

Hybrid Fitness - Problem Definition

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Device

The kind of device that assists people in running, and attaches to the person's leg or foot will be designed. The target range of end users is from ages 25-44. It is for those who are or would like to be active. The product must improve the desire to exercise through the main functionality of lowering impact, reducing stress, conserving energy, and making running an easier or more comfortable activity.

Customer

During a given year 65% of runners are injured badly enough to reduce training time. Continued minor injuries quickly develop into permanent damage to the body. 25-44 year olds do have the number of previous injuries to their bodies. Prevention of injury through the key functions described will lengthen the 25-44 year old's running life. Also, this age group has shown growth in activities and spending related to running. With spending reaching nearly \$850 million, 25-44 year olds were responsible for 46% of running footwear expenditures in 2003; running participation among 25-44 year olds has increased steadily in years 1998-2003. Other age groups comprise much less of running participation and spending. As well, 45+ year olds tend to shy away from running because of the injuries developed earlier in life.

Specific Problems

- With 70-80% of running related injuries occur at the knee or below. The knee is the most common site of injury with nearly 25% of running related injuries occurring there. Misalignment due to improper gait is a common cause of knee injuries.
- New runners are commonly injured because they lack the knowledge of how to train. They overexert themselves develop injury.
- When running in a gym or in the home on a treadmill psychological and monetary factors determine the willingness of a person to run. Men and women feel intimidated by the traditional gym atmosphere. Also, in both the home and gym treadmills are immobile and provide no change of scenery.

Current Problem Solutions

- The gazelle is a stationary running machine that simulates running motion. It provides a low-impact workout, relieving stress on joints.
- A gel insole is an inexpensive orthotic device. It provides cushioning support to the foot and stabilizes the position of the foot during motion.
- The Nike Shox is a running shoe that is designed to reduce impact and conserve energy during motion.

Gaps in Current Problem Solutions

The Gazelle is not very portable, and is an expensive piece of equipment. The user is also confined to the indoors, and the scenery is unvarying. Gel insoles can be uncomfortably tight, and crystallize and harden during the winter. Nike Shox only receive good traction on wood surfaces. The Shox do not reduce impact on the knee or ensure proper motion of the feet. They are priced at around \$150, and expensive price to pay for a shoe. A successful product within this market must merge shock adsorption, energy conservation, running motion guidance, and portability.

Customer Use of Device

The customer will put the product on when they desire to run. The user will attach the device to his or her lower body, with adjustability. Once the device is attached the user will run assisted by the device. They will also put the device on to lower impact on their joints, so they can run easier with less stress, thus enabling them to run longer without pain.

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Customer Requirements

- *Promoting Proper Gait* is necessary for a runner to prevent injury, where gait is defined as the motion of the feet and legs
- *Impact Reduction* is desired because it decreases the forces felt when stepping.
- *Size Adjustability* is necessary because runners must attach the device to their own unique bodies.
- *Energy Conservation* reduces the energy lost to heat during running, preventing injury to joints where heat loss occurs.
- *Durability* is expected by the end user [17].
- *Low Cost* is a concern of the end user, manufacturer, and retailer, because they are involved in the flow of money.
- *Low Design Complexity* is the primary concern of the manufacturer, so that the product may be made with conventional processes and the lowest number of parts.
- *Safe Operation* is required all customers, but specifically mandated by the government.
- *Ease of Use* is a necessary for the end user. The end user will not purchase the product if it takes too much time to learn how to use it.

Projected Value to Consumer

Nike Shox XL is priced at \$150 and the average price of a pair of running shoes is \$50. Comparing the prices of the analyzed benchmarks and the average price of a pair of running shoes, the product being designed will cost approximately \$100 to the end user.

Engineering Requirements

- *Force Displacement or Elasticity* relates to the cushioning and shock adsorption capabilities of a device.
- *Life Expectancy* relates to the durability of the product in years.
- *Weight* relates to performance and injury prevention because of the added energy required to run.
- *Ability to Fit Many Sizes* relates to adjustability among different users.
- *Steps Required Before Use* relates to the ease of use

Benchmark Analysis

- The Gazelle is a stationary running machine that simulates running motion. It provides a low-impact workout, relieving stress on joints. It retails for \$400.
- A gel insole is an inexpensive orthotic device. It provides cushioning support to the foot and stabilizes the position of the foot during motion. Priced at around 10-25 dollars.
- The Nike Shox is a running shoe that is designed to reduce impact and conserve energy during motion. A common price for Nike Shox is \$150.

Engineering Requirement Target Values

The force displacement of the shoe cushioning should be approximately 100 lbs/in for men and 85 lbs/in for women. The displacement of shoe cushioning at maximum should be 1.7 inches. The product needs to be able to withstand the rigors of the user running for two hours every day for a period of about two years. In addition to being durable, the equipment needs to be light weight, weighing less than 16 ounces each shoe. The device needs to be able to be put on in no more than three uncomplicated steps.