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Design and Fabrication of Shampooing Bed Using Indigenous Material: Ratan Cane (*Calamus Rotang L.*)

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Abstract: *The integration of the rattan industry with the decorative and furniture industries not only reflects a broader global trend towards sustainable practices but also presents a compelling intersection of traditional craftsmanship, modern design, and eco-conscious entrepreneurship. These advantages present a highly feasible opportunity to integrate nature as the main vanity component and material. However, in recent years, rattan industry is threatened by overexploitation owing to poor management practices and irresponsible cultivation. As such in this paper, a vanity shampooing bed made of rattan cane is designed and fabricated, promoting the importance of sustainable furniture-making materials and innovative concept. The proposed rattan-based shampooing bed not only an alternative to synthetic based materials commonly used in salon industry but also designed with multipurpose built-in functionality to meet the demands of market competition. Moreover, the proposed rattan-based product can be significantly adopted as laboratory-aide material to deliver better instructions in beauty care and wellness major.*

Key Words: *Rattan, Shampooing bed, sustainable material, and beauty care.*

1. INTRODUCTION:

Rattan (Calamus Rotang L.) is a naturally growing cellulosic vine-like and non-wood material derived from tropical palms used for centuries in various cultures to craft furniture, baskets, and other decorative items [1]. The historical significance of rattan as craft material can be traced back to ancient civilizations, including Egypt and China, where it was used to weave baskets and construct furniture [2]-[3]. Over centuries, rattan has gained popularity and widespread use in various parts of the world, particularly in Southeast Asia, owing to its abundance in tropical rainforests. In particular, rattan in the rainforests of southeastern Borneo is considered an indigenous plant that can produce food and cash crops that help sustain the ecological balance and stability of the rainforest [4].

Moreover, rattan has also become a growing industry in the City of Ilagan, Isabela, owing to the sizeable tropical forest region of the Sierra Madre Mountain range, where native rattan grows abundantly. Benefiting from the potential of the rattan industry, the Local Government Unit of the City of Ilagan is currently working on establishing a rattan-based product processing facility in Cabiseria 10, San Antonio Region, where it promotes locally grown raw materials as a community-based livelihood program for local and indigenous peoples, such as the Agta community.

The increasing popularity of rattan is mainly due to the rapid depletion of traditional wood resources and growing awareness of environmental sustainability. Rattan, on the other hand, is making its name as a staple and viable wood-like substitute in the furniture industry due to its inherent flexibility, durability, and visually pleasing aesthetic appeal. As a result, rattan has gained worldwide attention as a competitive and sustainable alternative in the small and medium-sized enterprises (SMEs) of the handicraft and furniture industries [5]. In addition, [6] described rattan as renewable, biodegradable, and generating a minimal ecological footprint; thus, it is an ideal candidate for industries seeking eco-conscious and sustainable solutions. The sustainability industry of rattan canes focuses on producing materials based on its rattan core and rattan skin manufacturing. The industry segregated rattan into market-related factors, such as cross-sectional size diameter classes, skin peeling, and polishing grade. Rattan skin is also graded into three quality stages: high-end, medium, and low. Depending on their quality grade, the core skin is marketed at different prices along with the additional manufacturing processes involved, such as bleaching and varnishing [3]. To date, these

aforementioned factors and challenges have considerably increased the number of raw materials in rattan cane by up to 30% since 1985 [7].

Indeed, handicrafts and furniture made of rattan have been synonymous with creating fine, exquisite, and durable products that provide eco-friendly alternatives to conventional materials, such as wood and metal. The rattan industry has transformed remarkably in recent decades, owing to its strength and flexibility [8]. It has evolved significantly from its traditional application in furniture craftsmanship to a wide range of innovative applications [9]. In particular, the versatility of the rattan cane has expanded beyond its traditional applications in beauty salons and personal care as a sustainable and environmentally friendly material. In recent years, rattan has found new niches in the salon industry, such as dressing tables and decorative interior materials.

Within the context of the salon industry, where aesthetics and comfort play pivotal roles, the incorporation of rattan into the design and construction of shampooing beds presents a convincing proposition. This study explores the utilization and acceptability of rattan products as a valuable alternative to commercially available salon equipment. By exploring the properties of rattan, its sustainability credentials, and the growing consumer demand for eco-friendly products and services, the researcher will unravel the manifold opportunities and challenges associated with using rattan as a vanity material in salons, particularly as a shampooing bed.

Furthermore, this research will examine the potential benefits to beauty care practitioners, customers, and TLE-major teachers while considering the unique design and marketing aspects, including its applicability as classroom instructional materials. Furthermore, this study on the potential application of rattan products to the beauty care and salon industries will help support local initiatives of the Local Government Unit of the City of Ilagan through its soon-to-rise Rattan Processing and Facility Center in promoting quality, sustainable, and eco-friendly furniture materials—similarly, this will support the livelihood program for our local and indigenous Agta community rattan industry.

2. LITERATURE REVIEW:

The Rattan Plant

Rattan is a climbing vine-like palm belonging to the palm family of Palmae or Arecaceae. According to [10], rattans represent approximately one-fifth of the currently described taxa, comprising 13 genera and 600 species. Most of these species belong to the genus Calamus rotang [11]-[12]. Calamus is under the genus within the Arecaceae family and is one of the most diverse genera of all climbing plants. Calamus is widely distributed and cultivated throughout the humid tropics and forests of Africa, Asia, and parts of the Pacific region. The Calamus genus attains maximum diversity in the closed-canopy forests of Southeast Asia, where their predominance is a striking characteristic of Asian liana communities [13]. A sample of rattan tree is shown in Figure 1.

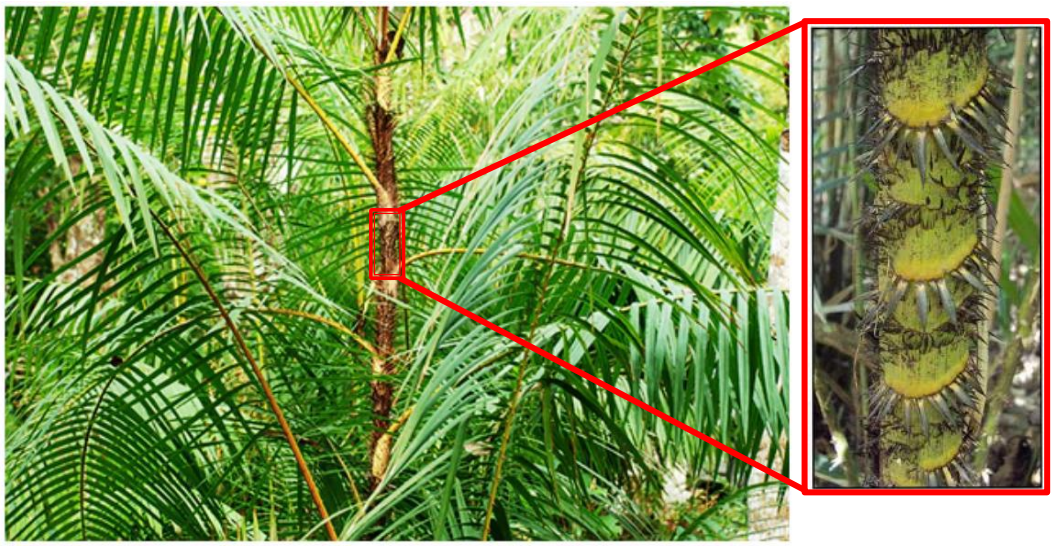

Figure 1. The rattan tree [14].

The Rattan Plant in the Philippines

Rattans are abundantly and naturally thriving in the Philippine forests. They are distributed throughout the country with four known genera found in the Philippines dipterocarp forestry, comprising of 91 species. The four genera are as follows: *Calamus*, *Daemonorops*, *Korthalsia*, and *Plectocomia*, [15]-[16].

According to the report of the Food and Agricultural Organization of the United Nations through a survey by [17], Calamus consists of 44 species, the largest of the four genera found in the Philippines. It is widely distributed in the parts of mountainous areas of Northern Luzon and Visayas regions, but some species are considered endemic and confined to specific islands or mountains. The second-largest group of Philippine rattans is the *Daemonorops*, comprising 14 species. Similar to the type *Calamus*, *Daemonorops* are generally scattered and distributed. On the other hand, the rattan type *Korthalsia* consists of only five species. This rattan genera are more restricted in terms of distribution, of which three species are only found in Palawan, one in Mindanao, and one in Polillo Island. Lastly, the genera *Plectocomia* is considered the smallest and rarest among rattan family with only two species found in the Philippines. Members of this genus are confined to the primary rainforests of Palawan, Leyte, and Mindanao. An illustration of the types of rattan located in the Philippines are shown in Figure 2.

(a) (b)

Figure 2. Type of Philippine rattan cane (a) solitary and (b) clustering [18].

Most rattan produced in the Philippines is extracted from wild forest regions throughout the country. Due to its increasing popularity as one of the most important non-timber forest products, the government has instituted production. There are a few rattan plantations established over the years, and two of the biggest are in Bislig, Surigao del Sur, and Talacogon, Agusan de Sur. The country encourages local farmers and developers to cultivate rattan by providing incentives. These incentives and benefits include reduced rental fees for the plantation area, distribution of rattan seedlings, free technical assistance, and the privilege to harvest, sell, and dispose in any way the owner deems appropriate [19]. Through these initiatives and the assistance of the Department of Environmental and Natural Resources and the Paper Industry Corporation of the Philippines (PICOP), the country has significantly increased its plantations to a total of 17,395 hectares, making it the third largest producer of rattan in the ASEAN region, next to Malaysia with 23,157 hectares and Indonesia with 118,802 hectares.

Rattan as a Sustainable Material

One of the key factors contributing to Rattan's resurgence is its sustainability. Rattan is a rapidly renewable resource with a short growth cycle, typically maturing within five to seven years. The stark contrasts, relative to the slow growth of traditional wood species used in furniture production, make rattan more sustainable. The ability of rattan to regrow quickly makes it an environmentally responsible choice, as it reduces pressure on natural forests and promotes biodiversity [20]. In fact, rattan can grow over 100 centimeters daily, achieving maturity and being ready to harvest within two years. That is way faster than hardwood products in the wild, which can take approximately 20 to 30 years or more. This characteristic of the rattan tree as a naturally growing palm in the wild makes it a highly sustainable and eco-friendly material [16], [21]. According to [22], the sustainability aspect of rattan can also be observed in its habitat and adaptability conditions as it grows in different terrains and harsh weather conditions, such as in floodwater-prone areas, which would usually make land unusable.

Rattan for Interior Design in Salon Industry

The value of rattan furniture for indoor settings becomes more enticing to manufacturers with the integration of ergonomic aspects. Visual perception can be associated with psychological perception, a key factor of interior furnishing products. While rattan's sustainability credentials laid the groundwork for its revival, its aesthetic qualities have catapulted it into the spotlight of interior design. Rattan's distinctive appearance, characterized by its natural textures and warm tones, complements various design styles, from bohemian and coastal to modern and minimalist [23]. The development and design of rattan furniture has evolved under the influence of modernity. It helps manufacturers design more intricate and complex concepts thanks to innovative technologies used in the design process that merge craftsmanship and technology. According to [24], using rattan as a raw material for interior design is also a way to connect people with nature. It is where people replicate the presence of nature in an indoor environment, as it suggests the vibes of being comfortable, warm, inviting, relaxing, and homey.

The salon and beauty care industries have been known to value aesthetics and comfort. Incorporating rattan products into the design concept of salon furniture provides natural aesthetic vibes and a green environment. In recent years, salon owners and designers have begun to recognize the potential of rattan as a sustainable, durable, and visually appealing material for creating salon environments that resonate with contemporary sensibilities.

Shampooing beds, in particular, are a critical component of salon infrastructure. These specialized beds provide clients with a comfortable and relaxing experience during hair washing and treatment sessions. Therefore, the choice of materials for shampooing beds is essential, not only for functional reasons but also for enhancing the overall ambiance of the salon.

The use of rattan in the design of shampooing beds has several advantages. Several advantages are associated with incorporating rattan into salons, particularly in the design of shampooing beds. Firstly, rattan's natural textures and colors contribute to a tranquil and visually appealing salon environment, positively impacting the overall customer experience. Secondly, Rattan's sustainability aligns with salon owners' efforts to reduce their ecological footprint and adopt environmentally responsible practices. Thirdly, the ergonomic properties of rattan contribute to client comfort during salon services, enhancing the quality of service delivery and customer satisfaction [25].

3. MATERIALS:

A. Tools and equipment

The following tools and equipment are used to perform the construction and fabrication of the proposed shampooing bed concept of the study. Preparatory tools and equipment are listed in the table below.

Table 1. Tools and equipment to be used in the preparation of rattan-made shampooing bed.

Tools	Description
Big Knifes	For purpose of peeling the skin or the outer layer of the rattan cane.
Hacksaw Blade	For cutting the rattan cane into appropriate pieces and sizes.
Hammer	For hammering nails and other sharp materials to form the frame structure or skeleton of the shampooing bed.
Nails	For joining connections and joints for stiffer frames.
Brushes	For applying varnish, paint, and other adhesives.
Blow Torch	For heating the rattan cane to bend it into the required shape and size.
Pointed Chisel	For inserting the cane strips in narrow areas.

B. Shampooing Bed Components and Materials

The following components are used in the conduct of the study. Preparatory, finishing materials, and built-in components are discussed in the table below.

Table 2. Built-in components and materials used in the fabrication of rattan-based shampooing bed.

Built-in features and Components	Description
Sink and Faucet	The sink and faucet are detachable for ease of operation and multifunction applicability of the product.
Rattan Cane	Served as the main component for the skeletal or framing structure of the shampooing bed and portions of it have been converted into rattan weave such as fine mesh type and cane web type.
Epoxy Resin	Applied adhesive in the sink.
Varnish	Material used for polishing the final output. It can be a natural varnish to obtain a glossy finish or any other coloring coat.
Reclining Mechanism	This to comfort and ergonomics for the end user by adjusting the shampooing bed to the desired angle and orientation.

4. METHOD:

The study has made used of the product development method (PDM). This method of PDM involves the process of creating, designing, and developing the product. The creation and design stages involved the conceptualization of the physical components and selection of proper rattan materials. It thoroughly assesses the applicability of the product while meeting the concept of aesthetic, comfort, and safety of end users. On the other hand, development stage denotes the actual fabrication phase of the product. The following are the processes involved in the production of rattan-based shampooing bed:

- **Skinning**. This process is the first step in skinning the surface of the rattan using a sharp knife. The outer layer of the skin of the cane is peeled off and removed, then cut into the desired lengths and widths.
- **Heating and bending**. The stem is then heated using a blow torch and bending tool to bend the material into the required shape. The arrangement is put together to build the frame, or the basic structure, of the shampooing bed. The process involves nailing to fix the connection of each rattan cane.
- **Binding**. After the parts are nailed together, the frame is filled by binding the cane strips or thin rattan stems over the frame. The nailed joints are then tightly bound by lengths of split cane strips, which act as covers to cover the visible nails and give additional rigidity. In this stage of the process, details about the design and decorative quality are incorporated.
- **Coating**. Finally, the last step is the coating of the shampooing bed using clear varnish and enamel paint applied to it. However, in most rattan handicrafts, the natural surface and color is retained to avoid the use of any colorant.

Moreover, the acceptability of the proposed rattan-based shampooing bed is evaluated based on level of acceptability as to a) Design and Durability, b) Functionality, and Workability. There were 40 respondents ranging from various end users such as salon owners, faculty, and students. The criteria were used to evaluate is listed in Table 3.

Table 3. Level of acceptability

A. Design and Durability
Q1. Convey appealing appearance or promote alternative product materials
Q2. Resistance to deformation/wear and tear.
Q3. Demonstrate sustainable practices.
Q4. Ergonomically design for all users.
B. Functionality
Q1. Suitable for its purpose as beauty care and salon equipment.
Q2. Ease of repair.
Q3. Easy assembly and disassembly of parts.
C. Workability
Q1. Availability of materials
Q2. Availability of technical expertise
Q3. Availability of tools and machines for fabrication works.

5. DISCUSSION:

Project Perspective Design

Illustrated in Figure 3 are the major components of the project rattan-based shampooing bed which are labelled accordingly. Moreover, the detailed features associated with the product are described in Figure 4. It can be observed that he incorporation of rattan into the design and construction of shampooing beds presents a compelling idea that integrates good quality of materials and it as it suggests the vibes of being comfortable, warm, inviting, relaxing, and homey.

Figure 3. Major components of the rattan-based shampooing bed.

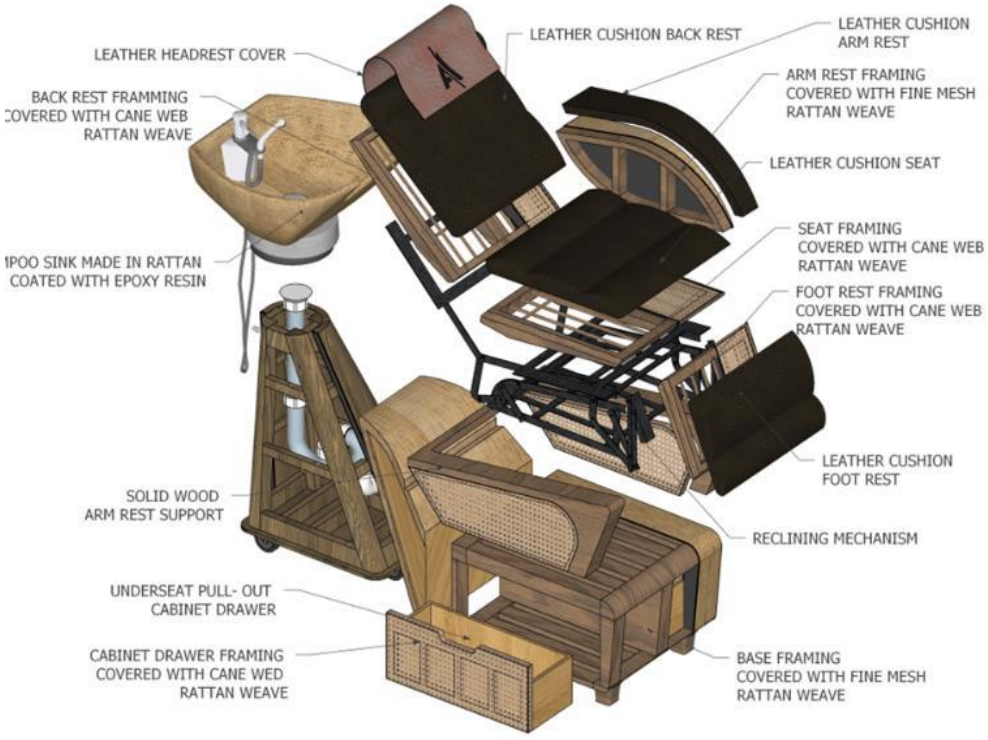

Figure 4. Key features and built-in functionality of the rattan-based shampooing bed.

Figure 5. Detailed part dimensions of the proposed rattan-based shampooing bed.

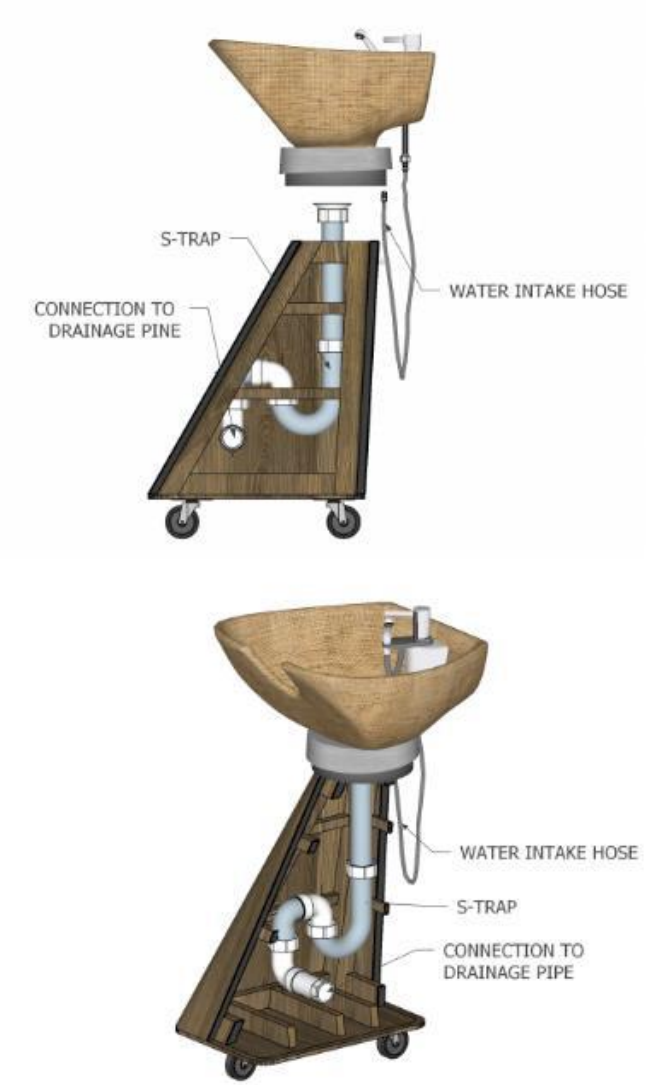

Figure 6. Detachable sink of the rattan-based shampooing bed.

In addition, the detailed actual dimension of the project can be shown in Figure 5. As illustrated, the height of the product is only 1 meter, making it comfortably placed in the desired location. It is portable as parts of the product can be detachable depending on the needs of end user. These features can be described in Figure 6.

6. RESULT:

To evaluate the overall response of the respondents, the following scale:

5 – Highly Acceptable
4 – Moderately Acceptable
3 – Acceptable
2 – Slightly Acceptable
1 – Not Acceptable

A. Design and Durability

Rattan-based products such as the proposed shampooing bed offers a blend of aesthetics, sustainability, ang practicality – making them excellent choice for various application. In this criterion, the respondents were able to evaluate the Q1) Physical appearance, Q2) Resistance to deformation, Q3) Promotion of sustainable practices, and Q4) promotes ergonomic design applicable to varies end users.

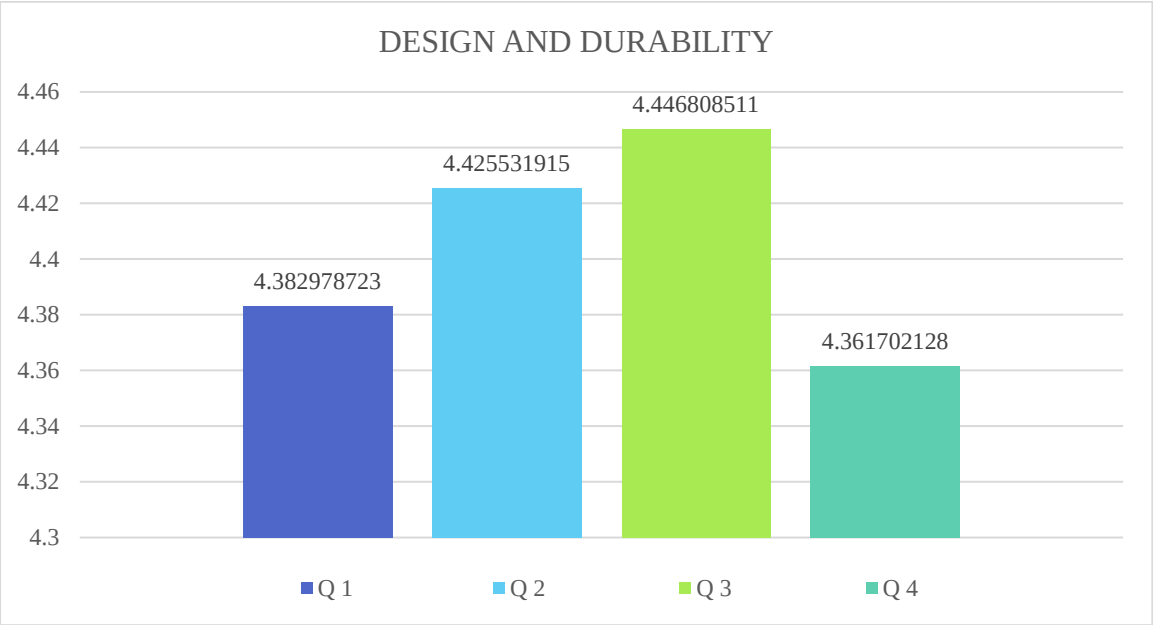

Figure 7. Level of acceptability of Design and Durability

Based on Figure 7, the results show a promising response from the end-users as to the design and durability of the shampooing bed, with a rating of "highly acceptable". The use of rattan materials as a substitute for synthetic materials in the salon setup promotes sustainable practices, which clearly received a mean score of 4.45. This is followed by the durability aspect, which is its resistance to deformation or wear and tear.

B. Functionality

Under functionality, the following criteria were evaluated, Q1) Suitability for its purpose as beauty care and salon equipment, Q2) Ease of repair, and Q3) Easy assembly and disassembly of parts.

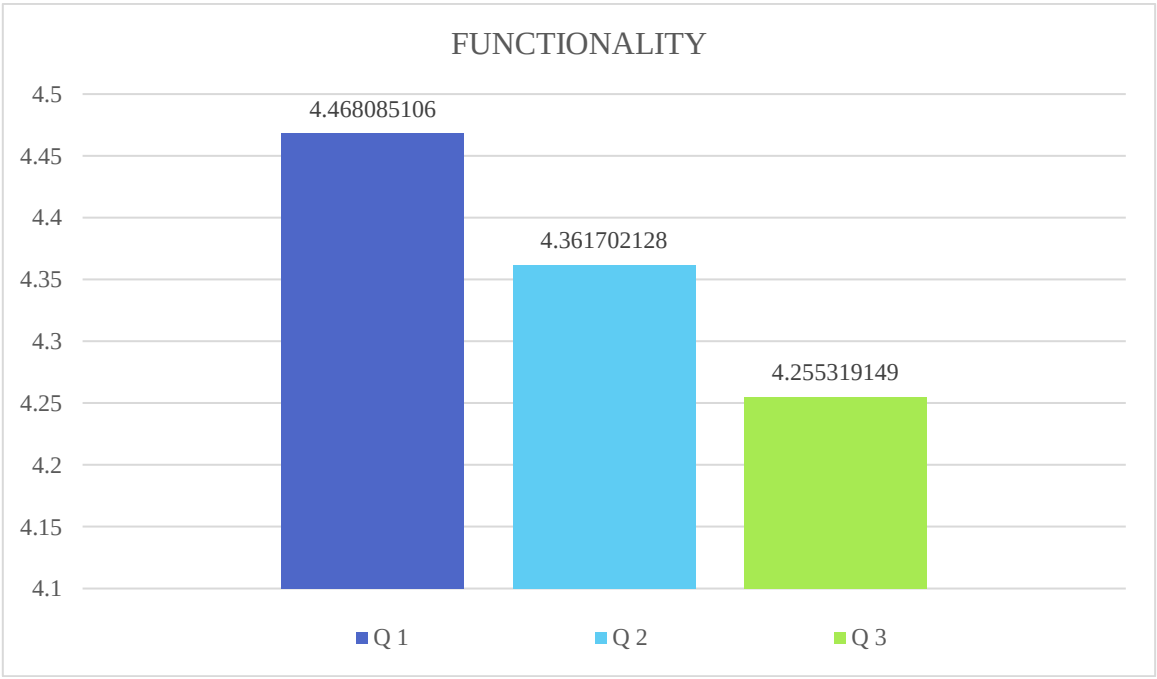

Figure 8. Level of acceptability of Functionality

Figure 8 depicts the response of end-users as to the functionality criterion of the shampooing bed. From the graph shown, it is obvious that the functionality of the product matters most as to Q1, that is, the suitability of the product as to its purpose for salon and beauty care equipment, with a mean rating of 4.47, which is "highly acceptable." Similarly, as to the repair and maintenance part of the shampooing bed, it is observed that it is only rated at 4.36 and 4.26 for Q2 and Q3, respectively. The results correspond to "moderately acceptable" due to its size, compactness, and presence of leather materials, making it challenging to repair.

C. Workability

The Workability aspect of the shampooing bed demonstrates three components as follows: Q1) Availability of materials, Q2) Availability of technical expertise, and Q3) Availability of tools and machines for fabrication works. From the data provided, the respondents perceived highly acceptable as to Q2 and Q3 with a mean of 4.38, both. This implies that the availability of technical experts and materials is widely available in the locality, which is true as the City of Ilagan is known to have many areas with a furniture industry. Moreover, the result supports the creation of rattan facilities in the area, which indicates that people are interested in the rattan industry. However, Q1 received the lowest mark of 4.36, indicating limited knowledge yet in the crafts related to rattan.

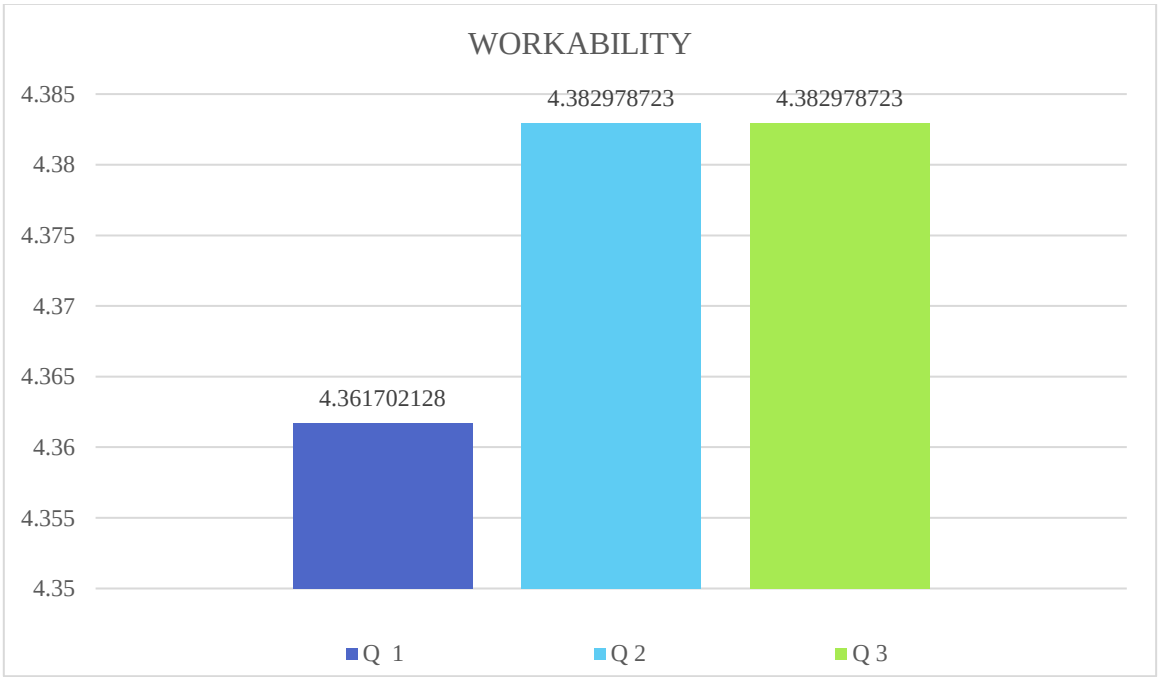

Figure 9. Level of acceptability of Workability

7. CONCLUSION / SUMMARY:

The findings of this research underscore the exceptional attributes of rattan as a material for salon equipment design, particularly shampooing beds. With an average rating of 4.41489375 for design and durability, and ratings of 4.361702 and 4.375886 for functionality and workability respectively, rattan emerges as a highly promising material that excels across multiple dimensions crucial to salon equipment.

The high rating for design highlights the aesthetic appeal and versatility of rattan, aligning perfectly with the aesthetic and comfort requirements of the salon industry. Its natural, organic look adds a touch of sophistication to salon spaces while providing a comfortable and inviting atmosphere for customers.

Durability is another standout feature of rattan, as evidenced by its strong rating. This aspect is particularly vital in the salon industry, where equipment undergoes frequent use and must withstand daily wear and tear. The resilience of rattan ensures that salon owners can invest in equipment that not only looks great but also stands the test of time, contributing to long-term cost-effectiveness.

Furthermore, the impressive ratings for functionality and workability highlight the practicality and ease of working with rattan. Its lightweight nature and malleability make it highly adaptable to various design requirements, allowing for the creation of innovative and ergonomic salon equipment that meets the diverse needs of both practitioners and customers.

These findings have significant implications for the salon industry, suggesting that the incorporation of rattan into equipment design can enhance both the aesthetic appeal and functionality of salon spaces. Moreover, the sustainable and eco-friendly properties of rattan align with the increasing consumer demand for environmentally conscious products and services, positioning rattan-based salon equipment as a compelling choice for forward-thinking salon owners.

In conclusion, the outstanding ratings for design, durability, functionality, and workability underscore the suitability of rattan as a material for salon equipment design. By harnessing the unique qualities of rattan, the salon industry can elevate its aesthetic appeal, improve functionality, and embrace sustainable practices, contributing to a more environmentally friendly and customer-centric approach to salon management.

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