Changes towards improvement require the mobilization of all human resources and reason to realize what is aspired (Shah et al, 2020). The development of human resources is a process of changing the human resources who belong to an organization, from one situation to another, which is better to prepare a future responsibility in achieving organizational goals (Werdhiastutie et al, 2020).

The increasing demands of human needs raise awareness about the importance of product design science and ergonomics (Bagas, 2002). Product design activities to generate creative ideas are also influenced by the speed of reading trends, especially market needs and consumer demands. For this reason, innovative ideas are needed supported by

technology so that it can answer user demands based on security, safety, and comfort factors (Winoto and Tristiyono, 2016). For this reason, several stages are needed in the process of designing volleyball sports shoes. Besides that, to solve ergonomic problems in volleyball shoe design, in analyzing the process of designing volleyball shoes, a total ergonomics approach is needed (PET).

II. Review of Literature

2.1 Study on Ergonomic Approach Total

The total ergonomics approach is the best effort in improving working conditions (humans, tools, and the environment) so that they are optimal with impact minimal possible. The minimal impact can be done in a systemic, holistic, interdisciplinary, and participation.

This approach is known as the SHIP or SHIP Approach (Manuaba, 2005a; 2005b). The SHIP approach is a comprehensive improvement in all aspects of ergonomics in the production process from upstream to downstream sustainably and sustainably integrated.

According to Sucipta (2016), the systemic approach is a systems approach. A holistic approach means that all factors or systems related to the existing problem must be solved, proactively and thoroughly. the interdisciplinary approach means that all related disciplines must be utilized because the more complex the existing problems are assumed not to be solved optimally if only studied through one discipline, for that it needs to be studied across disciplines. Participatory means that everyone involved in solving the problem must be involved from the start to the maximum so that a conducive working mechanism can be realized. And quality output is obtained in accordance with the demands of the times.

The Plan of Action is an elaboration of the existing work plan and is made more operational because it contains element 5 W, 2 H, and 1 R, which is what will be done (what), why should be done (Why), how to do it (How), who will do it (Who), when it is done (when), where it is done (Where), how much cost and funds required (How Much) and what is the legal basis for implementing the plan (Regulation). Every action plan that will be carried out should pay attention to TTG (Manuaba, 2005a; 2005b).

Appropriate Technology is an approach in which the technology to be used must be studied comprehensively through six criteria, namely economic, technical, ergonomic, socio-cultural (accountable), and energy-efficient and not damaging to the environment.

2.2 Definition of Design

The term design is more accurately said to be the implementation of a function, while art refers to the distribution of expression without looking at the implementation function of an item. So, in a broader perspective, design is a tool that can simplify our lives by providing the solutions we need. Steve Jobs once said, "design is not just what it looks like and feels like. Design is how it works". Design thinking is practiced by all professions, not only designers but also various other professions seeking innovation.

According to various theories of design, there are several goals. Some of these goals include the following:

- a. Design has the aim of adjusting the results of the design with humans as users by being aware of the advantages, limitations, and abilities they have.
- b. Designs that mix and match with elements of art and technology that aim at comfort, safety, and beauty.
- c. The design is made to increase efficiency, productivity, and quality of human life.

In addition to the understanding and design objectives that must be known before designing a product, you must also know the design method.

The design method is a method used by designers to produce a design work. Several methods are often used (Sachari and Sunarya, 2000):

- a. Exploding: This is looking for inspiration by thinking critically to get a design that has never been made.
- b. Redefining: Reprocessing a design so that it becomes a better and different form.
- c. Managing: This is creating designs continuously and continuously.
- d. Prototyping: It is to improve and or modify the design of the ancestral heritage
- e. Trendspotting: Is to make a design according to a developing trend

2.3 Definition of Design Product

According to Kotler, product design is the totality of features that affect the appearance and function of a product in terms of consumer needs (Saraswati, et al, 2015). According to Rian Pramono, product design is the value contained in a product in the form of a distinctive and attractive product appearance and a differentiator from competing products, where product design can produce its attractive allure (Ansah, 2017). Where style can play a role in attracting attention or being boring because style only describes the appearance of the product. Besides that, a sensational style can only produce a beautiful aesthetic, but that style is not necessarily able to make product performance better. While production design is not just an outward appearance, but product design is the heart of a product. There are two types of product designs, namely completely new designs that have never been on the market and modifications of existing designs. Design new results from study depth and innovation so that the production has a different appearance than the others. While the modified design is easier to do, but still has to highlight the characteristics typical alone so that the result is not the same as the design of the goods that are already on the market.

III. Result and Discussion

3.1 The Importance of Designing Ergonomic Products

Goods design produced is the most important thing for the company because the design determines the success or failure. So it can be said that product design is what makes a company able to remain productive. To make the company still productive, special handling is needed from the beginning to the creation of a good design. The design which good is a design that since the early stages have included ergonomic considerations to produce a final product that is qualified, certified, and customer need.

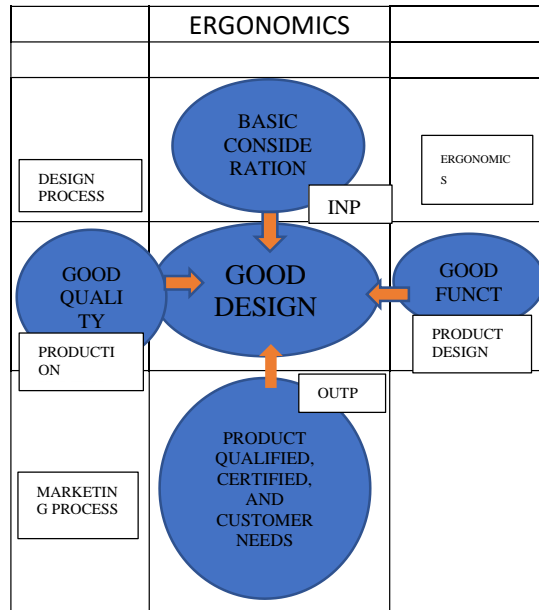


Figure 1. Ergonomic Thought on Design (source: Luthfianto and Siswiyanti, 2008)

3.2 A Study on the Total Ergonomic Approach to Product Design

The total ergonomics approach is the best effort in improving working conditions (people, tools, and environment) to be optimal with minimal impact. The minimal impact can be done with a systemic, holistic, interdisciplinary, and participatory approach. A systemic approach is a systems approach. A holistic approach means that all factors or systems related to existing problems must be solved, proactively and thoroughly. An interdisciplinary approach means that all related disciplines must be utilized because the more complex the existing problems are assumed to not be solved optimally if only studied through one discipline, for it needs to be studied across disciplines. Participatory means that everyone involved in solving the problem must be involved from the start to the maximum so that a conducive working mechanism can be realized and quality outputs are obtained in accordance with the demands of the times. This approach is known as the SHIP or SHIP Approach (Manuaba, 2005a; 2005b; Sucipta, 2016). The SHIP approach is a comprehensive improvement in all aspects of ergonomics in the production process from upstream to downstream in a sustainable and integrated manner.

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The Action Plan (Plan of Action) is an elaboration of the existing work plan and is made more operational, because it contains elements of 5 W, 2 H, and 1 R, namely what will be done (what), why should be done (Why), how to do it (How), who will do it (Who), when it is done (when), where it is done (Where), how much cost and funds are needed (How Much) and what is the legal basis for implementing the plan (Regulation). Every action plan that will be carried out should pay attention to TTG (Manuaba, 2005a; 2005b).

Appropriate Technology is an approach in which the technology that will be used in realizing a design must be studied comprehensively through six criteria, namely economic, technical, ergonomic, socio-cultural (accountable), and energy-efficient, and does not damage the environment.

3.3 Product Design Stages, namely (Jamnia, 2018)

a. Survey

The survey stage collects data from a product used by the user of the product, which is used as a sample. Record users' subjective complaints after using the product and measure the productivity gains from using the products they use. At this stage of the survey, a survey of materials to be used in product redesign was also carried out, workshops were held involving various stakeholders including the manufacturer, product users, and other parties related to the product. The workshop was conducted to find out the problems in product design that are known and felt by all stakeholders related to the product, to later solve the problems obtained as the basis for intervention in the redesign of the new product.

b. Describing the Problem

At this stage, it is carried out to describe the problems obtained from the survey results and the results of the workshop to get the right solution. The priority of the problem is to give priority value to the problems that will be submitted for immediate improvement. Priority is carried out based on the criteria for implementation time, namely implemented from now on (urgent), immediately but maybe later (important), and may be carried out later (essential). The negative sentences that have been collected are marked with U, I, and E, according to the implementation time. An example of a priority value table in the problem of designing volleyball shoes is as follows:

Table 1. Examples of Priority Values on Volleyball Shoes Design Problems

Masalah	Prioritas U E I	Keterangan
Posisi tubuh : Sepatu kurang nyaman dalam melakukan gerakan- gerakan voli	✓	Merancang sepatu voli yang lebih ergonomis.
Penggunaan tenaga otot: Otot tungkai bawah saat mendarat ke lantai setelah melompat terasa kurang nyaman.	✓	Menganti material sol sepatu bahan yang lebih lentur sehingga otot tungkai bawah saat mendarat ke lantai terasa lebih nyaman.
Kondisi sosial budaya : Kondisi yang Harus mendukung performa atlet di lingkungan sosial budaya	✓	Meredesain sepatu voli dengan mengimplemen tasikan warna-warna yang dapat menambah semangat dan kreativitas atlet voli saat bermain.

(Source: Workshop Results)

c. Concept Analysis

At this stage, concept analysis is carried out based on the demands of the user, trends, ergonomics, and design science.

d. Development of Ideas At this stage, explore ideas through several designs in the form of alternative sketches.

Then one is selected to make a picture.



Figure 2. *Alternative Image 1 (source: author)*



Figure 3. *Alternative Image 2 (Source of the Author)*

e. Design Presentation

This chosen design is a form of novelty from the overall design of volleyball shoes. At this stage, the designer presents 2 alternative sketches of ideas. The shoe manufacturers, athletes, and coaches seek agreement on the selection of an alternative.



(Source: Author)

Figure 4. *Selected Alternative Images*

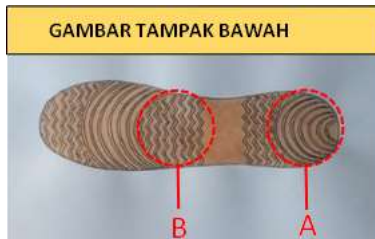
At this stage, the shoe manufacturer, athletes, and trainers conduct discussions in choosing the two alternatives. In the discussion, a thorough consideration was taken of the shape related to trends, the implementation of colors that can motivate athletes when playing and competing, and the materials used are related to comfort, construction, or material connections that can support the strength of the shoe so that it is strong to support movements in volleyball. Besides that, economic factors related to the selling price are one of the considerations in choosing alternative designs. With the selling price of volleyball shoe designs that are not too high but can provide comfort and improve athlete performance, it means that the product design can be said to be successful. In other words, the designer has designed with a holistic rationale through a total ergonomics approach. With affordable selling prices, being able to provide comfort, and being able to improve athlete performance, Indonesian athletes no longer need to use volleyball shoes made abroad. Where foreign volleyball shoe products are priced quite high and not necessarily fully able to provide comfort and support the athlete's performance.

f. Making Working Drawings

At this stage, the selected alternative is made into working drawings (views, cuts, and details). The purpose of making working drawings is so that the shoe company that is working on it can work on the shoe design more easily. With a complete working drawing, the company is less likely to make shoe mistakes during production.



Figure 5. Top View (Source: Author)



(Source: Author)

Figure 6. Bottom View Image



Figure 7. Rear View Image (Source: Author)



Figure 8. Image of Cut Perspective (Source: Author)



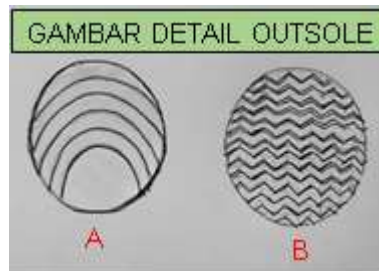


Figure 9. Outsole Detail Image (Source: Author)

g. DBT (Design Built Team)

This stage unites the picture or insight between the designer and the production party to evaluate the working drawings with the production capabilities of the facilities owned by the company.

h. Production Stage

The production stage is the stage of an embodiment of the working drawings that have been made with a scale of 1:1. At this stage production is supervised by the DBT. If there is a problem in production, DBT will help provide solutions, besides that DBT will guide the work of the production department so that the product has good quality and quantity.

i. Stages Evaluation

At this stage, the *prototype* shoes were tested on athletes to measure subjective complaints on the feet by doing volleyball movements and measuring the height of the jump. Before trying Athletes are required to wear shoes in daily activities, aiming to adjust the shoes and feet. These measurements are to measure the level of shoe comfort and the level of flexibility of the shoe sole in supporting the jump. If from the evaluation carried out there are still many subjective complaints on the athlete's foot that do not support the athlete's jumping ability, it must be designed and reproduced to obtain the desired results. good volleyball. This is because the design of volleyball shoes uses the principle of improvement with a total ergonomics approach, one of the goals of which is *continuous* improvement sustainable.

j. Presentation Market

The market presentation was done after the shoe design is considered capable of providing a positive distribution of comfort and can support volleyball movements during the evaluation stage. Presenting the results of the final design in the form of design drawings, prototypes, and types of materials used in the production that are intended to introduce the wider community, especially shoe distributors and consumers, and volleyball athletes to the advantages of the shoe design.

k. Distribution stages

This stage includes transportation and distribution of products from producers to consumers.

IV. Conclusion

To get a good volleyball shoe product design, you must go through a total ergonomics approach using SHP and TTG, from planning to production. Besides that, in designing volleyball shoes to produce volleyball shoes that can provide comfort and improve performance, athletes should go through the design stage.

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