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Enhancing Footwear Industry Competitiveness through Innovation-Oriented Design Thinking

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Abstract

This study enhances Ethiopia's footwear industry competitiveness through innovative design thinking that integrates customer voice with technical design priorities. It investigates key customer criteria in footwear purchasing and prioritizes design requirements to improve product quality and market responsiveness. Using Pareto analysis and the House of Quality (HoQ) framework, supported by Wondershare EdrawMax for visualization, the research identifies influential customer preferences and translates them into actionable design strategies. The findings emphasize customer-centric design, highlighting comfort, fitness, and durability as core satisfaction drivers. The study proposes a novel innovation-driven design framework—termed Innovation Design Thinking (IDT)—which synthesizes Design Thinking, Quality Function Deployment (QFD), and innovation principles, including commercialization. This approach offers strategic guidance for manufacturers on resource allocation and competitive product development while contributing to academic discourse by clarifying intersections between empathy-driven design, technical precision, and innovation outcomes in footwear.

Keywords: Footwear, Innovation Design Thinking, Voice of Customers, House of Quality, Competitiveness, Commercialization

1. Introduction

This study proposes design thinking as an innovative approach for driving innovation in the footwear industry, aiming to enhance the competitiveness of footwear design. It is the extension of design thinking. Design thinking is a comprehensive customer-oriented innovation approach that aims to generate and develop creative business ideas (Brown, 2008; Mueller-Roterberg, 2018). In practice, the design thinking stages are empathy, defining, ideating, prototype, and testing (Bourgeois-Bougrine et al., 2018; Sukoco et al., 2022; Lazar et al., 2021). Innovation is the invention of new technologies, ideas, or ways of doing things differently that must be commercialized to make value by disrupting the existing market. Firms live and die by their ability to successfully bring innovations to market, which makes commercialization a key capability(Munoz-Penas et al., 2024).

It is the ideas from inception to impact (Budden & Murray, 2019) or commercialization. Thus, innovation design thinking is an innovation-driven design process that involves identifying customers' voices, defining problems, ideating solutions, prototyping, testing, and commercializing. The existing scientific literature on Design Thinking reveals several research gaps, particularly in conceptual clarification, methodological approaches, and impact measurement (Meinel & Leifer, 2012; Bessant, 2013). Addressing these gaps will enhance the understanding and application of Design Thinking in various contexts. Considering these issues, this study adopted a comprehensive approach, namely innovation design thinking. This flesh insight extends the traditional design thinking to impact assessment through commercialized and competitive

Footwear. The development of new products, technologies, and services has been accelerated in recent decades due to globalization, connectivity, technological advancements (Santos et al., 2018), and innovative design thinking. Furthermore, the existing literature reveals the following gaps: 1) limitations in identifying comprehensive footwear customers' purchasing decision criteria, and 2) a lack of prioritization of the 'critical few' and the 'vital many' criteria to address the preference of footwear customers' purchasing criteria. The study by Spahiu et al. (2024) identified three key factors that affect customer purchasing power: price, brand identity, and the product's design stylistic attributes. 3) Furthermore, to our knowledge, there is no literature available in the Ethiopian context that examined the competitiveness of the Ethiopian footwear industry in terms of innovative design thinking and customer purchasing decision criteria. In another way, due to the entry of many sellers, customer preferences have dominated global markets(U. Abdul Kadar, S.R. Devadasan, 2019). World Footwear Yearbook (2023) reported that 2022, global footwear production reached 23.9 billion pairs, and consumers worldwide bought 19 billion pairs of shoes yearly. On average, global footwear consumption per person is approximately 2.9 pairs of shoes, whereas consumption in North America, Asia, and Africa is 5.9, 1.7, and 1.4 pairs per person, respectively. In production, over the past decade, the geographical distribution of Footwear has been dominated by Asia at the continental level. It covers about 87% of the world's shoe production. At the country level, China stands out as the origin of over 60% of total footwear exports (World Footwear Yearbook, 2023; Statista, 2023). The global footwear export market share is led by China (61.3%), Vietnam (9.9%), and Indonesia (3.5%) (World Footwear Yearbook, 2023; Statista, 2023). India is the second-largest footwear producer globally, after China, with production accounting for approximately 9% of the global annual output of 22 billion pairs (Pattanaik, 2019). Its footwear export market share is 1.9 % (World Footwear Yearbook, 2023).

Ethiopia's footwear industry and the leather sector have significant comparative advantages globally. It has abundant raw materials, a highly disciplined and competent workforce, lower wages, availability of production facilities (industry parks), supportive government policy, and possesses the largest livestock herd in Africa and the 10th largest in the world (Alubel Abtew, 2017; Assefa & Gebreeyesus, 2018). However, market research and studies indicate that the Ethiopian leather sector's Revealed Comparative Advantage (RCA) is currently limited to exporting raw hides and skins rather than finished leather products (United Nations, 2018).

The 2021 annual report from the Ethiopian Leather Industry Development Institute reveals that Ethiopian footwear exports experienced growth from 2012 to 2019, but saw a decline from 2019 to 2021. This downturn in footwear exports highlights the inconsistency in export performance. To improve the export success of the footwear sector, it is crucial to identify the underlying issues and implement innovative design thinking strategies from the initial stages to commercialization. While understanding customer feedback is vital for maintaining competitiveness, many organizations excel more at communicating with their customers than at truly listening to them (Freeman & Radziwill, 2018). HoQ is one of the quality function deployment tools used in translating customer requirements into the appropriate technical requirements at each stage of product development and production(Kowang et al., 2025; Singh et al., 2018; Shoukat et al., 2019; Bahia et al., 2023).

The following research questions (RQs) were developed to address the research gaps and objectives.

> RQ1: What are the priority areas for technical design requirements in footwear design to enhance product competitiveness in the global market?
>
> RQ2: What are customers' expectations or priority criteria for footwear purchasing?
>
> RQ3: What unanswered questions in DT does IDT seek to answer?

To address the research questions, data were obtained through a sample survey of 97 respondents, including Ethiopian footwear manufacturers (managers, designers, and experts), international footwear consultants, customers, and researchers.

In summary, to enhance the competitiveness of the Ethiopian footwear industry by leveraging an innovative design thinking approach, this study seeks to identify, examine, and prioritize the customers' criteria for footwear purchasing and the design requirements by applying quality function deployment (QFD)-The House of Quality (HoQ) framework, complemented by Pareto analysis. The remaining sections of the

article are organized as follows: Section 2 reviews the literature and outlines the research framework; Section 3 details the methodology; Section 4 presents and discusses the results; Sections 5 and 6 address theoretical and practical contributions; and Section 7 concludes with limitations and directions for future research.

2. Literature Review and Conceptual Framework

2.1. Design Thinking

Design Thinking is a comprehensive customer-oriented innovation approach that aims to generate and develop creative business ideas or entire business models (Mueller-Roterberg, 2018). Tim Brown, executive chair of IDEO, defined design thinking as a human-centred approach that draws from the designer's toolkit to integrate the needs of people, the possibilities of technology, and the requirements for business success and sustainability. Human-centred design approaches aim to generate better solutions through understanding people's social, emotional, and physical needs(Murphy et al., 2025).

The study conducted by Chasanidou et al. (2015) and Lazar et al. (2021) strengthened this idea. It explains design thinking as a system of three overlapping spaces, in which viability refers to the business perspective of design thinking, desirability reflects the user's perspective, and feasibility encompasses the technology perspective. One of the outstanding theoreticians of functional design, Thomas Maldonaldo, defined design as a creative activity that determines the precise properties of an item to be produced in an industry (Kutnjak-Mravlinčić et al., 2020). According to Thomas Maldonaldo and other authors, the perspective of design thinking differs from the traditional approach, which focuses on functionality and the ease of manufacturing products and services. In today's global competitive landscape, designing products solely from an engineering or technical perspective is insufficient. The design creates innovative and commercially viable products by incorporating the customer's voice into its design. In the long run, the industries' competitiveness and survival are determined by design thinking (Appleyard et al., 2020) and innovation. Even though Design Thinking is a process of products or services designed by a pool of multidisciplinary professionals from designing, marketing, management, and merchandising to provide salable products/services, there are no fixed steps to follow; however, some researchers mentioned the design thinking pillar stages as empathy, define, ideate, prototype and testing (Deitte & Omary, 2019; Wolfe, 2019). The design thinking concept is not only applicable to product development but also extends to academia. Salunkhe, Sudhir, and Kadam's (2018) study suggests a design thinking model for academic institutions and the industry to bridge the gap between industry and academia. However, the limitations of design thinking include ambiguous concepts, challenges in measuring impacts, and difficulties in assessing methodological approaches (Meinel & Leifer, 2012; Bessant, 2013). Furthermore, while there are numerous normative and process-focused depictions of Design Thinking, they are limited in their ability to reflect real-world practice(Carlgren et al., 2016). Another problem in design thinking might be that the product resulting from a design thinking process might be too specific, i.e., which is hard to sell (Vrahara & Jamil, 2021).

In contrast, innovation design thinking focuses on an innovation-driven approach that facilitates the measurement of impacts through the commercialization of products. The traditional methods of Design Thinking (DT) can be extended beyond their original focus on design and innovation to domains such as entrepreneurial marketing, where they support firms in effectively promoting innovative and design-driven offerings(Rösch et al., 2023). Building on this perspective, the present study advances this adaptation by applying the IDT approach.

2.2. Innovation

Innovation is the invention of new technologies, ideas, or improvements in ways of doing things that must be commercialized to create value by disrupting the existing market. Massachusetts Institute of Technology defined innovation as taking ideas from inception to impact" (Budden & Murray, 2019). Another study explained innovation in a broader context as innovation is not only the discovery or creation of new technologies or the commercialization of research findings but also about doing differently in a better way the successful introduction of new ideas to improve or create a process, an outcome, a product or knowledge for the benefit of an organization, a society, and its stakeholders (Cukier et al., 2021). Most academics and industries widely recognize innovation as a key factor in gaining a competitive advantage and sustaining competitiveness and growth (Rajapathirana & Hui, 2018). The study by Darbellay et al.(2017) explained

creativity and design through the expression of creative *design thinking*. Creative design thinking focuses on the creative (original and adaptive) aspects of the design process. In our study, innovation design thinking (IDT) is presented as a more comprehensive, innovation-driven approach that extends traditional design thinking by incorporating the element of commercialization. Innovation plays a vital role in the success and sustainability of a business. The extended IDT stages include empathy or voice of the customer (VoC), defining, ideating, prototyping, testing, and commercialization.

2.3. Competitiveness of the Ethiopian Footwear Industry

The necessity of footwear for humans extends beyond mere protection and comfort, encompassing aesthetic appeal as well. Thus, the three critical factors that influence consumer purchasing decisions are price, brand identity, and the design stylistic attributes of the product (Spahiu et al., 2024). The footwear market places high criteria on multifunctional products with top design, higher quality, and better end-use properties (Kutnjak-Mravlinčić et al., 2020). The evolving market landscape reflects the changing demands of consumers, who increasingly desire active involvement in the shoe design process, prompting shifts in design practices(Firtikiadis et al., 2024). Due to the entry of many sellers, customer preferences have dominated global markets(U. Abdul Kadar, S.R. Devadasan, 2019). The World Footwear Yearbook (2023) reported that in 2022, global footwear production reached 23.9 billion pairs, and consumers worldwide bought 19 billion pairs of shoes annually. The total market share of China, Italy, Germany, France, Indonesia, and India reached 69.71% in 2016, accounting for two-thirds of the global export of work shoes. From 2010 to 2022 (Zhang, 2018; World Footwear Yearbook, 2023), China's international market share of work shoes has consistently been ranked first globally, with an annual average share of 38.70%, indicating the strongest international competitiveness. This is mainly because, as a large producer of light industrial products, China has established a comprehensive industrial chain encompassing R&D and design, material development, technical application, and production and processing (Zhang, 2018). The strength in a complete industrial chain, such as materials (fabrics, plastic, rubber, foams, metals, wood, leather, and other accessories), enables the creation of fashionable, comfortable, durable, safe, and ergonomic Footwear. In 2022, the World Footwear Yearbook 2023 reported that China's total footwear export share in the global market is over 60%.

Ethiopia's footwear industry and the leather sector have significant comparative advantages internationally. It has abundant raw materials, a highly disciplined and competent workforce, lower wages, availability of production facilities (industry parks), supportive government policy, and possesses the largest livestock herd in Africa and the 10th largest in the world (Alubel Abtew, 2017); Assefa & Gebreeyesus, 2018). According to the Statista Market Insights 2023 report, the Ethiopian footwear industry is experiencing growth by focusing on sustainable production and utilizing locally sourced materials. Ethiopia has approximately 57.83 million cattle, 28.04 million sheep, and 28.61 million goats as livestock. Ethiopia's hides and skins are highly renowned for their natural qualities of clarity, flexibility, strength, thickness, and compact texture (Gezu Tadesse and Azage Tegegne, 2018).

The footwear market in Ethiopia is growing and presents a significant opportunity for businesses operating in the footwear sector. However, market research and studies indicate that the Ethiopian leather sector's Revealed Comparative Advantage (RCA) is currently limited to exporting raw hides and skins rather than finished leather products (United Nations, 2018).

The Ethiopian Leather Industry Development Institute's 2021 annual report indicates that the status of Ethiopian footwear exports grew from 2012 to 2019 but decreased from 2019 to 2021. From the decline in footwear exports, it is understandable that the progress of export performance is inconsistent. To enhance the export performance of the footwear industry, identifying the root causes and applying innovative ideas from inception to commercialization is crucial.

2.4. Quality Function Deployment (QFD)

Quality function development (QFD) is a management product planning tool that systematically develops customer needs and expectations (Ginting et al., 2020), and the House of Quality is a tool (HoQ) used in the structure of the Quality Function Deployment (QFD) in the first stage in the form of a house-shaped matrix (Series & Science, 2019). QFD has been around for over three decades but has only begun to realize its full potential as a powerful tool to improve companies' strategic position since the 1990s (Kumar et al., 2006). First, it was developed in Japan in the late 1960s and early 1970s at Mitsubishi's Kobe shipyard

site. It has been successfully used by Japanese consumer electronics manufacturers, as well as in the production of home appliances, clothing, integrated circuits, synthetic rubber, construction equipment, and agricultural engines. Later, it was introduced to the United States in the early 1980s. The first companies that used it on a larger scale in the 80s were the "Big Three" car manufacturers (Ford, General Motors, Chrysler). Then, as in Japan, the method began to be widely used in other industries (Wolniak, 2017). It is an important quality management technique that has been studied extensively and has already been tested in various real-world applications (Jian Zhou, Yixuan Shen, 2022). According to a bibliometric analysis of QFD's development between 1983 and 2019, based on 1,856 literature works retrieved from the Web of Science Core Collection database by Jian Zhou and Yixuan Shen (2022), QFD is considered to have entered its flourishing stage over the past decade. More than 3,000 scholars from 1,400 institutions and 82 countries and regions have contributed significantly to its development. The primary functions of quality function deployment are to identify and examine customers' needs and to engage customers in product development as early as possible, thereby improving product design quality based on customer evaluation. Using quality function deployment helps the product development management team make decisions about product quality by studying and improving its characteristics (P. Sivasankaran, 2021). The main application of QFD-HoQ is to identify, analyze, and prioritize customer needs and design requirements to enhance product quality planning, feasibility assessment, and documentation instead of value creation(Moura e Sá, 2016). QFD lacks a complementary tool to foster innovative product development. The study by Koppenhagen et al.(2024) highlights that hybrid process models, which combine elements of agile approaches with stage-gate processes from systems engineering, aim to address the specific challenges of developing physical products. However, there is currently no established hybrid product development process model that has been widely adopted in the industrial practice of new product development (NPD).

In light of the gaps in the literature, our study proposes the implementation of an innovation-driven design approach, specifically Innovation Design Thinking (IDT), which complements traditional design thinking and Quality Function Deployment (QFD) - the House of Quality (HoQ).

2.5. Conceptual Framework

A conceptual framework is the big picture, or vision, comprising the totality of research (Ronald Osei Mensah et al., 2020). A conceptual framework includes key concepts, variables, relationships, and assumptions that guide the research questions. It develops upon existing theories, models, or established bodies of knowledge to provide a structure for understanding the research problems. It defines research coverage, identifies relevant variables, establishes research questions, and guides the selection of appropriate methodologies and data analysis techniques. Accordingly, based on the existing literature, theories, and facts, a conceptual framework for this study has been developed, as shown in Figure 1.

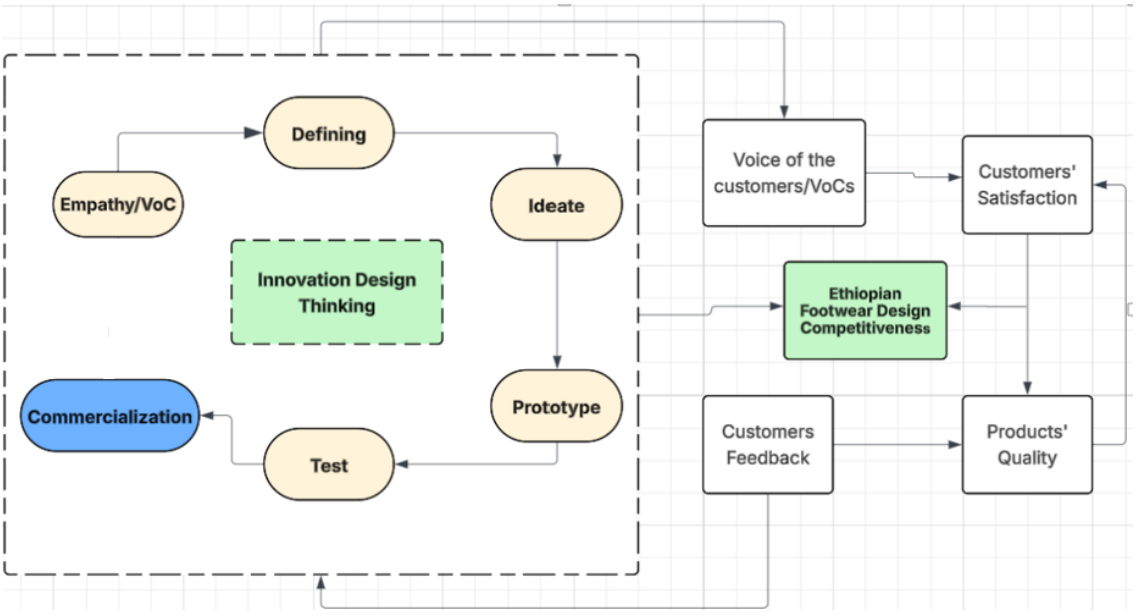


Fig. 1: The theoretical framework

In the conceptual framework, the authors utilised the Quality Function Deployment (QFD) tool to identify challenges in customer satisfaction and to determine footwear design requirements. The innovation design thinking concept was deployed to address the challenges. On the left, the first box encompasses Empathy/VoC, which includes defining, ideating, prototyping, testing, and commercializing, all stages of innovation design thinking. Innovation design thinking has a direct impact on the competitiveness of the Ethiopian footwear industry; in other words, the competitiveness of the Ethiopian footwear industry can be enhanced by applying innovative design thinking. Innovation design thinking can be realized by incorporating customers' voices into the design and development process and by collecting and analyzing customer feedback. Products that incorporate the voice of customers in their design and development will better meet customers' expectations. Customer satisfaction with product quality immediately improves the company's competitiveness.

3. Research Methodology

3.1. Research Design

We designed a survey questionnaire for our study because it effectively gathers relevant data from our target population (Vogt et al., 2012). This approach is also cost-effective, as questionnaires can be distributed and managed digitally, enabling remote administration. To clarify the question for the questioners and validate understanding for the respondents, the questionnaires were distributed to four international footwear manufacturing consultants before being disseminated to the entire target population. Based on their suggestions, some questions were added, and some were modified. We further sought suggestions from three footwear manufacturing managers. Two managers provided feedback, and one confirmed that the questionnaire was clear and valid to the best of his knowledge. At this point, we have completed finalizing the questionnaire. The questions were developed based on the research questions (RQs) and objectives. Correspondingly, the research design is outlined in Figure 2.

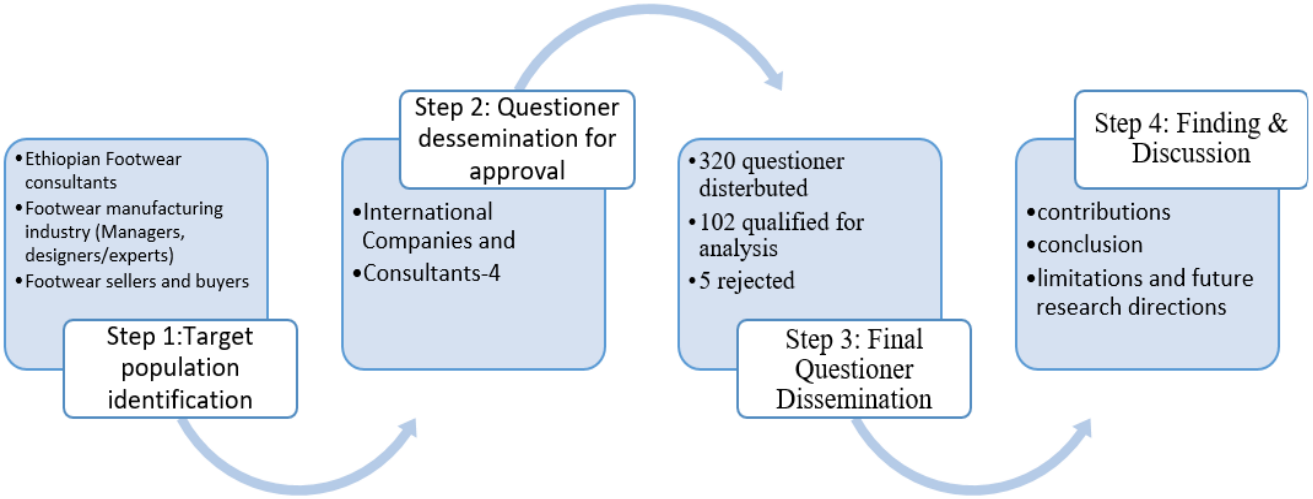


Fig. 2: Data collection methodology design (source: authors)

3.2. Data Collection

We created an online questionnaire using Google Forms and disseminated the link via email, WhatsApp, Telegram, and WeChat groups. The target population for the data collection encompassed Ethiopian footwear industry consultants, footwear manufacturing factories (including managers, owners, experts, and designers), as well as footwear customers and sellers. The sampling techniques employed for data collection included purposive and snowball sampling. The purposive sampling technique was implemented based on the knowledge and experiences of the respondents concerning the Ethiopian footwear industry markets and manufacturing techniques. The snowball sampling technique was employed to contact footwear companies without direct contact with the researchers. It was not easy to access data for collection through direct contact with researchers. These potential respondent companies were reached through consultants collaborating with all the factories. Out of the 320 questionnaires distributed, 102 individuals returned the questionnaires, and five respondent questionnaires were rejected as they were unqualified for analysis. The number of returned and accepted questionnaires was 97, which constituted 30 per cent. The data sampling

is acceptable for two reasons. First, the collected data were adequate to develop qualitative research findings. Second, as the data sampling technique was purposive and targeted the most potential customers, the research data achieved saturation.

3.3. Data Analysis

Data analysis was conducted based on the collected survey data, aligned with the specific objectives of the study. Given the potential of the QFD-HoQ tool in identifying, examining, and prioritising the challenges faced by manufacturing and service-providing industries to enhance competitiveness, this study utilised the HoQ tool to identify, investigate, and prioritise the product design challenges of the Ethiopian footwear industry. We used the Wonder-share endrawMax tool to develop the HoQ spreadsheet. Additionally, we utilised a Pareto chart and graph to prioritise the customer's criteria for making shoe purchasing decisions. The study identified and analysed the voice of the customers, the crucial footwear design requirements, the connection between Voice of the Customer (VoC) and critical design requirements, the correlations among design requirements, and comparisons with competitors in the Ethiopian footwear industry. Accordingly, the analysed data show that 91.75% of respondents were male, and 8.25% were female. Regarding education level, 55.67% held a degree greater than or equal to a master's degree, 26.8% had a first degree, 13.4% were at the secondary level, and 4.12% had less than a grade 12 education. Professional-wise, 17.53% were industry consultants, 12.37% were Company managers, 27.8% were designers and experts, and 42.27% were customers, sellers, and buyers.

Detailed respondents' profiles are mentioned in Table 1.

Table 1: Respondents detailed profile

Observations 97 Samples			
Items		**Frequency**	**Percent**
Gender	Male	89	91.75
	Female	8	8.25
Age	18-25	0	0
	26-33	21	21.65
	34-41	56	57.73
	42-49	16	16.49
	>=50	4	4.12
Education	<=12 grade	4	4.12
	Diploma	13	13.4
	Bsc/BA	26	26.8
	>= Msc/MA	54	55.67
Professions & Experiences	Consultants	17	17.53
	Company managers	12	12.37
	Designers/ Experts	27	27.84
	Customers/Sellers	41	42.27

4. Findings and Discussions

The comprehensive findings and discussions are synthesized using a Pareto chart, the House of Quality (HoQ), and an innovation design thinking framework. The Pareto chart effectively analyzes the criteria that influence customer footwear purchase decisions. Meanwhile, the HoQ clarifies the interrelationships between the voice of the customers and design specifications, the correlations among various design requirements, competitive analysis, and the relative importance of these design criteria. Finally, the innovation-driven design approach, specifically the innovation design thinking methodology, has been proposed, leading to the development of a comprehensive framework for designing competitive footwear.

4.1. Pareto Analysis

A Pareto chart was utilized to identify, examine, and prioritize footwear design issues in terms of customer purchasing criteria and design requirements. The study also utilised the House of Quality (HoQ) tool to translate the voice of the customer (VoC) into design actions and analyse critical factors influencing customer preferences. Pareto analysis, a statistical decision-making tool, is widely used to identify the "vital few" items that contribute significantly to an outcome, while filtering out the "trivial many." The 80/20 principle, introduced by Vilfredo Pareto and supported by Talib et al. (2010), suggests that approximately 80 per cent of consequences arise from 20 per cent of causes. By applying this principle, managers can focus efforts on addressing the most impactful factors first.

In this study, customer preferences were analysed across 13 criteria: comfort, durability, price, fitness, style, aesthetics, fashionability, brand, colour, weight, uniqueness, technical assembly, and warranty, based on responses from 97 individuals, including footwear manufacturers, users, retailers, and sector professionals. The Pareto analysis revealed that a small number of customer criteria have a significant influence on purchasing decisions. Specifically, comfort, fitness, and durability collectively accounted for more than 54 per cent of the cumulative importance, indicating that these factors are the most critical to buyers. When additional attributes, such as price, aesthetics, style, and fashionability, are considered, the cumulative importance rises to approximately 85 per cent. These findings highlight that core functional and experiential factors predominantly drive customer satisfaction in footwear, while considerations such as brand, colour, weight, and warranty play a relatively minor role in determining overall satisfaction.

Table 2: Pareto chart

Footwear buying criteria	Voice of customers/VOCs	Cumulative response	Cumulative %
Comfort	26	27%	27%
fitness	16	16%	43%
durability	10	10%	54%
Price	9	9%	63%
aesthetic	8	8%	71%
style	7	7%	78%
fashionability	6	6%	85%
brand	5	5%	90%
color	4	4%	94%
weight	3	3%	97%
uniqueness	2	2%	99%
technical assembly	1	1%	100%
warranty	0	0%	100%
Total respondents	97		

As shown in Table 2 and Figure 3, the top five factors—comfort (27%), fitness (16%), durability (10%), price (9%), and aesthetics (8%)—together contribute 70% of the total responses. When style (7%) is added, the cumulative contribution reaches 78%. These “vital few” factors should be the priority focus for design improvements and marketing strategies. In contrast, the remaining “useful many” or “trivial” factors—including brand, colour, weight, uniqueness, technical assembly, and warranty—collectively contribute only 22%, suggesting they exert less influence on customer decisions and can be deprioritised in immediate strategy formulation.

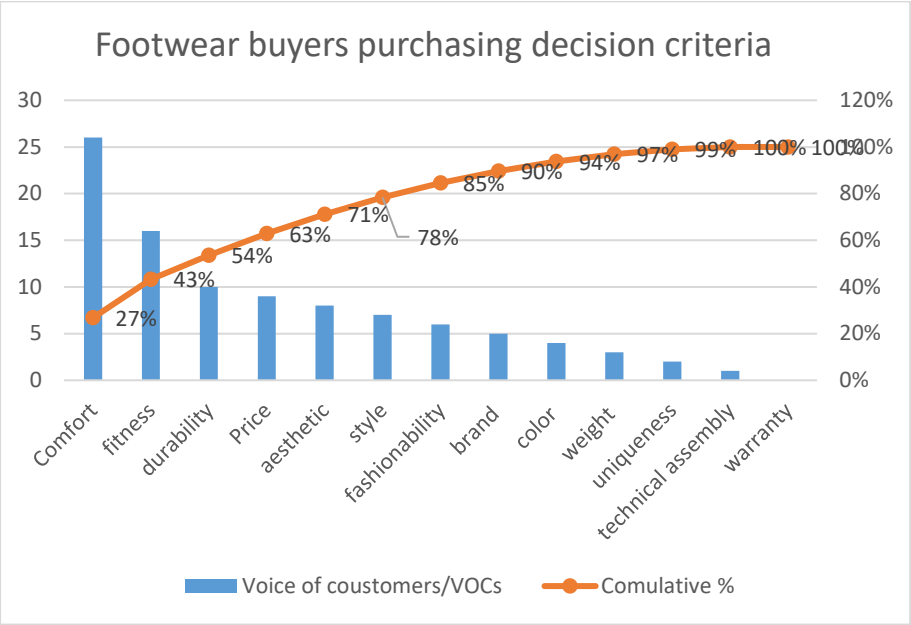


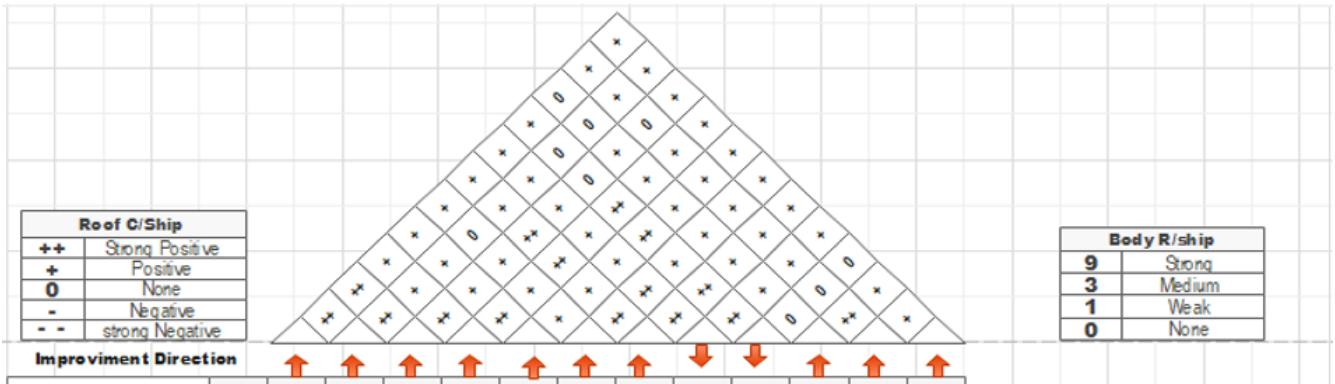
Fig. 3: Pareto diagram

The study by Spahiu et al.(2024) identified price, brand identity, and stylistic design as key drivers of footwear purchases. However, it lacked comprehensive prioritisation and failed to differentiate between dominant and minor factors influencing customer decisions. This study addresses that gap by classifying the customer criteria into high-impact and low-impact categories based on actual data, ensuring better alignment of product development with market demands.

In summary, the Pareto analysis provides a clear, data-driven framework to prioritize footwear design elements. By focusing on the core preferences—comfort, fitness, durability, price, and aesthetics—designers and manufacturers in Ethiopia can enhance customer satisfaction and market competitiveness. These insights can guide future innovations and resource allocations in the footwear sector.

4.2. House of Quality

After the Pareto analysis, customer priorities were further refined through the application of the House of Quality (HoQ) framework, which systematically established relationships between customer expectations and technical design requirements. This method allowed the translation of the "voice of the customer" into specific, actionable product development goals. The technical elements identified as most influential—sole design match, ergonomic design, and upper design—received the highest relative importance scores in the HoQ matrix and were strongly associated with the customer needs highlighted by the Pareto analysis. This integration of insights reinforced the need to focus design and engineering efforts on these priority areas.



Design Requirement ---➡ / Voice of Customers (Customers Need)	Weight	Size	Last Design	Sole Design /tech	Upper Design	Pattern Making	Components	Material selection	Cost Estimation	Material Wastage	Prototype	Testing	Measurments	Competitor Comparison (out of 5)		
														Ethiopia	China	India
Aesthetic	5	1	3	9	9	9	3	9	1	1	3	1	3	2	5	4
Color	3	1	1	9	9	1	9	9	3	1	9	9	0	3	5	4
Comfort	5	9	9	9	9	9	9	9	1	9	9	9	3	3	4	4
Construction	3	9	9	9	9	9	9	9	0	3	9	9	9	3	5	5
Fitness	5	9	9	9	9	9	3	3	3	0	9	9	9	3	5	4
Durability	5	0	0	9	3	3	9	9	1	3	0	9	1	4	3	5
Price	5	3	9	9	9	3	9	9	9	9	3	1	3	3	3	4
Fahionablity	4	1	9	9	9	9	9	9	3	1	9	9	3	2	4	3
Light weight	2	3	3	9	9	0	3	9	1	1	9	9	0	2	4	3
Brand	3	1	9	9	9	9	9	9	9	9	3	3	0	2	3	4
Style	4	3	9	9	9	9	9	3	3	3	9	3	3	2	5	4
Uniqueness	2	3	9	9	9	9	9	9	3	1	9	3	1	2	5	4
Warranty	1	1	0	1	1	1	1	3	1	0	0	0	0	3	3	3
														40	54	51
Relative importance		172	303	415	385	313	343	363	144	169	291	276	143			
Importance in %		5.19	9.13	12.51	11.61	9.44	10.34	10.94	4.34	5.09	8.77	8.32	4.31			
Proirity		9	6	1	2	5	4	3	11	10	7	8	12			
Measurement units		EU	1-5 scal	%match	N	mm	%	mm	$	%	days	%	cm			
Target value		38–46	≥ 4.5	≥ 85	≥ 30 N	±0.5 mm	100 compliance	≥ 1.4	≤ $20 USD	≤ 10 waste	≤ 8	≥ 95	≤ ±0.3			
Digree of difficulty (1-10)		5	8	8	8	7	7	9	8	8	7	8	8			

Fig. 4: House of Quality matrix.

In the relationship matrix, the associations between customer needs and design requirements were evaluated using a standardized scale: 9 indicates a very strong relationship, 3 denotes a moderate relationship, 1 reflects a weak relationship, and 0 indicates no relationship. According to this matrix, the top six prioritized design requirements for improvement are sole design technology, upper design, material selection, accessories/components, pattern making, and last design, in that order.

Notably, the relative importance in the HoQ reveals that 58.21% of Ethiopia's footwear design challenges stem from these six technical elements, underscoring their strategic importance. The remaining 41.74% of issues are related to prototype development, testing, size standardization, cost estimation, material utilization, and measurement practices. The HoQ roof matrix further illustrates interrelationships among technical elements using correlation symbols: "++" for strong correlation, "+" for weak correlation, and "0" for no correlation. For instance, strong correlations were observed between size, last design, and sole design, as well as between upper design and pattern-making and between components and material selection, revealing that improvement in one area can positively influence others.

Target values for each design requirement were established in consultation with experienced footwear designers to align with industry standards for leather footwear. For instance, ergonomic design was assigned a minimum rating of 4.5 out of 5, based on user trials, to enhance comfort. The sole design was expected to achieve at least an 85% match to average foot contours, ensuring a proper fit and support. The upper part

of the shoe was designed to withstand a stitch tear strength of 30 newtons and achieve a breathability rate of 60%, ensuring both durability and wearability. A leather thickness of 1.4 millimetres and a maximum shoe weight of 1.3 kilograms per pair were targeted to maintain comfort without sacrificing quality (this information is based on experts' and professionals' consultations).

The HoQ analysis also revealed systemic relationships among technical features. For example, enhancements in pattern-making or component selection may yield improvements in both comfort and aesthetics. However, trade-offs were also noted—such as between shoe weight and sole durability—highlighting the importance of carefully balanced design choices. Improvement direction indicators in the matrix point toward minimising cost and material waste, as indicated by the arrow ( ), while maximising performance-oriented design attributes.

To quantify the relative importance of each design requirement, the method proposed by Zheng et al.(2019) was employed, using the equation:

$$Rj = \sum Wi \times Vij,$$

Where Rj represents the relative importance of a design requirement, Wi is the absolute weight of a customer need, and Vij is the strength of the relationship between the customer need and the design requirement. This structured approach supports data-driven decision-making in footwear design.

Furthermore, the competitive benchmarking component of the HoQ highlighted Ethiopia's performance gap in comparison to major producers, such as China and India. Ethiopian footwear scored 40 out of 75 in customer evaluations, whereas Chinese and Indian footwear scored 54 and 51, respectively. Key areas of weakness included comfort, style, and fashionability. Addressing these gaps requires targeted improvement in the top-ranked design requirements informed by both customer needs and technical feasibility.

In summary, the combined use of Pareto analysis and the House of Quality provides a robust, integrated framework for enhancing the competitiveness of leather footwear in Ethiopia. By focusing on a limited set of high-impact technical requirements, guided by industry-informed target values and strong interrelationships, manufacturers can significantly improve product quality. This approach supports innovation design thinking, a novel, strategic perspective proposed through a thorough review of the literature on design thinking, quality function deployment, and footwear industry competitiveness. It provides a practical roadmap for aligning customer expectations with engineering priorities, thereby achieving improved market performance and innovation-driven growth.

4.3. Innovation Design Thinking

Innovation design thinking represents an innovation-centric design paradigm that extends the principles of traditional design thinking. This study examines the limitations inherent in design thinking, specifically regarding conceptual clarity, impact assessment, and methodological rigour. In contrast, innovation design thinking offers a holistic framework that synthesizes design thinking, quality function deployment (QFD), and the principles of innovation and competitiveness. Figure 5 illustrates the comprehensive and integrative nature of innovation design thinking, which encompasses design thinking, QFD, innovation, and competitiveness.

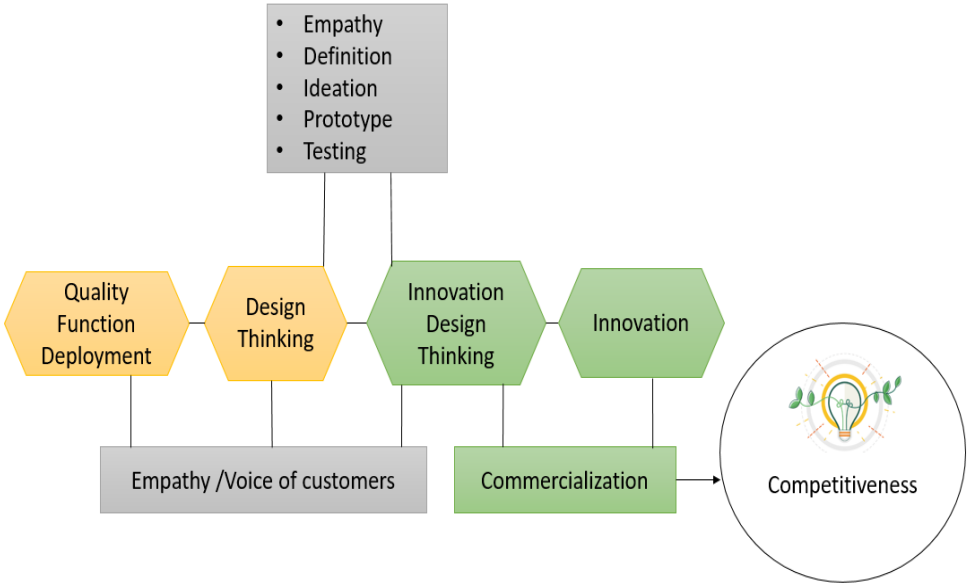


Figure 5: Comprehensive IDT model: authors' work

From the IDI model in Figure 5, we can observe the interconnections between Quality Function Deployment (QFD), Design Thinking (DT), and Innovative Design Thinking (IDT), particularly in terms of empathy and Voice of Customer (VoC) considerations. Additionally, it highlights the relationship between DT and IDT, encompassing the stages of empathy, definition, ideation, prototyping, and testing. Furthermore, it illustrates the link between IDT and Innovation, particularly in commercialization. Commercialization, often overlooked in other methodologies, is integral to the innovation design thinking framework. This approach facilitates the enhancement of competitiveness and enables the assessment of impact through the lens of commercialized products.

Moreover, Design Thinking (DT), Quality Function Deployment (QFD), and Innovation Design Thinking (IDT) differ in focus and application. DT is a human-centred approach that emphasizes empathy, creativity, and iterative prototyping to develop user-driven solutions (Liedtka, 2015; Brown, 2008). QFD is a structured, engineering-focused method that systematically translates customer needs into technical specifications for quality assurance(Hauser & Clausings, 1996). IDT builds on DT by integrating DT, QFD, and commercialization. In essence, DT centres on users, QFD on development precision, and IDT on aligning design, human needs, and business outcomes.

5. Theoretical Contributions

In comparison to existing research on the competitiveness of the footwear manufacturing industry, this study makes several contributions and extends the current literature. Numerous prior studies have examined and recognized the role of design thinking in business and design enhancement (Brown, 2008; Kurek et al., 2023). Nevertheless, other researchers have posited and critiqued design thinking regarding its impact assessment, methodological approach, and conceptual clarity (Meinel & Leifer, 2012; Bessant, 2013). In contrast, rather than simply acknowledging or criticising previous research, our study recognises and evaluates prior works in light of their strengths and limitations, thereby proposing the most viable and innovative design approach—innovation design thinking—to bridge the existing gaps. Additionally, to elucidate the concepts of design thinking, innovation design thinking, quality function deployment, and innovation with competitiveness, we formulated a comprehensive model that descriptively integrates these tools. Furthermore, this study contributes to the decision-making criteria for purchasing footwear for customers. Previous studies have identified customers' purchasing criteria as color, price, and design styles(Spahiu et al.,2024). However, these studies were not exhaustive in identifying, investigating, and prioritizing the decision to purchase footwear based on customers' purchasing criteria.

In contrast to the prior studies, our study comprehensively contributes to the identification, investigation, and prioritization of customers' footwear purchasing criteria decisions, which include (aesthetic, color, comfort, durability, price, brand, technical assembly, fashionability, uniqueness, fitness, style, and

warranty). Moreover, we have prioritized these criteria into the "critical few" (comfort, durability, price, fitness, and style) and the "vital many" (brand, color, weight, uniqueness, technical assembly, and warranty). Another contribution is identifying crucial design requirements that demand attention to enhance footwear design. Consequently, the six most critical design requirements are sole design, upper design, material selection, accessories/components, pattern making, and last design.

6. Practical contributions

The findings of this study provide a significant contribution to the field of footwear manufacturing by offering a framework for resource allocation and the formulation of innovative product development strategies. This research enhances the practical understanding of identifying, investigating, and prioritizing design requirements and customer purchasing criteria within the footwear sector. Additionally, it introduces a novel design methodology, termed innovative design thinking, which enriches the existing literature on footwear design. By implementing this approach, manufacturing firms can more effectively steer the development of creative and marketable footwear products. Consequently, this study supports management in establishing priorities for resource allocation and designing competitive footwear offerings.

7. Conclusion

This study has employed quality function deployment, specifically the House of Quality, to identify, examine, and prioritize the voice of the customers and technical design requirements for enhancing the competitiveness of the Ethiopian leather footwear industry. Ethiopia has comparative advantages in footwear manufacturing, including its labor market, hide and skin resources, and government support for job creation. However, the industry remains insufficiently competitive. In the current global competition, resources without innovation and value addition don't ensure competitiveness. Considering these factors, the study identified, examined, and prioritized the problems of the Ethiopian footwear industry using quality function deployment and introduced a new design concept, innovative design thinking, to enhance the footwear industry's competitiveness. The quality function deployment-house of quality tool research findings indicate that the footwear industry is not competent due to limitations in sole design technology, upper design, material selection, accessories, pattern making, last design, and other identified design issues. The study's other findings included the customers' criteria for buying shoes. The top five criteria for buying shoes among the top five customers were comfort, fitness, durability, price, and aesthetics.

Ethiopian footwear design is a traditional approach that emphasizes imitation or pattern-making based on technology, design capacity, manufacturing simplicity, and the design's financial feasibility. In contrast, innovation-driven design thinking is an innovation process that progresses through six stages: voice of the customer, defining, ideating, prototyping, testing, and commercialization.

7.1. Limitations and future research directions

This study presents certain limitations that highlight opportunities for future research. Primarily, the focus was restricted to footwear design within the context of the Ethiopian footwear industry. However, it is essential to recognize that competitiveness is influenced by a broader range of factors, including the availability of raw materials and the overall value chain associated with the industry. Consequently, future research should comprehensively analyze these elements to better understand the competitiveness of the Ethiopian footwear sector. The study highlights the necessity of implementing and evaluating new design approaches, such as innovative design thinking, as a pilot project to further assess their applicability and effectiveness.

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