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Alternate materials for bottom components and solutions for foot problems

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ABSTRACT

This is a thesis on the alternate material that can be used instead of leather soles and more solutions provided for not problems

Keywords: *Foot Problem, Soles, Leather, Shoe Designing*

Acknowledgment

I would truly thank my parents, Anupam Dutt and Samiksha Gupta for supporting me in achieving my goals. They have always been beside me through all times and taught me a lot.

Friends are definite part in my growth. Good friends always share their knowledge and are always ready to help me, whatever the situation may be. I am thankful to have such friends and I'll always be there for them too.

Anshika Dutt

Introduction To footwear Industry

Footwear Industry

Global footwear industry has been growing and has been valued $365.5 billion. Footwear help us protect our feet from abrasion, dust, sharp objects etc. They are predominantly made from leather, plastic, rubber etc.

Increase in healthy lifestyle and fitness have promoted people to buy footwear and has resulted in increase in the economy of the industry. Many factions like fashion changes, awareness have made this industry grow. Social media is one of the many things have promoted footwear.[20]

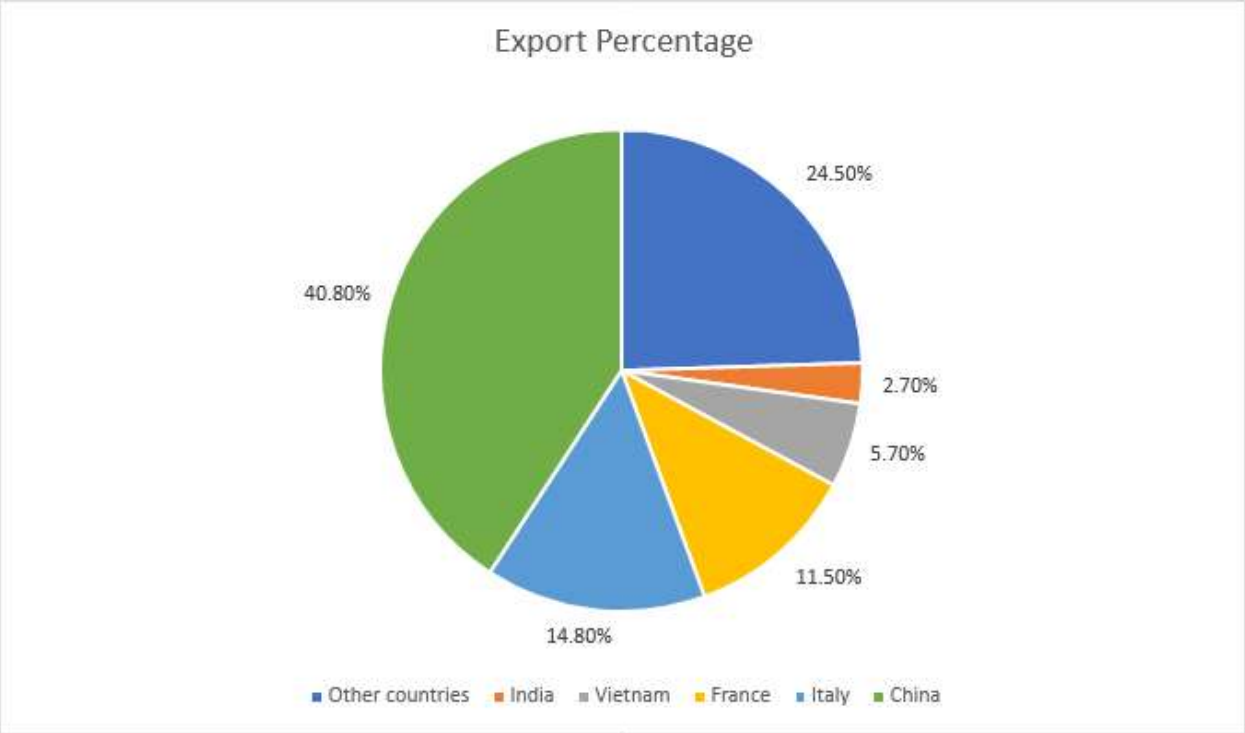
There are many companies like Adidas, Nike, Gap, Reebok etc. that have grown to become business giants and have increased the sales of the footwear.[21]

Fig 1

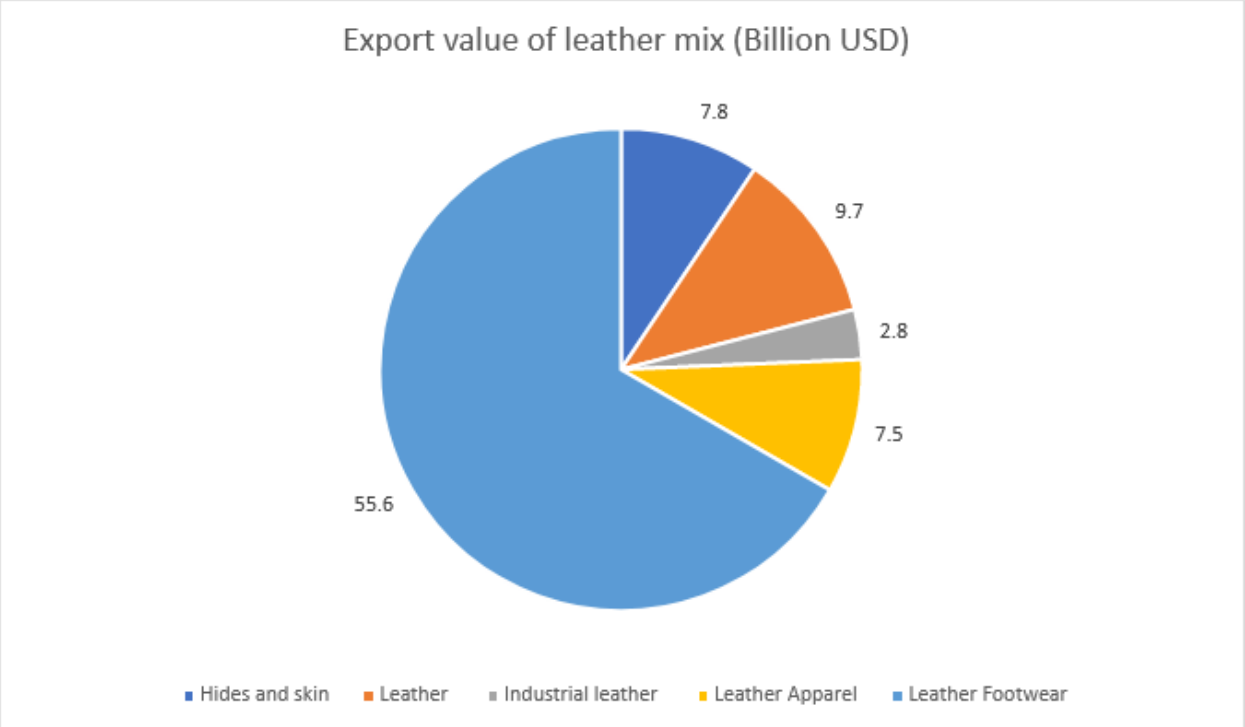
Strong presence of key companies boots the sales of this industry. China, India, and Vietnam - these companies are the largest producers of footwear in the world. Vietnam and Indonesia are seeing many dominant companies open as they are a growing sector for footwear. This would also likely contribute to growth of Asia- pacific market.[22]

The footwear industry is hundreds of years old. It is made from mostly leather. The most popular hides are from cows, sheep, goats, and pigs.[1] The most popular leather products are shoes, clothing, and upholstery.[2]

Leather is the most widely used commodity which is used extensively in fashion industry especially. the footwear industry. Footwear industry holds prominent position in economy of any country as one of the leading revenue generators. Below figure depicts the global export share of leading countries in 2018.[3]

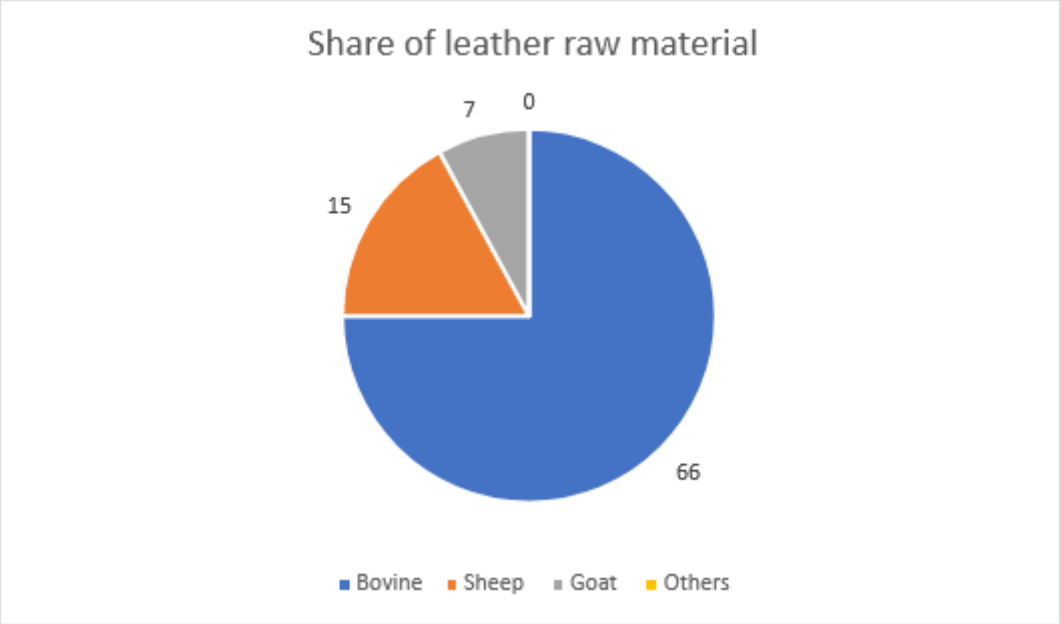


The export value of all types of leather, finished and unfinished, was US$20 billion in 2004. Export value of leather mix globally is shown in the below figure.[5]



Global leather goods market grew at a rate of around 5 % in 2014 -19 and it is going to grow further in the next 5 years. In the developing countries, footwear industry is a major employer. App. 10 million people are employed worldwide in the direct production of footwear.[1]

Currently, more than 60% of the raw material comes from the developing nations. These nations are now processing the raw material to finished products. Majority of raw material is bovine. In the decreasing order are sheep, pig, goat, and others.[1] The share of raw material is shown in the figure below. [1]



Footwear industry in India

India is the 2nd largest producer of footwear in the world. Which is approximately 13% of world share of 16 billion pairs. The footwear that is exported is sport shoes, moccasin shoes, dress shoes, sandals, boots, chappals etc. Men's footwear is about 50% of the market. Ladies, kids footwear have a great potential in the domestic market.

Footwear industry is expected to grow as it employs several people and several units of installed al over the country. With technological improvement footwear is improving ear by year and India is producing more footwear every year and this adds to the economy of the company[28].

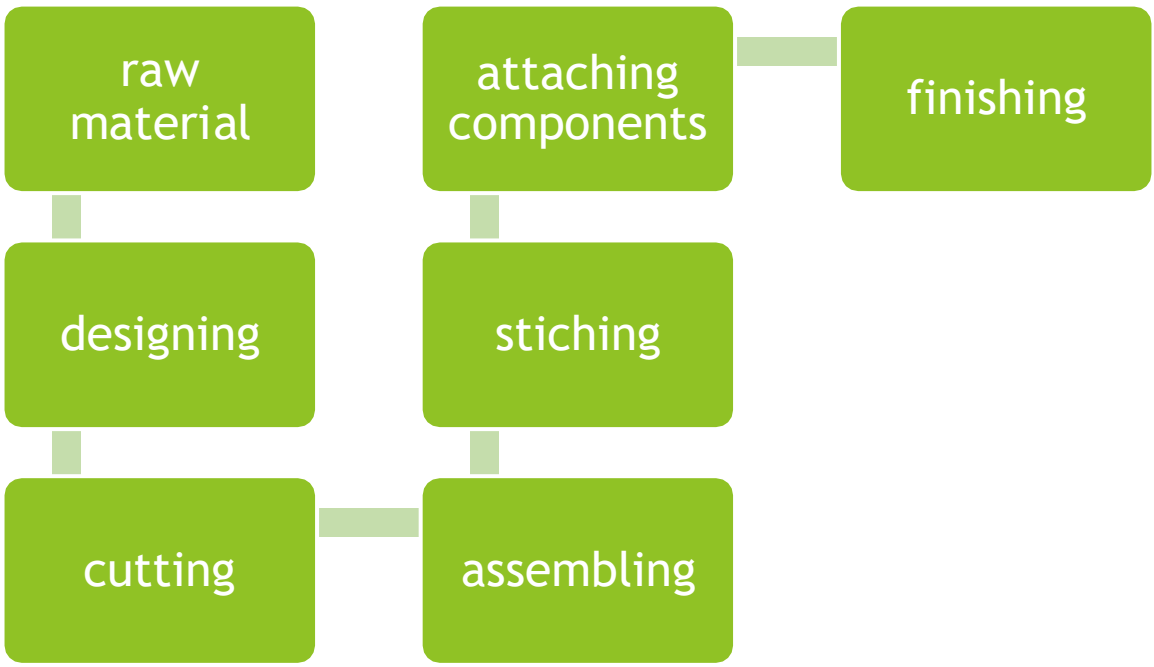
Fig 2

Future of footwear industry in India

The Government of India has initiated 'Make in India' program. Under this program Leather Sector has been identified as a focus sector. Accordingly, the Government is also implementing various Special Focus Initiatives under the Foreign Trade Policy for the growth of leather sector. Implementations of these initiatives, export promotion, skilled manpower, innovative technology, increasing industry compliance to international environmental standards, and support of other industries, the Indian leather industry aims to increase production, thereby the export, and resultantly create additional employment opportunities.

Footwear Manufacturing

Below figure depicts various steps in footwear manufacturing.[5]



Leather and footwear industry holds a prominent position in Indian economy. It is one of the top ten revenue generators for the country. The strength of the industry lies availability of raw material (cattle, goat, sheet etc.) skilled manpower, innovative technology and support of other industries.

India is second largest producer of footwear in the world, second largest exporter of leather goods and third largest exporter of saddlery and harness. Leather goods and leather garments. The Indian export share is shown in the figure [4].

Fig 3

Abstract

Shoe making is an art and has been almost always associated with leather. But in today's world where everyone is working towards conservation of environment, there is a need to switch over to alternative for the materials used in footwear industry.

The component department is involved in preparing other parts of the shoe like soles, insoles, toe puffs etc. These are the parts of a shoe which are mainly responsible for weight bearing of the wearer, provide arch support, stability of the heel during the movement. These are the parts of the shoe that can be switched over to alternative materials like PVC. The selection of these materials should be such that they do not harm the environment and not add to the already increasing pollution. The search for materials which are both environment friendly and biodegradable is still ongoing.

This thesis provides an insight into alternative materials which can be used and provided by the compartment department.

In the current times people having conditions are plantar fasciitis or other bone problems have difficult finding shoes that cater to their needs and also are pocket friendly. This thesis tries to find a solution for the same.

Key Words

Footwear industry,

Alternative material,

Biodegradable,

Natural,

Gel foam,

Leather alternatives,

Tanning.

Introduction

Shoe making is a complex process which starts with receiving the raw material which goes under several processes lie pre tanning, tanning, post tanning and finishing to get the final product. The design of the footwear to be made is sketched and it can be inspired, have pantone colors, could be according to seasons etc. the material to be used is selected and it is cut in the cutting room. Then the components are assembled and stitched in the closing room. The closing room also skives and smoothens the material. While the material is stitched, the component department gets the other components ready like toe puffs, stiffner, insole board etc. These are the parts of a shoe which are mainly responsible for weight bearing of the wearer, provide arch support, stability of the heel during the movement.[6]

Then the shoe is sent for finishing where it has its final finishing like waxing, lacing, eyelet fixation etc. The footwear is then sent to the packaging department.

Ideology/Study

Search was performed for alternatives of sole, heel, insole. The hits received were reviewed and most relevant hits were selected for inclusion. Articles identified in references were also reviewed and included when considered relevant.

Survey

What is component department?

During shoe making, while the upper is being fitted and assembled, other parts of the shoe are prepared in the Stuff Cutting Department/Compartment Department. These parts include insoles and outsoles, welting, counters which are molded to the shape off the last and which reinforce the shoe, preserve its shape, and serve as protection for the foot, heels.[6]

Idea 1

Insole

Insole is used as footbed or the material, which is used at the bottom of the footwear. The materials that are usually used are leather, cellulose, polypropylene, polyamide, acrylic, rayon fibers etc.[7] Leather used is very harmful for the environment as it employs tanning of the animal hide using harmful chemicals like chromium salts, acids, aluminum sulphate etc. Leather is made using animal hide which causes animal cruelty killing many animals like cow, deer, alligator, kangaroo, buffalo, lizard, crocodile etc.[8]

The alternates which can be used are algal biomass as it has advantage as rapid growth, and it is cruelty free. It when treated can be hardened and be used as an alternative to the previously used insole boards.[7]

Fig 4

Fig 5

Fig 6

Leather boards are mostly widely used in the footwear industry.[9]

The alternates which can be used are algal biomass as it has advantage as rapid growth, and it is cruelty free. It when treated can be hardened and be used as an alternative to the previously used insole boards.[7]

Bamboo and vegan cork can also be used for insoles. Bamboo is the softest eco fabric on earth. Vegan Cork is elastic, wear resistant and softens impact.[26]

Fig 7 – bamboo insole

Fig 8 – vegan cork insole

The other alternate can be increasing the use of non-woven fiber insole boards for their hardness, elasticity, and strength.

Fig 9 – nonwoven insole

Paper insole board can also be used for insoles of women sandals, casual shoes etc.[25]

Fig 10

Usually, latex foam is used in making foam insoles, instead eco-friendly recycled breathable foam can be used. It is made by polymerization of breathable foam with special material. Wearing this insole can create a comfortable, relaxed, dry and loose foot environment and reduce the occurrence of the pain to a certain extent.[10]

Fig 11

Insoles made of other sustainable material fabric are also being used. Instead of normal plastic biodegradable plastic is also being used by the industry.[24]

Fig 12

Sole

A shoe is complete only when the lasted upper is attached with a bottom sole. Sole is responsible to protect foot against heat, soiling, and sharp objects. To provide comfort to the wearer while walking it provides cushioning effect to the foot. Common materials used to make sole are chrome-tanned leather, synthetic rubber (Styrene), butadiene rubber soles (SBR), nitrile rubber, micro cellular rubber (EVA), poly vinyl chloride (PVC), thermoplastic rubber (TPR), poly urethane (PU), thermoplastic PU (TPU), ethyl vinyl acetate (EVA). [11]

Chromium is a heavy metal used for tanning leather. Chromium contamination can accumulate in food sources e.g. Fish. Chromium toxicity can cause respiratory, gastrointestinal and respiratory problems.

In its place vegetable-tanned Leather can be used which is safe for environment.

Fig 13

PVC is used in outsoles. PVC can cause rashes, headaches, vomiting, lung, liver and kidney damage and miscarriages. and indirectly affected. It also pollutes environment. PVC can be replaced by bioplastics which are biodegradable plastics.[7]

PU, TPU are used in outsoles. They can be replaced by bioplastics, EcoTPU and natural rubber can be used.[7] EcoTPU is a light sole made of eco-friendly material (sourced from plants), no forbidden chemical substances are used in its manufacture.[12] Bioplastics are either biodegradable or biobased plastics.[23]

Natural Rubber is made from the milk of the rubber tree.[13] Synthetic rubber can be replaced by natural rubber.[7]

Fig 14- eco TPU sole

Fig 15- natural rubber sole

Heels

The heel is the part of the sole that raises the rear of the shoe in relation to the front.[6] It is made of wood, rubber, leather, ABS (Acrylonitrile Butadiene Styrene) etc.[7]

ABS is a plastic used in heel making. It leads to environmental pollution as well as adverse health effects on humans. Use of bioplastics can avoid these harmful effects.[7]

Toe Puff

A lightweight reinforcement used inside shoe, placed between the upper and lining materials, which gives the toe its shape and support.[6] Materials used for toe puffs are leather, leather board, fiber board etc. Toe puffs are also made of non-woven material or can be made of 100% recycle fibers or the toe puff not dyed to make it economical or ecological. Cellulose fibre can be used which is a natural source and is biodegradable. [14]

Fig 16- nonwoven toe puff sheets

Fig 17- Cellulose fiber toe puff

Fig 18 – recycled fiber toe puff

Idea 2 -

Common problem observed is that certain people have problems in their legs and feet. People like them need custom made footwear but do not use the footwear according to their need.

Fig 19

The shoes or footwear with extra soft sole or any other type of customization costs a lot of money and it is difficult for everyone to afford them as they could range from a few thousands to sometimes even lakhs.

For example, the foot cushion of a normal brand starts at Rs. 2000/- INR.

Many companies like Nike do try to customize shoes but most of them have already attached soles, insoles etc. Most of the footwear sold provide only cushioning and shock absorption but most of them do not concentrate on the bio- mechanical problem of the feet.

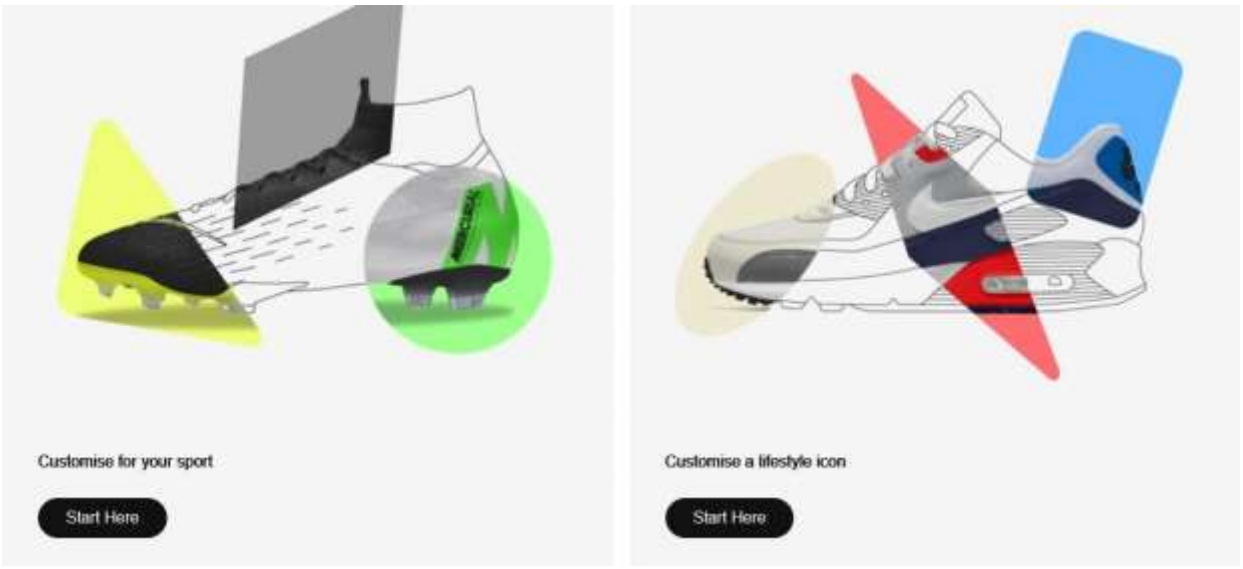


Fig 20 – Nike customization

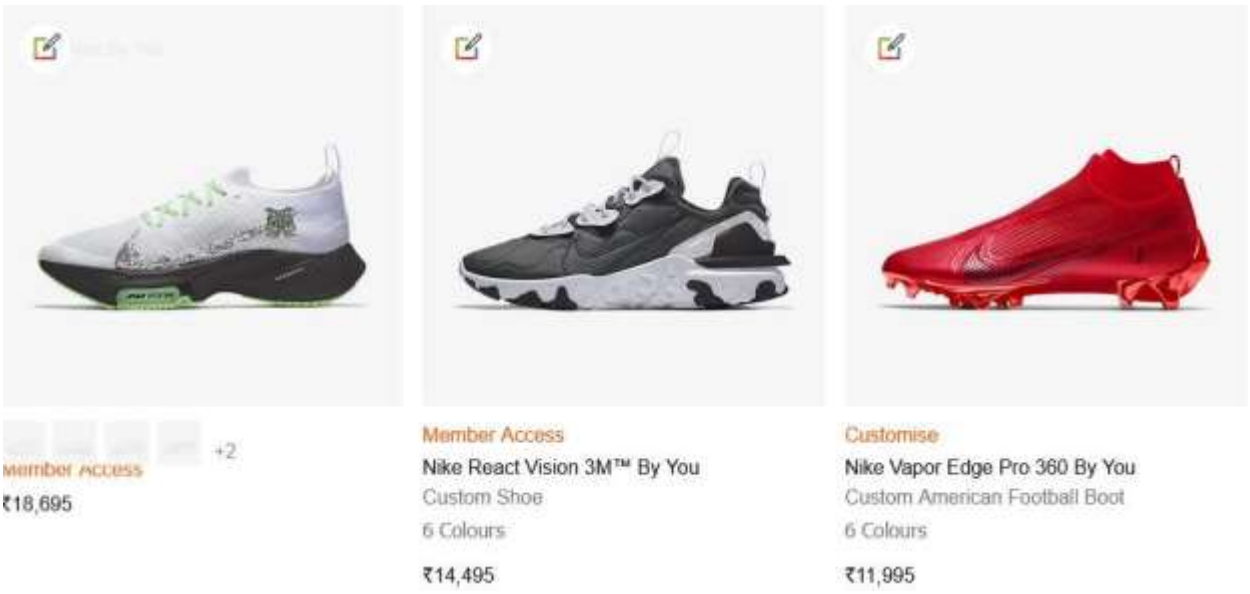


Fig 21 – customization site of Nike

As it can be seen figure 21 that customization starts at 11,995/- RS. which isn't affordable.

What usually causes the pain?

Feet problems can be caused by a variety of reasons including:

1. Prolonged working hours

2. Wearing the wrong size of shoe
3. Wearing footwear with not enough cushioning
4. Wearing too loose or too tight footwear
5. Congenital defects
6. Orthopedic conditions
7. Misalignment of the feet
8. Foot problems that a person gets over the life time like: bunion, hammer toe, corn etc.

Fig 22

What can be done?

By providing the person correct footwear for their condition. This not only helps fix the alignment of the feet but also helps in relieving the pain.

Spreading awareness about the importance of wearing the correct footwear etc.

A. Custom insole could be made which would match the curve of the feet.

The feet can also be digitally scanned and then the curves can be accurately measured, and the insole can be made accordingly. In digital scanning there would be more accuracy and easier in operation for the insole making.

For this the impression could be used by pressing the leg on a mould and the insole could be reciprocated according to that. This could be made available at various footwear stores these kinds of facilities are not available for normal public.

A different section could be divided and separated for people with problems in their feet.

These should be made in more quantities and provide it to all stores of bugger brands and then slowly provide to all the other stores and all of them could send the information about the insole to the manufacturing unit to help the people who need them and cant afford the customization. This kind of method is nit usually there for the common man.

The custom insole making process involves the following steps if it is made traditionally by hand:

1. Foot imprinting

2. Casting plaster
3. Adding positions
4. Insole shaping
5. Insole finishing

The custom insole making process involves the following steps if it is made computer scanning:

1. Foot scanning
2. Last modelling
3. Insole modelling
4. Insole milling
5. Insole finishing [15]

The impression created by this can be saved and be used for future use, this would also create customer loyalty for the brand.

Fig 23

B. The sole portion of the footwear is mostly hard to touch and does not have much cushioning.

Brands like Dr. Scholl's, Ortho rest, Cat walk, sketchers etc. are some brands that make footwear with comfortable heel portion.

The heel or the soles could be gel based which is more comfortable than regular soles used. Instead of one sole, there could be 2 soles which could be set in together. Gel is being used in insoles which is made from thermoplastic elastomer.[16]

Fig 25

Gel induced insoles and soles can be beneficiary as they provide more comfort and can help in walking. Gel induced soles can be very firm and springy and they have a deep gel padded heel cup which helps in the plantar fascia pain. These are very good for the feet as they provide extra comfort.[17] The lower outer sole portion could be hard made from rubber and the one above that would be below the sock could have memory foam or have a gel infused sole.

These gel insoles last for about 6 months, which can then be changed as they would cause pain if not replaced.[18]

Gel foam along with memory foam can be used in the footwear as memory foam. Memory foam has a high density with has a very good bouncy quality. Memory foam has softens to the human touch and gives time to warm up. [28]

Insoles can be replaced, and then new ones can be added for better fit and comfort of the feet.

Fig 26

Fig 27

I have personally observed my father who suffers from slip disk, joint problems and plantar fascitis pain. Buying footwear can be both time consuming and expensive as many brands do not have footwear matching his requirements.

The price ranges from 2000/- INR to 16000/- INR, which is usually not very affordable for all.

Fig 28- Asics 16000/- Rs

People like him who have any problems need footwear that will help them improve their condition. But many brands do not have all the facilities needed for each person according to their condition.

One of the ways could be that companies ask the customers their needs and stye need and make custom footwear for them. Like for plantar fasciitis pain gel insoles can be added, for arthritis therapeutic soles can be provided, for rocker kind of shoe for arteritis.[19]

The whole shoe or the footwear can be custom made for the customer for extra relief as many people have more than just one problem and many a times there are products available for only one of them not all of them.

Fig 29

Fig 30

Conclusion

For saving the environment the leather, poly vinyl chloride (PVC) etc. are used for component and in place of that materials like cellulose fibers, recyclable materials, bamboo, vegan cork etc. as then animal cruelty, pollution etc. can be avoided. These can be used to make the components like toe puff, insole, sole etc. these can be told as the alternative materials for the components.

For people with problems in their feet need customization for the insole as that would provide cushioning and stability and give comfort to their feet. The soles and the insole can use memory foam and gel infused for the comfort of the feet of the wearer. Customization according to the customer needs will help them with their foot problems and make them the brands loyal customer and give the brand a good image in the market.

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