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Designing "Forest" into Daily Lives for Sustainability: A Case Study of Taiwanese Wooden Furniture Design

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Abstract: Taiwan's forest resources are abundant, diverse, and of high quality. However, Taiwan's self-sufficiency rate for timber is only 1.2%. How to build Taiwan's local wooden furniture brand to improve quality of life and achieve sustainable development is worth considering. This study adopted a qualitative research method using Taiwan's local carbon-negative furniture brand "*Forest in Living*" as a case study. We used communication theory to construct a conceptual model that was then used to analyze the design and promotion of furniture. Carbon-negative furniture makes people feel like they are living and breathing deep in the forest, which is one of the best ways to reduce one's carbon footprint. The *Forest in Living* furniture is full of Taiwanese characteristics and firmly captures the country's foundation and soul. The designers have great respect for wood and strong control over the characteristics of the material, and the furniture has unique characteristics and rich content. In the future, we will further study the findings of this paper by inviting consumers to express their views on the design concepts and finished products of this type of furniture, which will be used to examine whether the design concepts can be recognized by consumers.

Keywords: carbon-negative furniture; Taiwan wooden furniture; *Forest in Living*; carbon footprint; sustainable development

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1. Introduction

Sustainable development is not just a slogan, its basic definition was established a long time ago [1]. Over the years, numerous related concepts, methodologies, and principles have been proposed. Within this field of study, they are employed in various processes of product development and design, as well as serving to reflect on whether these designed objects genuinely embody the principles of sustainable development [2–5]. However, it must be implemented in all aspects of life. The attention given to this issue by official authorities and their ability to find suitable development paths and specific policies for their respective countries or regions is undoubtedly a good starting point [6].

Taiwan was introduced to the Forest Stewardship Council (FSC) network in 2011, at which point, it began to set standards for forest management and timber production and established a management plan for planted forests. In order to achieve effective forest land management and maintain forest health, Taiwan proposed a plan called Forest Sustainable Management and Industry Revitalization from 2017 to 2020, which emphasizes increasing the capacity of plantation clearance and guiding the management of public forests, including protecting the health of trees and promoting the conservation and restoration of nature [7].

During 2008–2013, the Forestry Bureau completed the Fourth Forest Resources Survey, which showed that the forest area in Taiwan reached 60.71%, twice the global average

of 30.3%. However, most steep hills in Taiwan are not conducive to logging, and since the 1990s, laws have been enacted to restrict forest harvesting. Taiwan relies on imports for timber, which has seriously affected the development of its forestry industry. Taiwan, which is rich in forest resources, faces a timber self-sufficiency rate of less than 1% (the rate rose slightly to 1.2% in 2019), making it susceptible to the impact of policy adjustments in timber exporting countries and affecting daily life. The increase in forest cover is mainly due to the increase in the area of naturally occurring forests, while plantation forests are rapidly decreasing. The Forestry Bureau speculates that the decline in plantations may be affected by the policy that bans natural forests completely and that limits annual logging, limiting forestry development and creating a one-sided public perception of forest environmental protection. However, plantations are the primary source of timber production, and a decrease in plantations means less timber output. Internationally, there are issues such as reducing emissions from deforestation and forest degradation, which reduce people's willingness to support afforestation when state-owned forests can only be sporadic and private forests are insufficient. Conventional wisdom holds that deforestation is the destruction of nature. In fact, moderate logging is a means of protecting forests in line with the rational use of forest resources based on conservation. Therefore, how to increase Taiwan's timber supply and stabilize supply sources has become a critical issue.

Taiwan's distinct culture and cultural variety offer potential applications in the field of design, with designing local features into products becoming more important for the global market, where products are losing their identity because of similarities in function and form [8]. Cultural elements are considered to be unique characteristics that can be embedded into a product both to enhance its identity in the global market and to enhance the individual consumer experience [9–11]. The increasing emphasis on localized cultural development in Taiwan already demonstrates an ambition to promote Taiwanese style in the global economic market [8]. The unique multicultural background of Taiwan is suitable for creating wooden furniture products and brands. Taiwan has rich forestry resources, but the process of developing, promoting, and using domestic wood is not promising, and there is room for improvement, providing an opportunity for Taiwan to build a domestic wood brand [12–14].

However, whether in Taiwan or in the broader global market, the reach of Taiwanese wood furniture brands is relatively low, and this phenomenon needs to be reversed. This is also the most critical motivation behind the research and creation of wood furniture presented in this study; that is, we aim to introduce the characteristics, advantages, and value of Taiwanese wood to people in different countries and regions and to consider the future of furniture design from the perspective of sustainable development.

It is important to note that this study does not discuss specific design processes and methods, but this is not to say that they are unimportant. As mentioned earlier, there are already mature research findings available for reference, including furniture design, on how to implement the principles of sustainable development and the potentially more suitable methods or principles [15–21]. Based on the context and the core issues mentioned above, this study focuses on two issues:

1. We address the design concept and method of producing Taiwanese negative-carbon wooden furniture using the brand *Forest in Living* to allow more people to understand the advantages, characteristics, and value of Taiwanese wood and wooden furniture.
2. We construct a conceptual model of communication and cognition and apply it to analyze the process of the conceptualization, design, and promotion of domestic wood and furniture production in Taiwan.

2. Literature Review

2.1. The Correlation between Taiwan's Forestry Background and Furniture Design Concepts

The forestry environment in Taiwan has played an important role in the country's economy and culture for centuries. The island's abundant natural resources and diverse ecosystems have fostered a rich tradition of woodworking and furniture making. Taiwan

has a long history of using wood in traditional architecture, furniture making, and art. The concept of Taiwanese furniture design is deeply rooted in the country's forestry heritage. Over time, Taiwanese designers have developed a unique approach to furniture design that draws inspiration from local materials, craftsmanship, and cultural traditions [22]. Meanwhile, the forestry industry in Taiwan has also undergone significant changes in recent years. In response to concerns over deforestation and environmental degradation, Taiwan has implemented new policies and practices aimed at promoting sustainable forestry and reducing waste [23,24]. These policies have led to the development of new materials and technologies that are now being used by Taiwanese furniture designers to create innovative and eco-friendly designs. In short, the connection between Taiwan's forestry and furniture design concepts can be seen as a reflection of the country's rich cultural heritage as well as a reflection of its commitment to sustainability and innovation. By drawing on the island's natural resources and traditional craftsmanship, Taiwanese furniture designers are creating designs that are both beautiful and functional and that also promote a more sustainable and environmentally friendly approach to furniture making [25,26].

As far as the field of furniture design is concerned, the concept of green furniture is widely adopted in manufacturing to avoid the negative environmental impact of the manufacturing process and final products, and this type of furniture is gradually becoming more accepted by consumers [27–32]. As Muhammad Suandi et al. [33] pointed out: "The design of furniture products is influenced by increasing consumer interest in green products and sustainability values. However, although the demand for sustainable furniture products is high, the standardization of sustainability characteristics in furniture design has still not been achieved". Although this situation may not affect furniture design in the short term, it makes it difficult for local furniture brands to enter the global market, and it is also not conducive to the sustainable development of furniture manufacturing in the true sense. Therefore, creating a standard with a more established brand as the leader may be a solution. Some existing research and models have provided great inspiration in this regard [34–37].

2.2. The Concept of Humanistic Design

The two concepts of user-centered design (UCD) and human-centered design (HCD) are easily confused [38–40]. UCD focuses on the individual, resulting in a user-friendly design, whereas HCD focuses on a range of people, which may be appropriate when addressing deeper social issues. In addition, more attention is being paid to the experience of users or consumers using products.

Thus, in the process of product development, designers need to consider the beauty of the product while also fulfilling function and efficiency, especially in terms of whether beauty can satisfy consumers at the psychological and emotional levels. It is not difficult for consumers to buy good furniture, but not all furniture can provide a deeper experience during consumer interaction. This study argues that this deep experience can be achieved through different senses, including vision, touch, and smell. The appearance of the furniture should be unique and beautiful, the materials should make people feel comfortable when they touch and use it, and the unique smell of wood should make people relax and feel like they live in the forest.

The aesthetic movement that prevailed in the 1970s and 1980s centered on the worship of beauty, which was defined as an independent life force that transcends religious, historical, and geographical boundaries. The aesthetic movement emphasized the need for beauty in everyday life and attempted to introduce art into the daily lives of every family. This movement advocated the cultivation of people's tastes; cleverly decorated goods (furniture or ornaments) are often referred to as "artistic furniture" [41]. In other words, when designing furniture, designers need to pay attention to its beauty and composition in addition to ensuring that it will meet the needs of users (e.g., the form and material used in some furniture may have a story or a meaning).

2.3. The Transmission and Cognitive Model of Design

There is a dialogue that takes place between the consumer and the designer while appreciating the furniture. The theory of communication can further explain this phenomenon. Figure 1 is the communication matrix for evaluating furniture, and Figure 2 is the cognitive model of decoders perceiving furniture [42–45].

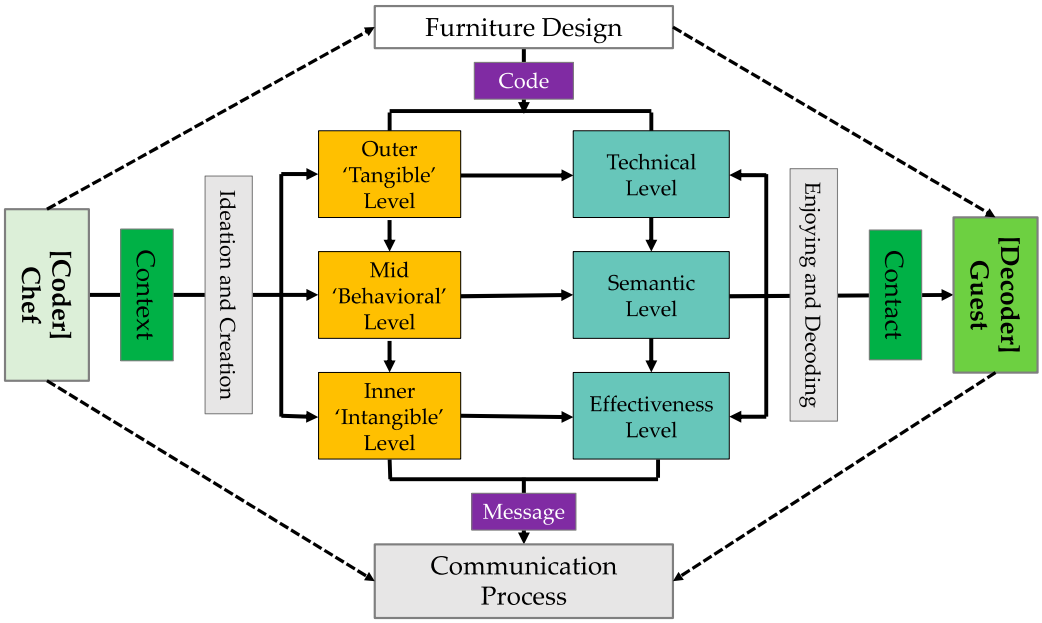

Figure 1. The communication matrix for evaluating furniture. (Source: Adapted from [46–49]; Redrawn for this study).

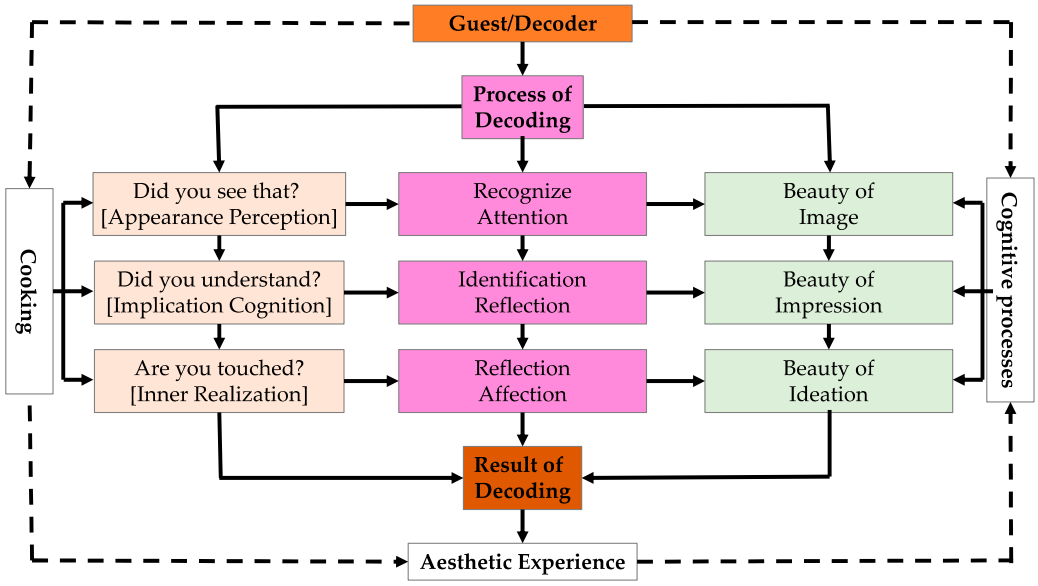

Figure 2. The cognitive model of the decoder's perception of furniture. (Source: Adapted from [46–49]; Redrawn for this study).

The following theories and their core essences are used to construct these two models, which are briefly described below.

Briefly, the designer is the coder, and the consumer is the decoder. Encoding and decoding are widely used in various fields of study [46,47], and their mechanisms can also be applied to the interpretation of furniture design. In this study, we believe that people's

ability to successfully "decode" is an important aspect of communication. Designers' creativity is often described as a manifestation of their pursuit of beauty, characterized by a process by which connotations are expressed through form, and the connotations enrich the form [50]. Form (style) and connotation (concept) complement one another in the process of design. The question is, how does the relationship between connotation and form result in a creative visual concept? Form and connotation seem to be in a close interrelationship, and there seems to be some evidence of connotation in form. From the viewpoint of artistic production as a form of semantic transformation, designers encode their work with particular messages that are later decoded by consumers [42,43,51].

From the perspective of decoding by the consumer, exploring the cognition of furniture design helps one to gain an understanding of the process of creation [52–55]. Whether it is product design or artistic creation, a designer should consider whether their work can transfer information from the consumers' perspective during conceptualization. As far as communication theory is concerned, the designer's expression of the creative process in terms of mood and situation is the process of encoding, and the consumer's understanding of the product of design can be called "decoding", with the designer as the transmitter and the consumer as the recipient [48,56–58]. Goldman [49] proposed that evaluating artwork requires a deep understanding of the communication between the artist and the viewer, not only in a social context, but also to understand the emotional and cognitive experience between designer and consumer. Understanding this communication process is of great benefit to designers.

3. Materials and Methods

Exploratory research into these issues would be beneficial [59,60]. This study was mainly carried out using case studies based on a detailed description of the situation and a problem statement and with systematic data collection and analysis to better understand the phenomenon, background, and enlightenment of the case [61–65].

This section begins with an explanation of the concept and design approach of *Forest in Living*. Then we propose a conceptual model of communication and cognition, which is used to interpret the process of conceptualizing, designing, and promoting car-bon-negative furniture using Taiwanese wood. More importantly, the model is used to analyze whether the cultural connotation of Forest in Living furniture can be recognized by consumers.

3.1. Forest in Living: An Brief Introduction

Forest in Living was created at the Woodworking Training Design Research Center (WTDRC), National Taipei University of Technology, after being in development for more than 7 years. The team hopes that through the establishment of this brand, the world will see the characteristics and advantages of Taiwanese wooden furniture. WTDRC carried out a systematic study of Taiwanese wood and constructed 60 pieces of various types of furniture and related crafts or ornaments (see Table A1). The design team called for the use of carbon-negative furniture made from Taiwanese wood to support a sustainable net-zero environment. Carbon negative means, in effect, the emission of less than zero carbon dioxide and carbon dioxide equivalent (CO_2e) greenhouse gasses. Carbon negative as applied to furniture means that the carbon sequestration of the furniture itself is greater than the carbon emissions generated by the furniture manufacturing process.

The Taoist classic *Tao Te Ching* states that "The Tao produced One; One produced Two; Two produced Three; Three produced All things." Chen [7] applied this as inspiration to further propose the theory of spiral innovation and the theory of three needs (survival, living, and life), which are used as the design concept for *Forest in Living*. On this basis, the 30–70 principle was proposed as the criterion for innovative design (see Tables 1 and 2).

Table 1. Two theories of *'Forest in Living'*.

Two Theories	Interpretation
Spiral Innovation	Inspired by the *Tao Te Ching*, in the process of innovation, if designers achieve harmony between yin and yang, new wisdom can be generated and the efficiency of innovation will be improved. In this way, designers can create good products and make corresponding profits. In short, the metaphysical is the Tao, and the physical is the artifact.
Three "L" of Needs	1. Livelihood level: The basic conditions necessary for human survival. 2. Living level: What humans need in their daily lives. 3. Life level: In addition to the conditions for survival and life, humans need to pursue the meaning and value of life.

Source: [7].

Table 2. The 30–70 Principle.

Three Aspects	Interpretation
Designing	Language of the design: local (30%) + international (70%)
Manufacturing	Manufacturing mode: handmade (30%) + mechanization (70%)
Marketing	Proportion of marketing: taste for art (30%) + goods (70%)

Source: [7].

The most important thing is that furniture design should be human-oriented, meaning that it should meet the needs and expectations of consumers. Designers highlight the natural form of wood given by nature, and the finished furniture expresses the highest state of harmony between humans and nature.

Taiwanese forests have a rich variety of trees of excellent quality, and many of them also have rich cultural connotations or unique meanings, thus furniture made of their wood can evoke stories or memories (see Table 3).

Table 3. Cultural connotations or meanings of trees commonly used in Taiwan.

Name		Interpretation
Chamaecyparis formosensis		The tree of a happy life. The most familiar Taiwanese wood for most people. It has a unique fragrance and is most often used to make door and window frames or to make storage cabinet drawers.
Swietenia macrophylla		A pleasing tree. Has long been believed to ward off evil spirits, and the color of the wood is close to pink, which has a festive connotation and evokes reassuring and pleasant feelings.
Acacia confusa		A tree full of childhood memories. Many people went to acacia woods to catch cicadas as children. Thus, acacia trees evoke memories of the past.

Table 3. *Cont.*

Name		Interpretation
Fraxinus griffithii		The unicorn's favorite tree. Between June and August, it is said that its sap is the favorite food of adult unicorns. A zipper-like strip on the bark is seen as a bite, a unique creation of the unicorn fairy.
Melia azedarach		A cursed tree. It is said that the neem tree was cursed by Zhu Yuanzhan (founding emperor of the Ming dynasty in China). When the New Year comes, the whole tree will appear dead and will not grow new shoots until spring comes.
Cinnamomum camphora		A tree with a smell from childhood memories. Camphor oil was an important economic industry in early days and was collected by cutting pieces in the tree and extracting it through steam. Because of the poor living environment in the past, people used mothballs and camphor oil to remove insects, often placed in wardrobe drawers; its familiar smell on clothes is a special Taiwanese preference.
Taiwania cryptomerioides		The tree that hits the moon. Taiwan cedar has existed on the earth for more than 100 million years, so it has the title of living fossil. It is the only plant of the genus Taiwania. It can grow to 40 to 50 m and higher. Because it is hard to see the canopy from the ground, the Rukai people call it "the tree that hits the moon".

Source: [7].

The interaction of these three elements, Taiwan (local brand), wood (high-quality product), and design (creative ingenuity) motivated the creation of the furniture brand Forest in Living, the core concept of which is shown in Table 4.

Table 4. *Forest in Living*: The concept and connotation.

Name	Interpretation
Forest	Circle of Life Being generous and kind Step down gracefully and benefit all living being unconditionally Forest giving us a new lease of life.
In	The beginning of ways, Repeating the way, in every 7 days. Being simple and profound, with skill and ease. Enjoy the life footloosely.
Our	Circle of Our Life, "TaiChi" Two Forms, Three Powers, Four Divisions The greatest attribute of the amazing world Livelihood, Living, Life.
Living	Live our own life, Savor our life Woodcraft can represent Taiwan. Show the world a different Taiwan with woodcraft from Taiwan!

Source: [7].

3.2. Transformation from Wood to Wooden Furniture: A Conceptual Framework

Traditional craftsmanship is an important part of the culture of a country or region, and the finished products are cultural products. Furniture designed and manufactured using Taiwanese wood and transformed through creative ingenuity not only has the functional attributes of furniture, but, more importantly, can integrate Taiwan's diverse culture. This furniture, reflecting Formosa style and taste, can better integrate into society and meet the deeper cultural and aesthetic needs of consumers.

This research focuses on promoting furniture made from Taiwanese wood. In addition to various official support and incentive policies and the joint efforts of designers, industry, and academia, it is also important for consumers to recognize such furniture.

According to communication theory [46], if the designer (sender/coder) is to successfully communicate a signal to the consumer (receiver/decoder), certain requirements must be met on three levels [59]. As a result, the cognitive process of furniture design and promotion in this study are as follows:

1. On the technical level, the craftsperson must accurately convey the message they intend to transmit so that the decoder can see, touch, and even feel it. (Do you see it?)
2. On the semantic level, the decoder needs to appropriately understand the message being transmitted. (Do you understand?)
3. On the effectiveness level, the message needs to affect the decoder in such a way as to elicit a particular response or behavior. (Are you touched?)

For the audience to understand the cultural significance of furniture, three steps must be followed: (1) attract their attention (recognition); (2) generate correct cognition (understanding); and (3) encourage them to form deep emotions (reflection) [45,51–53,66]. In short, recognition, as situational perception, indicates whether the furniture appeals to the consumer; understanding, as artistic cognition, indicates whether the consumer can understand the meaning of the message being conveyed; and reflection is a psychological response that indicates whether the consumer can be moved in the process of viewing or experiencing the furniture.

Therefore, in this study we constructed a conceptual model to examine the communication process and cognitive patterns between designers and consumers (see Figure 3). This process of communication and cognition is as follows:

1. Designer: Designers think about how to transform wood into beautiful furniture based on their own life experience, creative thinking, and from the perspective of sustainable development. In this process, designers attach great importance to materials and can integrate creative thinking and cultural connotation into the design process. The furniture completed by the designer must not only have good function, but should also take into account aesthetics and culture.
2. Consumer: For consumers, the function of a piece of furniture is the first thing to consider, followed by style. Finally, consumers consider whether the furniture piece itself has a connotation and story. In other words, a piece of furniture can be seen by consumers through the promotion carried out by designers or manufacturers, and consumers can read the designer's intentions and have the opportunity to recognize the value of the product while interacting with the product.

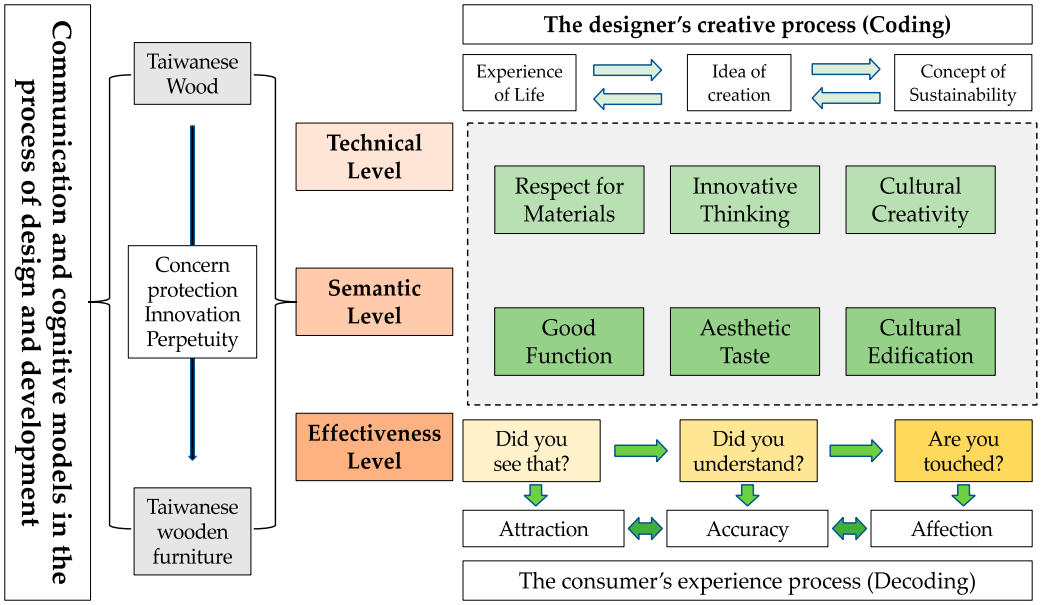

Figure 3. The communication and cognitive models in the process of design and development of *Forest in Living*: a conceptual model. (Source: Adapted from [42–46]; Redrawn for this study).

4. Results: Case Analysis and Discussion

In 2016, the National Taipei University of Science and Technology created a desk using traditional construction methods and Taiwanese wood, which was given to President Tsai as a gift (see Figure 4: left). The height of the desk was specially designed for ergonomic fit, so it is suitable for President Tsai, making it more comfortable for her to review documents. In addition, the desk was built using traditional construction methods; it does not use nails, and a total of 438 mortises were used. The table is mainly made of *Chamaecyparis formosensis*, and the drawers are made of *Zelkova serrata*.

Figure 4. A desk specially designed for President. Size: 1880 × D950 × H740. Material: *Chamaecyparis formosensis* and *Zelkova serrata*. (Source: [7]).

In Chinese characters, *Chamaecyparis formosensis* and *Zelkova serrata* are pronounced "jumu" and "kuaimu", or, idiomatically, "ju" and "kuai", meaning "shoot to fame" and "happy life". The 12 kinds of wood used in the decoration on the front of the desk were collected by the designer from all over Taiwan; they represent the essence and soul of the country and can accompany the president in determining the country's future. Mount Jade and *Lilium formosanum* are typical images of Taiwan, giving this desk a distinct Taiwanese style and feel (see Figure 4: right). In short, the desk not only reflects the roots of Taiwan, but also highlights the essence of the Taiwanese soul.

Details determine the success or failure of sustainable development. Many craftsmen and designers have a deep bond with the materials they use. The mirror shown in Figure 5 is one of the best examples of the use of fragmented wood. Designers create new products in the most natural way possible.

Figure 5. The mirror. Size: Large (1560 × D610 × H50), Medium (W1130 × D490 × H50), Small (W 890 × D680 × H50). Material: *Taiwania cryptomerioides*. (Source: [7]).

"Formosa Flower" uses wood chips or shavings as the main material, which the designer transformed into beautiful and interesting ornamentation. For example, as shown in Figure 6, shavings of different types of wood are transformed into beautiful flowers that make up the hair of the characters.

Figure 6. *The Passing Years*. The three portraits show the appearance of a woman at three different ages, symbolizing the passage of time. Size: W610 × D610 × H150. Material: Rosewood, Maple, *False cypress*, Walnut, *Fokienia hodginsii*, Purpleheart, *Alnus formosana*, and Metallic paint. (Source: [7]).

Another interesting piece is shown in Figure 7. The shavings are transformed into peas, and the pronunciation of the Chinese character for "pea" is similar to "wonderful", which has the meaning of fulfillment and blessing.

Figure 7. *The Pea*. Size: W1530 × D170 × H630. Material: *Picea asperata* and *Alnus formosana*. (Source: [7]).

Consumers may not have the same frequent contact with a variety of furniture made of Taiwanese wood as professionals do, and they may be relatively unfamiliar with the properties and characteristics of different types of wood. Therefore, the design team of Forest in Living has held many exhibitions on different occasions. Designers use Taiwanese wood to show the uniqueness of Taiwan, and carbon-negative furniture created with ingenious thinking successfully shows rich Taiwanese cultural patterns.

Figure 8 shows some photos of an exhibition. Exhibitions have a significant effect on promoting various products, crafts, and works of art, including furniture. Holding exhibitions generally has four advantages: (1) it provides consumers with the opportunity to get close to a variety of excellent works; (2) it provides peers with the opportunity to stay abreast of the latest design trends; (3) it provides the industry with the opportunity to grasp popular business opportunities; and (4) it provides the academic community with the opportunity to carry out in-depth learning, communication, and research.

Figure 8. Some exhibitions. (Source: [67]).

5. Conclusions and Follow-up Research

5.1. Conslusions

In 2017, a new starting point was officially designated for the development and use of domestically produced timber in Taiwan. The amount of felling and production of timber has increased significantly, and the quality of the wood is excellent, which makes it a good choice for various products, including furniture. In the past, most Taiwanese wood was used for construction, stencils, flooring, and plywood. In recent years, the Forest Service has integrated industrial, official, and academic resources to develop products based on Taiwanese timber in an attempt to shake off the stereotype that domestic wood is of poor quality, resulting in its underuse. For example, some wood can be used to develop products for health care and pest control or to develop recyclable and environmentally friendly products that are strong and resistant to decay. In addition, domestic wood can be used to manufacture general daily necessities so that more Taiwanese consumers can understand its advantages and characteristics. In recent years, a new trend has begun to emerge. Designers are paying more attention to the grain, color, and smell of wood, and even use nodules, branches, leaves, roots, bark, and other parts that are usually considered waste materials to give them new life and create many crafts and works of art. In addition, some materials left after processing can also be used as substitutes for raw petrochemical materials or agricultural products, which can solve problems such as material waste and environmental pollution.

The potential for developing and designing furniture using high-quality Taiwanese wood is great. Carbon-negative furniture evokes the feeling of living and breathing deeply in one's own forest and is undoubtedly one of the best ways for individuals to reduce their carbon footprint.

Forest in Living furniture is full of Taiwanese style and taste, firmly capturing the roots and soul of Taiwan. The designers have great respect for wood and strong control over the characteristics of the material and design furniture with unique characteristics and rich connotations. Future research will further examine the results of this paper by inviting consumers to express their views on Forest in Living furniture. Their feedback will be used to examine whether the design concept is recognized by consumers to better promote Taiwanese wooden furniture and the new concept of carbon-negative furniture.

The establishment of a style must involve finding its roots and soul. Different cultures are blended in Taiwan, forming a multicultural society. Using local elements in areas such as humanity, landscapes, and materials, an exclusive style has been created in Taiwan, the Formosa style, which highlights the advantages of Taiwanese wooden furniture.

5.2. Follow-Up Research

Regarding the concept model, our research team built the core framework of this brand based on Chinese traditional philosophy and communication theory, and developed this series of furniture and some handicrafts according to the basic principles of furniture design, highlighting the characteristics and advantages of different types of wood. This article believes that the concept of sustainable development is receiving more and more attention from society, but there are still many issues that need to be improved. By using models or methods that have been repeatedly verified as feasible, we can focus more on product development and how to get consumers to recognize the concept of the product.

As the communication and cognitive models constructed in the study show, consumer recognition is an important condition for a design or a brand to succeed and to have a chance to stand firm in the market. In addition, the two concepts of "carbon-negative furniture" and "carbon footprint" are relatively unfamiliar to most consumers. Therefore, future research, in addition to increasing publicity and promotion, should aim to help the public to understand what role "carbon-negative furniture" plays in our lives and how these concepts can improve the environment. At the same time, we also aim to invite consumers to experience this type of furniture and aim to determine what people really think about it through questionnaires. The results of these surveys can not only be fed

back to designers, but can also further clarify the future development trend of this type of furniture. Consumers are more concerned about the relationship between furniture and health. Many pieces of furniture tout that they are environmentally friendly, but the reality is very different. The series of furniture developed by this research team can also be measured by scientific means, and consumers should be invited to try it to further highlight its value in contributing to health and sustainability. These studies will be carried out in an orderly manner in the next phase research.

In short, we hope that more and more people will become interested in carbon-negative furniture. Additionally, our research team looks forward to receiving valuable feedback from anyone, including designers, entrepreneurs, consumers, and researchers, on the beliefs of this brand, the design of these furniture pieces, and even their promotion and marketing. Only when everyone truly realizes the importance of sustainable development and contributes their efforts from different perspectives can we gradually achieve a low-carbon, healthy, and sustainable living environment and lifestyle.

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Appendix A

Wooden furniture and derivative artworks or ornaments of *Forest in Living* are shown in Table A1.

Table A1. *Forest in Living*: All products.

Category	Name	Photo	Information
Arts	Roots and soul [A desk specially designed for the President]		Size: W1880 × D950 × H740 Material: *Chamaecyparis formosensis* and *Zelkova serrata*.
	The will of the people [Table]		Size: W1930 × D690 × H750 Material: *Swietenia macrophylla*, *Acacia confusa*, *Cinnamomum camphora*, *Taiwania cryptomerioides*, *Chamaecyparis* and *Pinus taiwanensis*

Table A1. *Cont.*

Category	Name	Photo	Information
	Blessing of superposition [Stools]		Size: W400 × D400 × H450 Material: *Chamaecyparis formosensis, Quercus glauca, Taxus sumatrana, Melia azedarach, Ulmus parvifolia, Calocedrus formosana, Litchi chinensis Sonn, Cinnamomum camphora, Michelia compressa, Acacia confusa, Cryptomeria japonica, Machilus zuihoensis, Taiwania cryptomerioides, Elaeocarpus sylvestris Thermally modified Acacia confusa* and *Swietenia mahagoni*
	The beauty of nature [Table]		Size: W1930 × D795 × H695 Material: *Taiwania cryptomerioides*
	Exemplary conduct and nobility [Bench]		Size: W1900 × D380 × H430 Material: *Taiwania cryptomerioides*
	Pleasurable and enjoyable [Table and Chairs]		Size: Desk (W1800 × D800 × H750); Chair (W580 × D460 × H820) Material: *Swietenia macrophylla*
	Pleasurable and enjoyable [Chairs]		Size: W580 × D460 × H820 Material: *Swietenia macrophylla*
	Pleasurable and enjoyable [Stool]		Size: W1550 × D380 × H430 Material: *Swietenia macrophylla*

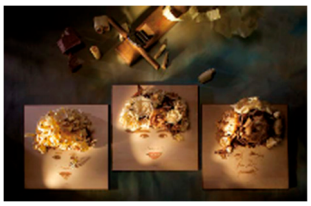
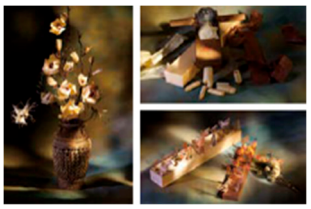
Table A1. *Cont.*

Category	Name	Photo	Information
	Combining vigor and suppleness [Dining Table]		Size: W2100 × D900 × H750 Material: *Zelkova serrata*
	Naturally [Chair]		Size: W1880 × D950 × H860 Material: *Zelkova serrata*
	Freely andcomfortably [Desk]		Size: W1750 × D475 × H690 Material: *Ulmus parvifolia*
	Blinking [Teapoy]		Size: W1830 × D1050 × H460 Material: *Zelkova serrata*
	Rest [Table and Chair for Zither]		Size: Desk (W1100 × D420 × H620); Chair (W500 × D280 × H430) Material: *Ulmus parvifolia*
	Good luck great blessing [Chair]		Size: W1900 × D390 × H830 Material: *Cinnamomum camphora*
	Good-luck of opening [Stools]		Size: W2600 × D350 × H440 Material: *Cinnamomum camphora*

Table A1. *Cont.*

Category	Name	Photo	Information
Design	Respect the material [The Mirror]		Size: Large (1560 × D610 × H50), Medium (W1130 × D490 × H50), Small (W890 × D680 × H50) Material: *Taiwania cryptomerioides*
	A blessing of superposition [Backrest chair]		Size: W434 × D431 × H681 Material: *Swietenia macrophylla*
	Five types of wood, double the blessing[Stools]		Size: W400 × D400 × H450 Material: *Swietenia macrophylla*, *Acacia confusa*, *Melia azedarach*, *Cinnamomum camphora*, and *Fraxinus griffithii*
	Wuxing (Chinese philosophy) [Chest of Drawers]		Size: W1200 × D500 × H850 Material: *Acacia confusa*, *Melia azedarach*, *Swietenia mahagoni*, *Cinnamomum camphora*, and *Formosan Ash*
	Pleasurable and Enjoyable [Tea Table]		W1250 × D480 × H650 Material: *Swietenia macrophylla*

Table A1. *Cont.*

Category	Name	Photo	Information
	Dancing [High Table]		Size: W450 × D360 × H750 Material: *Swietenia macrophylla*
	Self-discipline and freedom [cabinet]		Size: W1810 × D460 × H550 Material: *Taiwania cryptomerioides*
	Colorful [Stools]		Size: Large (W315 × D315 × H500), Medium (W265 × D265 × H400), Small (W225 × D225 × H300) Material: *Taiwania cryptomerioides*
Formosa Flower	The Passing Yea		Size: W610 × D610 × H150 Material: *Rosewood*, *Maple*, *False cypress*, *Walnut*, *Fokienia hodginsii*, *Purpleheart*, *Alnus formosana* and *Metallic paint*
	Abundant Blessings and Happiness		Size: W700 × D485 × H135 Material: *Rosewood*, *Maple*, *False cypress*, *Walnut*, *Fokienia hodginsii*, *Purpleheart*, *Alnus formosana* and *Metallic paint*
	The Pea		Size: W1530 × D170 × H630 Material: *Picea asperata* and *Alnus formosana*

Source: [7].

Appendix B

Wood is an environmentally friendly natural resource and the most temperate material, which can adapt to Taiwan's humid and hot weather and increase the durability of furniture. The use of domestically produced wood can save transportation costs and reduce carbon emissions, which is in line with the concept of green consumption. The main categories of trees commonly found in Taiwan are shown in Table A2.

Table A2. The main categories of trees commonly found in Taiwan.

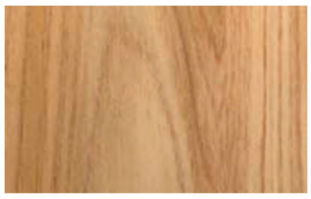
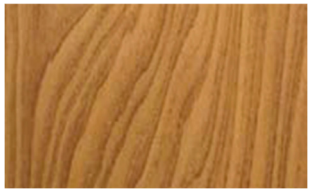
Category	Name	Photo
Conifers	*Taiwania cryptomerioides*	
	Cryptomeria japonica	
	Cunninghamia konishii	
	Calocedrus macrolepis var. formosana	
	Chamaecyparis formosensis	
	Chamaecyparis obtusa var. formosana	

Table A2. *Cont.*

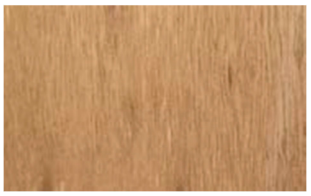
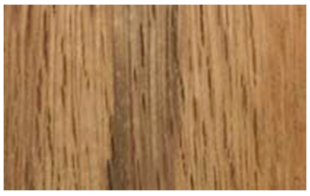
Category	Name	Photo
Broad-leaved tree	*Taxus sumatrana*	
	Swietenia macrophylla	
	Acacia confusa	
	Cinnamomum camphora	
	Melia azedarach	
	Machilus zuihoensis	
	Michelia compressa	

Table A2. *Cont.*

Category	Name	Photo
	Cyclobalanopsis glauca	
	Ulmus parvifolia	
	Fraxinus griffithii	
	Zelkova serrata	
	Cinnamomum kanehirae	

Source: [7].

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