

Quality Matrix-Based Product Innovation in Birkinpet Pet Harness Apparel**Lusi Zafriana¹, Anita Hakim Nasution², Prihono³**¹UPN “Veteran” Jawa Timur²Telkom University³Universitas PGRI Adi Buana, Surabayae-mail : ¹lusizaf69@gmail.com, ²anitahakimnst@gmail.com, ³prihono@unipasby.ac.id

Abstract — This study employs the Quality Function Deployment (QFD) method to develop BirkinPet pet harness apparel, focusing on customer needs and competitive advantages. A House of Quality (HoQ) matrix was constructed using responses from 96 participants, evaluating the relationship between Customer Importance and Technical Importance to identify key technical priorities for immediate implementation in BirkinPet’s production process. The primary HoQ matrix results indicate that lightweight, comfort, and safety (481.5), design for various activities (416.1), and ergonomic and comfortable design (389.9) are the most important attributes to customers. The main technical priorities include ensuring the product is safe and strong (4.99) and providing a variety of sizes and options (4.86). The novelty lies in the comprehensive and structured application of QFD, emphasizing innovation in designing products that align with current market trends and customer preferences. By integrating comfort, safety, and flexible design, BirkinPet successfully creates a high-quality product that meets customer needs, enhancing customer satisfaction and loyalty while strengthening its competitive position in the pet accessories market.

Keywords : *Pet Harness Apparel, Product Innovation, Quality Function Deployment*

I. INTRODUCTION

Product innovation is a key determinant of a company's success in maintaining market competitiveness in a dynamically evolving environment. Effective product innovation can increase market share and contribute to long-term success [1]. Innovations based on customer needs and desires can enhance

customer satisfaction and strengthen the company’s competitive position in the market. Customer involvement in non-technical innovation processes can enhance customer satisfaction and loyalty, as well as improve company performance.

One effective method for identifying and implementing customer needs into product technical specifications is QFD [2]. QFD is a structured approach to defining customer needs and translating them into specific plans for producing a product. QFD integrates consumer requirements with product technical characteristics and ensures that these technical characteristics are prioritized in the product design [3]; [4]. [5] added that the multi-step innovative method often starts with HoQ to capture the voice of the customer and prioritize inputs in design refinement. Management teams apply QFD through a series of matrices, including HoQ [6]. QFD is critical in product design that contributes to increasing customer satisfaction and reducing design and development time [7].

Pet harness apparel has gained popularity as pet owners become more aware of the importance of comfort and safety for their pets. High-quality harnesses not only provide better control during walks but also minimize injury risks compared to traditional collars. BirkinPet sees this opportunity as a challenge to innovate harness products that not only meet basic pet needs but also emphasize design and quality aspects.

[8] highlighted the importance of choosing the right harness that does not cause stress or discomfort to pets. [9] that pet harness apparel plays a role not only in safety but also in providing comfort and enhancing the pet’s appearance. [10] support the significant role of harnesses in improving pet mobility and comfort. [11] emphasized the importance of

DOI : <https://doi.org/10.36456/tibuana.7.2.9294.117-129>

regulatory oversight and improving product standards to ensure harnesses meet animal welfare criteria.

BirkinPet emerged as a product innovation designed to meet the growing demand for pet harness apparel. To enhance product quality and customer satisfaction, BirkinPet adopts the QFD method as part of its product innovation process. Using QFD as a strategic tool integrates BirkinPet customer needs with technical specifications and competitive advantages, while the HoQ framework helps identify and prioritize the most important product attributes for BirkinPet customers and compares them with close competitors.

QFD has been widely applied across various industries to improve product quality and meet customer expectations. In this study, QFD is used to develop pet harness apparel that is lightweight, comfortable, and safe, designed for various activities, and ergonomically comfortable. The implementation of QFD includes several stages: identifying customer needs, translating these needs into technical specifications, and setting key technical priorities. This method has proven effective in various studies and applications, including electronic product design and medical equipment [12]; [13]. Meanwhile, [14] applied QFD in construction to ensure key customer needs are considered from the project's outset, leading to successful outcomes such as timely delivery and high customer satisfaction.

In developing BirkinPet products, strict quality control, stylish design in various colors and patterns, and reflective safety features are top priorities. This study involves customer surveys and market analysis to gather relevant data, which is then analyzed using the HoQ matrix. The QFD analysis results indicate that the highest-ranking attributes are ergonomic and comfortable design, strong and durable materials, and easy-to-use design [15]; [16]; [17].

This study also shows that QFD can address various challenges in product development. For instance, [18] an integrated approach to prioritize technical characteristics, demonstrating that QFD can handle complexities in product development. [19] proposed a new framework for QFD using linguistic numbers to enhance accuracy in capturing customer needs. [20] introduced a new method for QFD based on rough cloud

model theory, addressing shortcomings in traditional QFD by improving the accuracy of customer characteristic weight determination. Additionally, [21] stated that QFD can be applied in the healthcare sector to improve service and customer satisfaction.

Research by [22] confirms that applying QFD in mobile phone selection using a fuzzy approach can enhance efficiency in capturing customer needs. [23] highlighted the importance of using QFD for product development analysis to improve product quality according to customer needs. QFD effectively identifies customer needs and translates them into technical specifications applicable to the product design process. [24] stated that QFD is effective in customer-oriented product development, helping organizations plan and implement various technical support tools effectively. Subsequently, [25] applied multi-criteria decision-making in QFD for renewable energy, considering various important factors in renewable energy product development.

The use of QFD in BirkinPet's product innovation development helps identify key customer needs in pet harness apparel, translate these needs into specific technical attributes, and determine product development priorities based on the relationship between customer needs and technical attributes. With QFD, BirkinPet can develop implementation strategies to ensure that the product meets or exceeds customer expectations, competes successfully in the global market, and improves customer satisfaction.

II. RESEARCH METHODOLOGY

This study employs the QFD approach with a focus on HoQ to integrate customer needs with measurable product specifications and identify areas for improvement and innovation. A mixed-method approach was used to gain a comprehensive understanding of customer requirements and product performance. The quantitative approach involved collecting numerical data through surveys and performance metrics, while the qualitative approach included in-depth interviews and focus groups to explore customer perceptions and experiences.

Data were collected through surveys targeting users of pet harness apparel. The survey was designed to measure user

DOI : <https://doi.org/10.36456/tibuana.7.2.9294.117-129>

satisfaction with various aspects of the product. It was developed and distributed to pet product customers to gather data on product satisfaction, preferences, and customer needs. The survey included both closed-ended and open-ended questions to collect quantitative and qualitative data.

Interviews with stakeholders, including product managers, marketing personnel, and customers, as well as focus groups with product users, were conducted to gain deep insights into user experiences and expectations. Data were also collected for competitive analysis to understand the perception of competing products, identifying business benchmarks and areas for improvement. Competitive product data were gathered through market research and analysis of public documentation to assess BirkinPet's product positioning against competitors.

Analysis within HoQ was implemented using analytical software that enabled quantitative comparisons of various product aspects and visualized relationships between involved variables. The study was conducted from December 2023 to May 2024 in Surabaya to obtain primary data directly from end consumers. Consumer surveys were conducted on BirkinPet harness apparel products.

The research was carried out in several stages: a preliminary survey involving direct observation of BirkinPet operations, data collection through observation, and interviews to obtain a direct understanding of BirkinPet products and production activities. BirkinPet provided an overview of the existing problems. Problem identification and formulation were performed to determine clear and structured research objectives. A literature review was conducted by searching books, research journals, magazines, and other sources related to QFD and its application in companies. The research was limited to the Product Planning

stage in the QFD method through the compilation of the House of Quality (HoQ).

This study involved academics, business experts, and customers. Academic respondents included lecturers in management and product design. Business experts were practitioners in the pet apparel industry. Customer respondents were end consumers in Surabaya. Information was obtained through interviews and questionnaires. Purposive sampling was used to select 80 frequent BirkinPet customers, while accidental sampling was used to randomly distribute questionnaires to consumers encountered incidentally.

Primary data for the research were obtained from various respondents through observations, interviews, and focus group discussions to understand customer desires and expectations for BirkinPet products. A questionnaire with closed-ended questions and a Likert scale was also used. Secondary data were obtained from the company and literature related to QFD, aiming to support the primary data. Validity and reliability tests were conducted through statistical analysis using SPSS 26.0 software.

III. RESULTS AND DISCUSSION

The analysis using the QFD method on BirkinPet's pet harness apparel can be seen in detail in Figure 1, which presents the complete House of Quality (HoQ) diagram.

What Matrix - Customer Requirements Matrix

The Customer Requirements Matrix highlights the key needs and expectations of consumers when selecting pet harness apparel. BirkinPet's pet harness apparel is designed to provide comfort and safety for pets. Based on survey results, the main consumer concerns when choosing pet harness apparel are as follows:

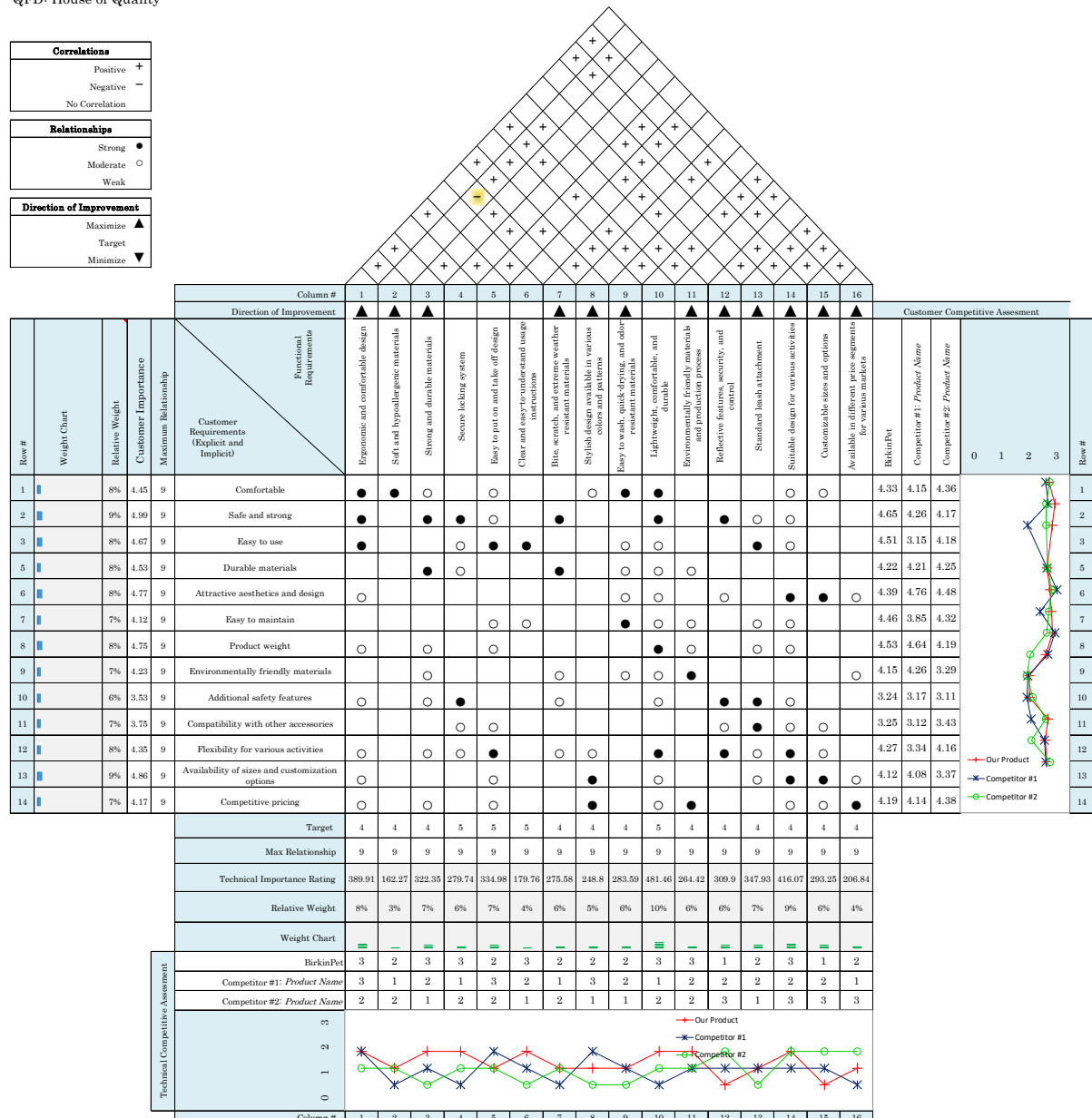


Figure 1. House of Quality (HoQ)

1. Comfort: Consumers want a harness that is comfortable for their pets, and does not cause irritation, or discomfort. Comfort is the top priority for users.
2. Safety and Strength: Product safety and strength are crucial factors. The harness must securely keep pets safe, with no risk of detachment or breakage.
3. Ease of Use: Ease of putting on and taking off the harness is a highly desired feature. The product should have an intuitive design and features that facilitate its use.
4. Durability of Materials: Consumers expect high-quality, durable, and environmentally friendly materials to be used in the harness.
5. Aesthetic and Attractive Design: An attractive and aesthetically pleasing appearance that aligns with pet fashion trends adds significant value for consumers.
6. Ease of Maintenance: Harnesses that are easy to wash, quick to dry, and do not absorb odors are highly appreciated, as they simplify daily maintenance.

DOI : <https://doi.org/10.36456/tibuana.7.2.9294.117-129>

7. Product Weight: The harness should be lightweight yet strong to provide additional comfort without compromising durability.
8. Environmentally Friendly Materials: Consumers are increasingly concerned about the environment and appreciate the use of eco-friendly materials.
9. Additional Safety Features: Extra features, such as small pockets or attachments for pet identification, are highly valued by consumers.
10. Compatibility with Other Accessories: The ability to be used with other accessories enhances the product's flexibility and adds value for consumers.
11. Versatility for Various Activities: The product should be versatile and suitable for various activities, from leisurely walks to more intense outdoor activities.
12. Availability of Sizes and Options: Consumers expect the product to be available in various sizes and customizable options to meet the needs of pets of different sizes and preferences.
13. Competitive Pricing: Pricing that matches the quality offered is a critical factor in influencing consumer purchase decisions.

By understanding the needs and expectations of consumers, BirkinPet can develop products that meet or exceed customer expectations and maintain a competitive position in the market. Identifying Customer Needs is the primary focus in the development of BirkinPet's pet harness apparel. By focusing on key aspects such as comfort, safety, and durability, and ensuring an attractive design with innovative additional features, BirkinPet aims to strengthen its market position and enhance customer satisfaction.

How's Matrix – Functional Requirements

This matrix outlines the technical attributes that the company needs to implement. These attributes are derived from translating customer desires and expectations (the "What's") into specific product development characteristics that the company must achieve to meet consumer expectations. Based on interviews and observations, the following attributes were identified:

1. Ergonomic and Comfortable Design
Objective: Ensure maximum comfort for pets.
Implementation: Design that conforms to pet anatomy, preventing irritation or discomfort.
2. Soft and Hypoallergenic Materials

- Objective: Avoid skin irritation and allergies in pets.
Implementation: Use hypoallergenic and breathable materials.
3. Strong and Durable Materials
Objective: Ensure product safety and durability.
Implementation: Use materials resistant to bites, scratches, and extreme weather.
4. Bite, Scratch, and Weather-Resistant Materials
Objective: Enhance product durability under various conditions.
Implementation: Use strong and long-lasting materials.
5. Stylish Design in Various Colors and Patterns
Objective: Attract customers with appealing aesthetics.
Implementation: Provide a variety of colors and patterns that follow trends.
6. Easy to Wash, Quick-Drying, and Odor-Resistant
Objective: Facilitate maintenance and cleanliness of the product.
Implementation: Use materials that are easy to wash and quick-drying.
7. Environmentally Friendly Materials and Production Processes
Objective: Appeal to environmentally conscious customers.
Implementation: Use recycled materials and implement eco-friendly production processes.
8. Reflective, Safety, and Control Features
Objective: Enhance visibility and safety for pets.
Implementation: Add reflective elements for better visibility.
9. Standard Leash Attachments
Objective: Provide good security and control.
Implementation: Use strong and durable leash attachments.
10. Design for Various Activities
Objective: Flexibility for different activities.
Implementation: Design suitable for a variety of outdoor and indoor activities.
11. Customization of Sizes and Others
Objective: Meet the needs of pets of different sizes.
Implementation: Provide various sizes and customization options.
12. Pricing Variants for Different Market Segments
Objective: Reach various market segments.
Implementation: Competitive pricing strategy with different price variants.

DOI : <https://doi.org/10.36456/tibuana.7.2.9294.117-129>

By translating customer needs into technical specifications, BirkinPet can ensure better product development that aligns with customer expectations and strengthens BirkinPet's competitive position in the market.

Technical Importance Planning Matrix

This matrix prioritizes the most crucial technical characteristics to achieve BirkinPet's product goals, enabling the design of products that better meet customer expectations and market demands. The stages include:

1. Target Sub-Matrix

Establish realistic and measurable targets for designing BirkinPet products according to their technical characteristics. The Target Sub-Matrix in this study includes:

- a. **Ergonomic and Comfortable Design:** Achieve a minimum comfort score of 4.5 in customer product testing.
Implementation: Develop a design that follows the pet's anatomy and ensure the use of hypoallergenic and breathable materials.
Measurement Method: Conduct comfort testing through user surveys and product trials on various types of pets.
- b. **Soft and Hypoallergenic Materials:** Use 100% hypoallergenic and breathable materials.
Implementation: Use high-quality, durable, hypoallergenic materials resistant to bites and scratches.
Measurement Method: Perform raw material quality audits and periodic product durability tests.
- c. **Strong and Durable Materials:** Achieve a minimum durability score of 4.5 in product strength tests.
Implementation: Use durable, high-quality materials, such as those resistant to bites, scratches, and extreme weather.
Measurement Method: Conduct laboratory testing for material strength and durability periodically.
- d. **Secure Locking System:** Maintain a detachment rate (harness coming loose) below 0.5%.
Implementation: Use strong, rust-resistant locking systems to ensure pet safety.
Measurement Method: Test the strength and durability of locks under normal and extreme usage conditions.
- e. **Easy to Put On and Take Off Design:** Achieve a minimum ease-of-use score of 4.5 in customer product testing.
Implementation: Develop intuitive locking mechanisms, prototype testing, and provide guides and video tutorials.
Measurement Method: Use customer satisfaction surveys with a Likert scale and user testing to measure the time and difficulty of putting on/removing the harness.
- f. **Clear and Easy-to-Understand Instructions:** Achieve instruction comprehension by 95% of users on the first try.
Implementation: Provide comprehensive and simple usage guides, along with accessible video tutorials for all customers.
Measurement Method: Use customer satisfaction surveys to measure instruction comprehension and conduct user testing to evaluate how well instructions are followed without additional assistance.
- g. **Bite, Scratch, and Weather-Resistant Materials:** Achieve a minimum durability score of 4.5 in bite, scratch, and weather resistance tests.
Implementation: Use high-quality materials resistant to bites, scratches, and extreme weather and conduct material durability tests.
Measurement Method: Use customer satisfaction surveys with a Likert scale and perform durability tests against bites, scratches, and various weather conditions to ensure product longevity.
- h. **Stylish Design in Various Colors and Patterns:** Provide at least 10 attractive color and pattern options.
Implementation: Add appealing color and pattern variations following current pet fashion trends.
Measurement Method: Use customer satisfaction surveys with a Likert scale to assess aesthetics and design appeal, and conduct market trend analysis to ensure the design remains relevant and attractive.
- i. **Easy to Wash, Quick-Drying, and Odor-Resistant:** Materials that are machine washable and dry within 3 hours.
Implementation: Use materials that are easy to wash, quick-drying, and odor-resistant. Develop clear care instructions.
Measurement Method: Use customer satisfaction surveys with a Likert scale to evaluate ease of care and conduct laboratory tests to ensure materials meet the criteria for

DOI : <https://doi.org/10.36456/tibuana.7.2.9294.117-129>

- easy washing, quick drying, and odor resistance.
- j. **Lightweight, Comfortable, and Strong:** Harness weight not exceeding 150 grams for medium size.
Implementation: Use lightweight yet strong materials and test across various pet sizes to ensure comfort and strength.
Measurement Method: Use customer satisfaction surveys with a Likert scale to assess comfort and strength, and conduct laboratory tests to measure the material's weight and strength.
 - k. **Environmentally Friendly Materials and Production Processes:** Use at least 50% recycled materials.
Implementation: Identify and adopt high-quality recycled material sources and optimize production processes to be more environmentally friendly.
Measurement Method: Perform raw material audits to ensure the proportion of recycled materials and monitor carbon footprint and energy efficiency in the production process.
 - l. **Reflective, Safety, and Control Features:** Achieve a minimum safety score of 4.5 in customer product testing.
Implementation: Add reflective elements to the design, enhance safety features, and improve control of the harness.
Measurement Method: Use customer satisfaction surveys with a Likert scale to assess reflective and safety features and conduct field tests to ensure effective visibility and control under various conditions.
 - m. **Standard Leash Attachments:** Achieve a minimum strength score of 4.5 in customer product testing.
Implementation: Use high-quality, strong, and durable leash attachments, and conduct thorough material strength tests.
Measurement Method: Use customer satisfaction surveys with a Likert scale to assess leash attachment strength and conduct laboratory tests to measure the durability and strength of leash attachments under load and stress.
 - n. **Design for Various Activities:** Achieve a minimum flexibility score of 4.5 in customer product testing.
Implementation: Develop a versatile design that can be used for various activities, such as walking, running, and playing. Conduct trials in various activity scenarios.
Measurement Method: Use customer satisfaction surveys with a Likert scale to assess design flexibility and conduct field tests to ensure the product can be used comfortably and effectively in different activities.
 - o. **Customization of Sizes and Others:** Provide at least 5 different sizes.
Implementation: Develop products in various sizes that cover the range of pet sizes from small to large. Conduct testing to ensure each size fits and is comfortable for different types of pets.
Measurement Method: Use customer satisfaction surveys to assess size fit and comfort, and monitor sales and feedback for each available size.
 - p. **Pricing Variants for Different Market Segments:** Set 10 different price variants.
Implementation: Develop products with various features and materials to create variants suitable for different market segments, from economical to premium.
Measurement Method: Monitor sales and customer feedback for each price variant, and conduct market analysis to ensure each segment is well-served.
- By setting realistic and measurable targets for each technical attribute, BirkinPet can ensure that the developed products meet customer needs and expectations. Establishing targets helps in developing better, higher-quality, and more competitive products in the market.
- ## 2. Sub-Matrix of Maximum Relationship
- This matrix shows the strength of the relationship between Customer Requirements and the Technical Requirements of the BirkinPet product to be developed. The maximum relationship scores between customer needs and technical attributes are derived from the Voice of the Engineers process.
- Comfort:**
- **Ergonomic and Comfortable Design (●):** Very strong relationship. Ergonomic design is crucial for comfort.
 - **Soft and Hypoallergenic Materials (●):** Very strong relationship. Soft and hypoallergenic materials ensure comfort.

DOI : <https://doi.org/10.36456/tibuana.7.2.9294.117-129>

- Strong and Durable Materials (○): Moderate relationship. Durable materials should also be comfortable.
 - Secure Locking System (▽): Weak relationship. The locking system focuses more on safety than comfort.
 - Easy to Put On and Take Off Design (○): Moderate relationship. Easy design enhances comfort.
 - Clear and Easy-to-Understand Instructions (▽): Weak relationship. Instructions focus more on ease of use.
 - Bite, Scratch, and Weather-Resistant Materials (▽): Weak relationship. Durable materials focus more on durability.
 - Stylish Design in Various Colors and Patterns (○): Moderate relationship. Stylish design can enhance psychological comfort.
 - Easy to Wash, Quick-Drying, and Odor-Resistant (●): Very strong relationship. Materials that are easy to wash and odor-resistant are very comfortable.
 - Lightweight, Comfortable, and Strong (●): Very strong relationship. Lightweight materials are very comfortable.
 - Environmentally Friendly Materials and Production Processes (▽): Weak relationship. The focus is on sustainability, not directly on comfort.
 - Reflective, Safety, and Control Features (▽): Weak relationship. The focus is on safety.
 - Standard Leash Attachments (▽): Weak relationship. The focus is on safety and control.
 - Design for Various Activities (○): Moderate relationship. Flexible design can enhance comfort.
 - Customization of Sizes and Others (○): Moderate relationship. Size customization can improve comfort.
 - Pricing Variants for Different Market Segments (▽): Weak relationship. The focus is on pricing diversity.
- Safety and Strength:**
- Ergonomic and Comfortable Design (○): Moderate relationship. The ergonomic design also contributes to safety.
 - Soft and Hypoallergenic Materials (▽): Weak relationship. Hypoallergenic materials focus more on comfort.
 - Strong and Durable Materials (●): Very strong relationship. Strong materials are crucial for safety.
 - Secure Locking System (●): Very strong relationship. A strong locking system is crucial for safety.
 - Easy to Put On and Take Off Design (○): Moderate relationship. Easy-to-use design also contributes to safety.
 - Clear and Easy-to-Understand Instructions (▽): Weak relationship. Instructions focus more on ease of use.
 - Bite, Scratch, and Weather-Resistant Materials (●): Very strong relationship. Bite and weather-resistant materials are crucial for safety.
 - Stylish Design in Various Colors and Patterns (▽): Weak relationship. Stylish design focuses more on aesthetics.
 - Easy to Wash, Quick-Drying, and Odor-Resistant (▽): Weak relationship. Focus is on ease of care.
 - Lightweight, Comfortable, and Strong (●): Very strong relationship. Lightweight and strong materials ensure safety and comfort.
 - Environmentally Friendly Materials and Production Processes (▽): Weak relationship. The focus is on sustainability.
 - Reflective, Safety, and Control Features (●): Very strong relationship. Reflective features improve visibility and safety.
 - Standard Leash Attachments (●): Very strong relationship. Strong and standard leash attachments ensure safety.
 - Design for Various Activities (○): Moderate relationship. Flexible design enhances safety in various activities.
 - Customization of Sizes and Others (○): Moderate relationship. Size customization ensures better safety.
 - Pricing Variants for Different Market Segments (▽): Weak relationship. The focus is on pricing diversity.
- Ease of Use:**
- Ergonomic and Comfortable Design (○): Moderate relationship. Ergonomic design enhances ease of use.

DOI : <https://doi.org/10.36456/tibuana.7.2.9294.117-129>

- Soft and Hypoallergenic Materials (▽): Weak relationship. The focus is on comfort.
 - Strong and Durable Materials (▽): Weak relationship. The focus is on durability.
 - Secure Locking System (○): Moderate relationship. A secure locking system facilitates ease of use.
 - Easy to Put On and Take Off Design (●): Very strong relationship. The easy-to-use design significantly facilitates ease of use.
 - Clear and Easy-to-Understand Instructions (●): Very strong relationship. Clear instructions greatly facilitate ease of use.
 - Bite, Scratch, and Weather-Resistant Materials (▽): Weak relationship. The focus is on durability.
 - Stylish Design in Various Colors and Patterns (▽): Weak relationship. The focus is on aesthetics.
 - Easy to Wash, Quick-Drying, and Odor-Resistant (○): Moderate relationship. Easy-to-wash materials facilitate ease of care.
 - Lightweight, Comfortable, and Strong (○): Moderate relationship. Lightweight and strong materials facilitate ease of use.
 - Environmentally Friendly Materials and Production Processes (▽): Weak relationship. The focus is on sustainability.
 - Reflective, Safety, and Control Features (▽): Weak relationship. The focus is on safety.
 - Standard Leash Attachments (▽): Weak relationship. The focus is on safety and control.
 - Design for Various Activities (○): Moderate relationship. Flexible design enhances ease of use.
 - Customization of Sizes and Others (○): Moderate relationship. Size customization enhances ease of use.
 - Pricing Variants for Different Market Segments (▽): Weak relationship. The focus is on pricing diversity.
- Material Durability:
- Ergonomic and Comfortable Design (▽): Weak relationship. The focus is on comfort.
 - Soft and Hypoallergenic Materials (▽): Weak relationship. The focus is on comfort.
 - Strong and Durable Materials (●): Very strong relationship. Strong materials are crucial for durability.
 - Secure Locking System (○): Moderate relationship. A secure locking system enhances durability.
 - Easy to Put On and Take Off Design (▽): Weak relationship. The focus is on ease of use.
 - Clear and Easy-to-Understand Instructions (▽): Weak relationship. The focus is on ease of use.
 - Bite, Scratch, and Weather-Resistant Materials (●): Very strong relationship. Bite, scratch, and weather-resistant materials are crucial for durability.
 - Stylish Design in Various Colors and Patterns (▽): Weak relationship. The focus is on aesthetics.
 - Easy to Wash, Quick-Drying, and Odor-Resistant (○): Moderate relationship. Easy-to-wash materials enhance product durability.
 - Lightweight, Comfortable, and Strong (○): Moderate relationship. Strong materials enhance durability.
 - Environmentally Friendly Materials and Production Processes (○): Moderate relationship. Environmentally friendly materials and sustainable production processes enhance durability.
 - Reflective, Safety, and Control Features (▽): Weak relationship. The focus is on safety.
 - Standard Leash Attachments (▽): Weak relationship. The focus is on safety and control.
 - Design for Various Activities (▽): Weak relationship. The focus is on usage flexibility.
 - Customization of Sizes and Others (▽): Weak relationship. The focus is on comfort.

3. Sub-Matrix of Technical Importance Rating

This matrix assesses the importance of enhancing or improving specific technical features or specifications in BirkinPet products. The ratings are derived from the Voice of the

DOI : <https://doi.org/10.36456/tibuana.7.2.9294.117-129>

Engineer analysis and the maximum relationship matrix, with each feature assigned a Technical Importance Rating of 9. The stages are as follows:

- a. **Ergonomic and Comfortable Design:** Ergonomic design is crucial for ensuring the comfort and functionality of the product. It affects how the product is used and how it feels when worn by pets. Importance: Ensures comfort and proper function, crucial for user satisfaction.
- b. **Soft and Hypoallergenic Materials:** Soft, hypoallergenic materials are essential for pet comfort and health, preventing skin irritation and allergies. Importance: Critical for preventing discomfort and health issues in pets.
- c. **Strong and Durable Materials:** Strong and durable materials ensure the product's safety and longevity, which is vital for users. Importance: Essential for product safety and longevity, improving user confidence.
- d. **Secure Locking System:** A secure locking system ensures that pets cannot escape from the harness, enhancing product safety. Importance: Key for maintaining pet safety and security.
- e. **Easy to Put On and Take Off Design:** The ease of putting on and taking off the harness is important for user convenience, making everyday use simpler. Importance: Increases user convenience and daily usability.
- f. **Clear and Easy-to-Understand Instructions:** Clear and easy-to-understand instructions help users to use the product correctly and effectively. Importance: Assists in correct and efficient product use, reducing user frustration.
- g. **Bite, Scratch, and Weather-Resistant Materials:** Materials that resist bites, scratches, and extreme weather ensure the product remains durable and functional in various conditions. Importance: Vital for maintaining product integrity under different conditions.
- h. **Stylish Design in Various Colors and Patterns:** An attractive design available in various colors and patterns enhances the product's market appeal. Importance: Increases market appeal and attracts customers.
- i. **Easy to Wash, Quick-Drying, and Odor-Resistant:** Ease of maintenance is a significant added value for users, ensuring the product remains clean and hygienic. Importance: Simplifies product maintenance, keeping it clean and hygienic.
- j. **Lightweight, Comfortable, and Strong:** A product that is lightweight yet strong provides additional comfort without sacrificing durability. Importance: Enhances comfort while ensuring durability.
- k. **Environmentally Friendly Materials and Production Processes:** Using environmentally friendly materials and production processes is important for attracting environmentally conscious consumers. Importance: Appeals to eco-conscious customers, adding value to the product.
- l. **Reflective, Safety, and Control Features:** Adding reflective features increases pet visibility and safety, especially when used at night. Importance: Improves pet visibility and safety, particularly in low-light conditions.
- m. **Standard Leash Attachments:** Strong and durable leash attachments are a standard feature necessary to ensure good safety and control. Importance: Essential for maintaining safety and control.
- n. **Design for Various Activities:** A flexible design for various activities enhances the product's usefulness and value in the eyes of consumers. Importance: Increases product versatility and consumer value.
- o. **Customization of Sizes and Others:** Providing various sizes and customization options ensures the product meets the needs of different types of pets. Importance: Allows the product to accommodate various pet sizes and preferences.
- p. **Pricing Variants for Different Market Segments:** Offering different pricing variants helps reach various market segments and enhances the product's appeal. Importance: Expands market reach and attracts diverse customer segments.

By assigning a high technical importance rating to each attribute, BirkinPet can ensure that product development focuses on the most crucial aspects to meet customer needs and expectations. This will help BirkinPet design and produce high-quality, safe, comfortable, and attractive products for consumers.

4. Sub-Matrix of Relative Weight Technical Importance Rating

This sub-matrix determines the priority order of technical responses and assesses the comparative performance of the company's technical responses against competitors. Relative Weight is calculated based on the importance of each technical

DOI : <https://doi.org/10.36456/tibuana.7.2.9294.117-129>

attribute and how these attributes contribute to fulfilling customer needs. Although each technical attribute has the same Technical Importance Rating (9), the relative weight of each is calculated to show its proportionate importance in overall product development.

By assigning the same technical importance rating to each attribute and calculating the relative weight, BirkinPet can ensure that product development encompasses all critical aspects contributing to customer satisfaction. Focusing on technical attributes with strong relationships to customer needs and ensuring that each attribute receives appropriate attention in the product development process will help BirkinPet enhance its product quality and market competitiveness.

5. Sub-Matrix of Weight Chart Technical Importance Rating

This sub-matrix presents a bar chart or table with vertical pipe markers corresponding to the Technical Importance Rating values for BirkinPet's product. The weight chart or table illustrates the relative weight of each technical attribute based on the technical importance rating. This visualization aids in understanding the technical priorities that need to be addressed in BirkinPet's product development.

6. Technical Requirements and Relative Weight

This section visualizes the relative weight of each technical attribute in a table and chart, showing both the Technical Importance Rating and the Relative Weight of each technical attribute. With the relative weight assigned to each technical attribute, BirkinPet ensures that all critical aspects of the product are considered in the development process. The bar chart helps visualize that each technical attribute is prioritized for product development, highlighting the importance of balancing all customer needs and expectations.

Using the Weight Chart, BirkinPet can allocate resources and focus appropriately on each technical aspect, ensuring that the developed product is of high quality, safe, comfortable, and appealing to consumers.

Thus, BirkinPet can ensure that the resulting product meets or exceeds customer expectations, enhancing customer satisfaction and loyalty, and strengthening its competitive position in the market.

7. Sub-Matrix of Technical Competitive Assessment

This sub-matrix involves benchmarking product quality against competitors. Some technical response requirements in BirkinPet's production lag behind competitors, such as additional safety features and attractive design. However, BirkinPet excels in material quality and quality control. This sub-matrix evaluates the technical performance of BirkinPet's product compared to competitors' products. The assessment is conducted for each technical attribute based on consumer perceptions and technical testing. BirkinPet excels in many technical aspects compared to competitors, particularly in comfort, material strength, ease of maintenance, and safety features. This indicates that BirkinPet effectively meets the primary needs of customers. BirkinPet has an advantage in hypoallergenic materials, secure locking systems, and material durability. Focusing on these attributes can further strengthen BirkinPet's position in the market.

IV. CONCLUSION

This study employed the Quality Function Deployment (QFD) method to evaluate and develop BirkinPet's pet harness apparel by prioritizing customer needs. By distributing questionnaires to 96 respondents and constructing a House of Quality (HoQ) matrix, the relationship between Customer Importance and Technical Importance was analyzed to determine the technical priorities to be implemented in BirkinPet's production process.

Based on the House of Quality matrix analysis, the attributes that stand out in BirkinPet's product are:

1. Lightweight, Comfortable, and Safe (481.46): This attribute indicates that customers highly value a product that is not only comfortable for pets but also safe.
2. Design for Various Activities (416.07): The flexibility of the design allowing for use in various activities is highly appreciated by customers.
3. Ergonomic and Comfortable Design (389.91): A design that follows the pet's anatomy for comfort is one of the attributes highly valued by customers.

The main technical priorities to achieve these important customer attributes are:

1. Safe and Strong (4.99): The safety and strength of the product are the primary technical priorities to ensure that the product meets high standards of safety and durability.

DOI : <https://doi.org/10.36456/tibuana.7.2.9294.117-129>

2. Availability of Sizes and Options (4.86): The variety in sizes and product options is an important technical aspect to be implemented to meet various customer needs.

In BirkinPet's product, ergonomic and comfortable design, flexibility for various activities, as well as comfort and safety, are the main characteristics that significantly impact customer satisfaction. To achieve and enhance customer satisfaction further, BirkinPet must focus on the technical implementation related to safety, strength, and product variety. By prioritizing and implementing the most important technical attributes, BirkinPet can continue to meet or even exceed customer expectations, increase customer satisfaction and loyalty, and strengthen its competitive position in the pet accessories market.

REFERENCES

- [1] Deeds, D., DeCarolis, D., & Coombs, J. (2000). DYNAMIC CAPABILITIES AND NEW PRODUCT DEVELOPMENT IN HIGH TECHNOLOGY VENTURES: AN EMPIRICAL ANALYSIS OF NEW BIOTECHNOLOGY FIRMS. *Journal of Business Venturing*, 15, 211-229. [https://doi.org/10.1016/S0883-9026\(98\)00013-5](https://doi.org/10.1016/S0883-9026(98)00013-5).
- [2] Chan, L., & Wu, M. (2002). Quality function deployment: A literature review. *Eur. J. Oper. Res.*, 143, 463-497. [https://doi.org/10.1016/S0377-2217\(02\)00178-9](https://doi.org/10.1016/S0377-2217(02)00178-9).
- [3] Erdil, N., & Arani, O. (2019). Quality function deployment: more than a design tool. *International Journal of Quality and Service Sciences*. <https://doi.org/10.1108/IJQSS-02-2018-0008>.
- [4] Bossert, J. (2021). Quality Function Deployment. <https://doi.org/10.1201/9781003066545>.
- [5] Chan, L., Kao, H., & Wu, M. (1999). Rating the importance of customer needs in quality function deployment by fuzzy and entropy methods. *International Journal of Production Research*, 37, 2499-2518. <https://doi.org/10.1080/002075499190635>.
- [6] Hauser, J., Griffin, A., Klein, R., Katz, G., & Gaskin, S. (2010). Quality Function Deployment (QFD). <https://doi.org/10.1002/9781444316568.WIEM05023>.
- [7] Kwong, C., & Bai, H. (2002). A fuzzy AHP approach to the determination of importance weights of customer requirements in quality function deployment. *Journal of Intelligent Manufacturing*, 13, 367-377. <https://doi.org/10.1023/A:1019984626631>.
- [8] Grainger, J., Wills, A., & Montrose, V. (2016). The behavioral effects of walking on a collar and harness in domestic dogs (*Canis familiaris*). *Journal of Veterinary Behavior-clinical Applications and Research*, 14, 60-64. <https://doi.org/10.1016/J.JVEB.2016.06.002>.
- [9] Kim, J., Kweon, S., & Choi, J. (2007). A Study on the Purchasing Practices of Pet Dog's Apparel. *Journal of the Korean Society of Clothing and Textiles*, 31, 189-196. <https://doi.org/10.5850/JKSCT.2007.31.2.189>.
- [10] Pálya, Z., Rácz, K., Nagymáté, G., & Kiss, R. M. (2022). Development of a detailed canine gait analysis method for evaluating harnesses: A pilot study. *Plos one*, 17(3), e0264299.
- [11] Bläske, A., Schwarzer, A., Ebner, M. V., Gerbig, H., Reese, S., Erhard, M., & Wöhr, A. C. (2022). Evaluation of small mammal pet supplies offered in German retail under animal welfare aspects. *Plos one*, 17(2), e0262658.
- [12] González, S. M., de León, C. V. C., & Castillo, E. A. R. (2023). Continuous improvement of a face protection mask using quality function deployment. *Revista Venezolana de Gerencia: RVG*, 28(10), 1280-1297.
- [13] Huang, J., Mao, L., Liu, H., & Song, M. (2021). Quality function deployment improvement: A bibliometric analysis and literature review. *Quality & Quantity*, 56, 1347-1366.

DOI : <https://doi.org/10.36456/tibuana.7.2.9294.117-129>

- <https://doi.org/10.1007/s11135-021-01179-7>.
- [14] Delgado-Hernandez, D. J., Bampton, K. E., & Aspinwall, E. (2007). Quality function deployment in construction. *Construction Management and Economics*, 25(6), 597-609.
- [15] Xu, J., & Xia, C. (2023). Application of Quality Function Deployment and Theory of Inventive Problem Solving in the Human-Pet Shared Furniture Design Process. 2023 International Conference on Culture-Oriented Science and Technology (CoST), 61-66. <https://doi.org/10.1109/CoST60524.2023.00022>.
- [16] Mincolessi, G., Giacobone, G., Marchi, M., & Imbesi, S. (2020). New Collaborative Version of the Quality Function Deployment: Practical Application to the HABITAT Project. , 823-828. https://doi.org/10.1007/978-3-030-39512-4_125.
- [17] Cardoso, J., Filho, N., & Miguel, P. (2015). Application of Quality Function Deployment for the development of an organic product. *Food Quality and Preference*, 40, 180-190. <https://doi.org/10.1016/J.FOODQUAL.2014.09.012>.
- [18] Ping, Y., Liu, R., Lin, W., & Liu, H. (2020). A new integrated approach for engineering characteristic prioritization in quality function deployment. *Adv. Eng. Informatics*, 45, 101099. <https://doi.org/10.1016/j.aei.2020.101099>.
- [19] Song, C., Wang, J., & Li, J. (2020). New Framework for Quality Function Deployment Using Linguistic Z-Numbers. *Mathematics*. <https://doi.org/10.3390/math8020224>.
- [20] Fang, H., Li, J., & Song, W. (2020). A New Method for Quality Function Deployment Based on Rough Cloud Model Theory. *IEEE Transactions on Engineering Management*, PP, 1-15. <https://doi.org/10.1109/TEM.2020.3020339>.
- [21] Sukma, D., Stiawan, I., Kurnia, H., & Purba, H. (2022). Quality Function Deployment in Healthcare: Systematic Literature Review. *Spektrum Industri*. <https://doi.org/10.12928/si.v20i2.62>.
- [22] Efe, B., Yerlikaya, M., & Efe, Ö. (2020). Mobile phone selection based on a novel quality function deployment approach. *Soft Computing*, 1-15. <https://doi.org/10.1007/s00500-020-04876-x>.
- [23] Susanto, R., & Andriana, A. (2020). Product Development Analysis using Quality Function Deployment. *IOP Conference Series: Materials Science and Engineering*, 879. <https://doi.org/10.1088/1757-899X/879/1/012038>.
- [24] Ginting, R., Ishak, A., Malik, A., & Satrio, M. (2020). Product Development with Quality Function Deployment (QFD): A Literature Review. *IOP Conference Series: Materials Science and Engineering*, 1003. <https://doi.org/10.1088/1757-899X/1003/1/012022>.
- [25] García-Orozco, S., Vargas-Gutiérrez, G., Ordóñez-Sánchez, S., & Silva, R. (2023). Using multi-criteria decision making in quality function deployment for offshore renewable energies. *Energies*, 16(18), 6533.