Available Online at www.e-iph.co.uk
Indexed in Clarivate Analytics WoS, and ScienceOPEN

E-B Environment - Behaviour Proceedings Journal

ARCADESA2024Yogyakarta

https://arcadesa.isi.ac.id/index.html

8th Art, Craft and Design in Southeast Asia International Symposium

ISI Yogyakarta Indonesia, 27-28 September 2024

Organised by: Institute Seni Indonesia, Yogjakarta, Indonesia

e-IPH e-International Publishing House Ltd., United Kingdom

Bamboo Installations Design as an Appreciation of Local and Environmentally Friendly Materials

Vanya Alessandra Leonardo*, Amadea
**Corresponding Author*

Interior Design Department,
Universitas Pelita Harapan, Jakarta, Indonesia

vanya.tjioe@uph.edu, amadea.sod@uph.edu
Tel: +628111995308

Abstract
Bamboo, an abundant and sustainable material in Indonesia, has diverse applications, from crafts to construction. This study introduces bamboo's unique characteristics and its potential for development in art, crafts, and monumental works, emphasizing its fast growth and structural durability. In studio learning, bamboo's flexibility and natural inspiration foster innovative, organic designs that reflect contemporary aesthetics. These designs, realized in public spaces, not only promote bamboo's environmental benefits but also serve as educational tools, showcasing its value as a locally sourced, eco-friendly material with broad potential for artistic and structural applications.

Keywords: Local material; bamboo design; bamboo installation; studio learning

DOI: https://doi.org/10.21834/e-bpj.v9iSI23.6168

1.0 Introduction

Bamboo plants are widely utilized because they are easily found across various geographical conditions, from low to highlands, and in various climates, both tropical and subtropical climate zones. There are 176 bamboo species in Indonesia out of 1439 bamboo species worldwide. This means nearly 10% of bamboo species worldwide are found in Indonesia. Indonesia is estimated to have over 1 million hectares of bamboo plants, but only 25,000 hectares are managed as bamboo plantations. The rest grow freely and sporadically (Setiawan, 2023). Bamboo, known as the "green gold grass," is one of the fastest-growing plants on the planet, capable of growing up to 1.2 meters per day (Muttaqin et al., 2023). Bamboo has a relatively fast life cycle, with only 3 to 4 years of harvest time. Bamboo is a plant that, once planted, can be harvested throughout its lifetime because it grows continuously (Kementerian Koordinator Bidang Perekonomian Republik Indonesia, 2021).

Using bamboo as a material can have a good impact on society. Conserving traditional bamboo handling skills is possible while creating new income opportunities by developing a bamboo-based construction industry. The skills of local people can be increased, which in turn will support them in income generation. The rise of the bamboo industry significantly promotes economic growth and increases people's income. In the craft industry (a combination of arts and crafts) in Indonesia, bamboo is a material that has the

DOI: https://doi.org/10.21834/e-bpj.v9iSI23.6168

tremendous economic potential to enter the export market of countries that apply these 'environmentally friendly' considerations because: (1) it does not damage the environment; (2) has a relatively short production period of 3-5 years; and (3) is multi-functional (versatile) (Pramono et al., 2021).

The vast potential of bamboo as a material for both crafts and construction makes bamboo worthy of being one of the primary materials in Indonesia, whether in small products such as craft or furniture or even in buildings. This study aims to introduce the unique characteristics of bamboo as a material with potential value to be developed into many kinds of works, whether in art, craft or monumental works. These works will serve as agents to promote bamboo as one of the abundant and easily found local, sustainable and environmental friendly materials in Indonesia, considering the fast growth rate and durability of structures built using bamboo. The challenge in promoting bamboo as a versatile material to replace conventional building materials such as wood, concrete, and steel depends on how far designers and artists produce the design and how great the ability of local craftsmen who will produce the design using bamboo that is unique, contemporary, and at the same time, attract attention. To produce unique and compelling works that promote and empower the use of bamboo as the primary material requires creativity to create designs that differ from those currently available in the market.

One of the learning experiments in foundational studio studies at Interior Design UPH is balancing form, content, and context in design by using hands-on experience to juggle material knowledge and the making process. The final project from the class was to create a human-sized installation project that can be used as a design for a space in the public area and provide a certain experience for the user of that public space using bamboo as the primary material. In the design process, students are guided to develop their ideas based on their inspiration from nature, which typically features organic characteristics that align with bamboo's bendable and flexible nature. The design produced by students is expected to showcase the distinctive characteristics of bamboo through their installation forms.

In this class installation project, the resulting work is designed to be placed in a public space to encourage engagement between visitors and the public space. The installation, designed using bamboo, leverages bamboo's flexible and easily bendable characteristics to achieve a design outcome inspired by nature, which tends to feature more organic and less geometric forms, mimicking nature's characteristics. In designing the installation, the form is expected to showcase the uniqueness of bamboo as a material, beyond its typical processing and shaping, highlighting the distinctive methods of bamboo treatment compared to other materials. This aims to create a more relevant installation design for the visitors. The student's installation is placed in a publicly accessible space where it can be visited and enjoyed by the general public to serve as an educational agent and promote bamboo's unique qualities as a substitute for conventional materials as building materials. As future designers who will create works in the future, introducing bamboo to students is an effort aimed at gradually fostering an appreciation for the versatility of bamboo as a material and encouraging them to continue designing with it. Ultimately, the increasing number of design works using bamboo will symbolize the success of making bamboo one of the main materials in Indonesia.

2.0 Literature Review

Indonesia has enormous potential to develop the bamboo industry because of its abundant availability. The community utilizes it for daily needs, crafts, and weaving, as well as as a traditional building material. The young shoots of bamboo, known as 'rebung,' can be used as a food ingredient. Bamboo has been utilized as a household appliance and building material since ancient times, particularly by those living where bamboo grows naturally and abundantly. Some utilize bamboo as a craft material for its elasticity and flexibility, which makes it easy to transform into crafts in the form of decorations or furniture. Many foreign tourists are interested in the beauty and uniqueness of bamboo crafts, thus opening up opportunities for exports to various countries. Cultivating, processing, designing, and producing high-quality bamboo products can increase exports and foreign exchange income (Shukla & Joshi, 2020).

Because of its innate strength and flexibility, bamboo has been utilized as a building material since ancient times. Bamboo is easy to shape, and its price is lower than wood. Using bamboo as a building material can reduce pressure on natural resources and have a lighter environmental impact than conventional building materials such as concrete and steel. Bamboo has good resistance to wind and temperature changes but can be susceptible to decay if submerged in water for a long time. Therefore, choosing the right type of bamboo and applying special treatments to bamboo before and during the construction process are crucial factors in ensuring the optimal performance of bamboo in structures. Compared with other building materials, bamboo structures have weaknesses in strength and durability. However, these can be overcome by considering more flexible designs and employing innovative construction techniques. Furthermore, bamboo's advantages in terms of environmental sustainability and lower construction costs make it an attractive alternative to consider in residential building construction, especially in areas abundant with bamboo resources (Honta, 2024).

In addition to benefiting the economy and culture, bamboo contributes to environmental conservation. Bamboo has gained recognition for its versatility and sustainability. From its easy growth to its remarkable strength and durability, bamboo has become a valuable resource for construction purposes. Ecologically, bamboo plants help maintain balance as their roots prevent erosion and control groundwater (Putro et al., 2014). Bamboo is beneficial to the environment because it produces more oxygen than equivalent tree strands, reduces light intensity, protects from ultraviolet rays, is an essential atmospheric land and soil purifier, and its roots can minimize soil erosion by up to 75% (Sharma et al., 2016). Bamboo can produce 30% more oxygen than other trees (Basari & Pari, 2017). Bamboo is a source for sustainability and maintaining the ecological balance (Liu et al., 2012). Bamboo can also be processed into clothing using its bamboo fiber. With the help of technology, bamboo can also be utilized as a raw material for paper production. The versatility of bamboo materials has been known and utilized for a long time up to the present day.

In the existing literature, the term art installation generally refers to artwork executed in public in openly accessible locations, different than the conventional museum and gallery. Some are situated permanently at a site: a monumental statue or a bespoke sculpture. Others are for temporary situations in a specific place and at a specific time, as in the case of a public art festival. Public art can be aggressive, abstract, symbolic, decorative, and aesthetic (Adina & Cuffie, n.d.). Artists create it for different reasons. It can take a wide range of forms, sizes, and scales and can be temporary or permanent. It often interprets the history of the place and its people and addresses a social or environmental issue. Public art includes murals, sculptures, memorials, integrated architectural or landscape architectural work, community art, digital new media, and performances and festivals. Recent literature on installation art stresses that public art installation is structured around the beholders, who are invited to explore their spaces and the objects possibly placed within them. Installation art can prompt the public to engage in various actions (Caldarola, 2020).

This project will use a specific method adapted from the journal 'A Strategy to Support Experience Design Process: The Principle of Accordance', which discusses how the process of implementing experience design is carried out. This method is in accordance with the learning process in the design studio class, where hands-on experiments are prioritized to improve the learning experience (Camere & Bordegoni, 2015).

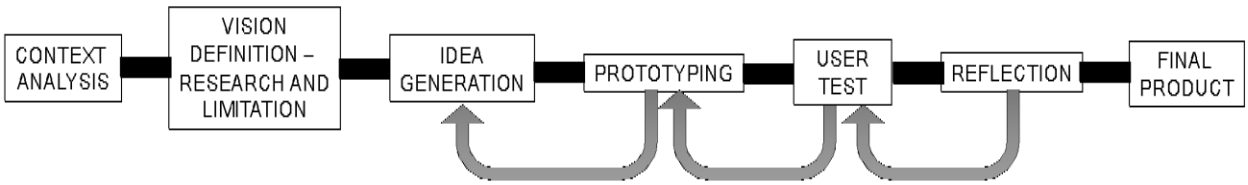

Fig. 1: Adaptation of Design Process
(Source: Camere & Bordegoni)

3.0 Methodology

In designing this bamboo installation for public space, based on Figure 1 steps above, students will carry out a process like this:
(1) Class content given.
(2) Students observe the specific public area to convey the context and produce the best design for the space by conducting a thorough site analysis. This process is in accordance with the 'Context Analysis' and 'Vision Definition' processes in Figure 1. While observing, students interact with users in the public space where the installation will be built to get information that could help design the installation.
(3) Students propose the installation design in groups regarding the content and context data from observation, in accordance with the 'Idea Generation' process in Figure 1.

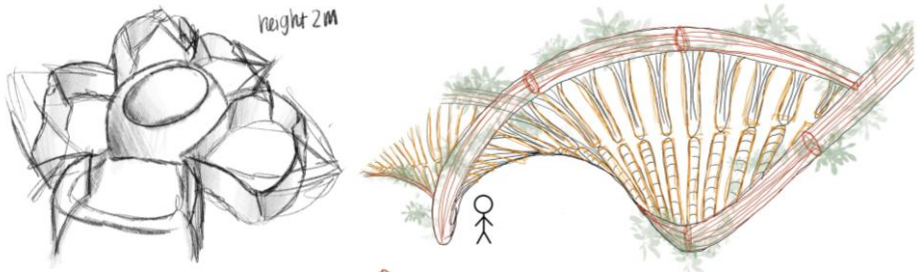

Fig. 2: Design Ideation Inspired by Nature
(Source: Student Works)

(4) To enhance form, students began to make prototypes of the design ideas formulated in accordance with the 'Prototyping' and 'Test' process in Figure 1. Prototypes with a scale of human proportions were made to facilitate and test usage analysis and installation design.

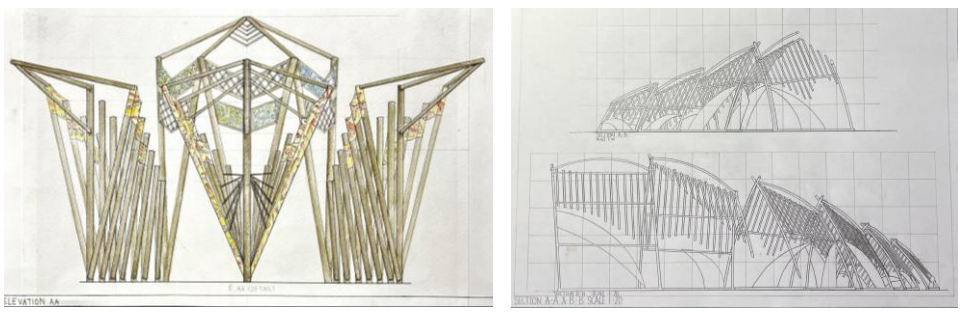

Fig. 3: Working Drawing
(Source: Student Works)

Fig. 4: Prototyping
(Source: Student Works)

(5) Students built the installation in collaboration with the local bamboo craftsmen. After the installation was completed, the students conducted a post-test using a questionnaire and interviews to obtain feedback on the design of the installation they created in accordance with the 'Reflection' and 'Final Product' processes.

Fig. 5: Result
(Source: Student Works)

Through this process, the interaction between teacher and student is in the form of brainstorming and discussions while experimenting to get the best design results that are used as solutions to the design problems obtained.

4.0 Findings

This project of utilizing bamboo to produce installations has been going on since 2018. At first, this activity only involved local bamboo craftsmen providing a workshop and insights into local bamboo processing techniques in crafts for students. This workshop was held with the aim of honing students' hands-on experiments and skills on bamboo materials. The involvement of local bamboo craftsmen in this activity is to expose the techniques and works of local bamboo crafts as a form of introduction to students. In this workshop, the introduction of techniques only extends to the manufacture of craft objects, emphasizing the use of bamboo material, which is no longer shaped like real bamboo but is already made of thin and flexible material.

Fig. 6: Early Bamboo Workshop with Local Craftsmen
(Source: Class Activities)

Activities then developed in 2019, where workshops were conducted while involving local bamboo craftsmen with a higher learning intensity. In this activity, the craftsmen share knowledge about construction techniques using bamboo to produce a design by taking inspiration from nature, which tends to have an organic shape. This is an emphasis on the use of bamboo materials that try to escape from the grip of traditional forms of construction so far. In the use of bamboo in traditional construction systems, most of the bamboo construction is used to create geometric shapes, for example, as in hut buildings such as *saung* or *pendopo*. Meanwhile, the character of the bamboo material, which tends to be easy to bend and flexible, is better used to form not only geometric shapes but also more organic and curved shapes. Recently, buildings with bamboo materials have begun to appear, using curved designs that also apply constructions that can accentuate the curved shape, especially in tourist areas like Bali; there is a growing trend of villas and restaurants using contemporary designs using bamboo materials. However, most of the newly built structures are limited to simple single-story buildings.

Designs that utilize the characteristics of bamboo, which are easy to bend and flexible, can help produce designs that are more contemporary and unique, either on craft or buildings. The use of the flexible character of bamboo is often applied to craft objects but is rarely used in construction because there are still few bamboo building designs that use curved shapes. Organizing bamboo processing workshops involving students and local craftsmen focusing on bamboo construction influences the shape of the installations designed by the students. The installation design from this period was greatly influenced by the thin and flexible character that wrapped around the robust main structure to mimic its inspiration from nature. For example, thin materials arranged horizontally to depict the shape of a shell or thin bamboo weaving to form the configuration of a turtle's body.

Fig. 7: Installation Results from 2018 and 2019
(Source: Student's Installation)

In 2023, The development began with the creation of more modular and proportional installation forms tailored to the proportions of their users' bodies. One of the installations produced during this period was used as a display to showcase the collaborative work between a Japanese bamboo artist and local bamboo craftsmen at an event held in one of the shopping malls in Jakarta. In this collaboration, the Japanese bamboo artist and local craftsmen showcased the unique bamboo processing techniques from their respective regions, which were then applied to crafting handmade objects. The students' installation was used as a display for this collaboration because its design was considered fitting for the bamboo craft theme and could harmonize with the design of the collaborative artworks.

The installations created during this period are heavily influenced by modular forms to achieve two objectives: first, as installations themselves, and second, where one of the installation modules can serve as a display for exhibits. Some of the designs produced by students utilize a 2-layer system, where the first layer constitutes the main structure, and the second layer, placed on its facade, serves as accents that enhance the aesthetic value of the installation.

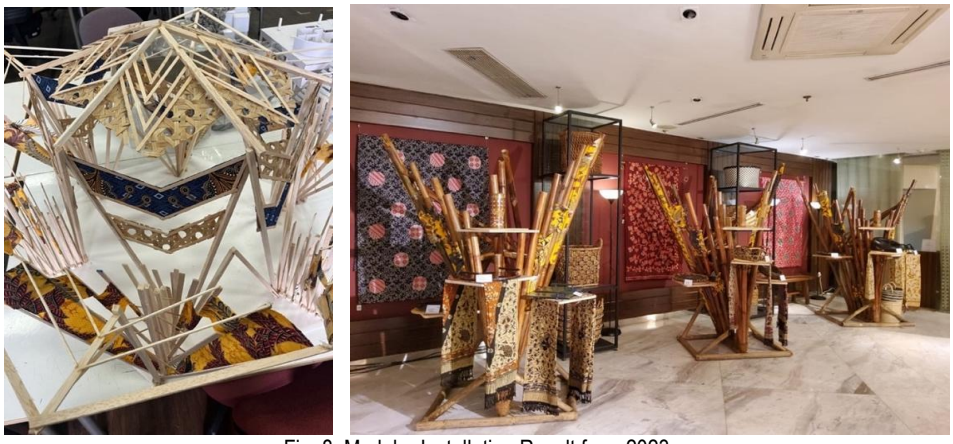

Fig. 8: Modular Installation Result from 2023
(Source: Student's Installation)

Another installation caught the attention of a bamboo park in Tangerang and was placed there. In this location, the installation is frequently used by children aged 4-12 years for activities similar to those in a playground. The bamboo park itself is a public park under the auspices of the Dinas Kebudayaan dan Pariwisata, appropriately themed around bamboo as reflected in its name. The bamboo installation placed in this location has successfully stood firm until 2024, demonstrating that bamboo's durability as a construction material for installations has been quite successful. However, compared to the durability of conventional building materials, bamboo still needs to match the resilience of conventional building materials since it could decay faster than conventional building materials.

Fig. 9: Installation Result from 2023
(Source: Student's Installation)

In 2024, this project began with a different approach, considering a collaborative location where the installation would be placed before designing it, ensuring that the resulting design is relevant to its location. The chosen location is not explicitly related to bamboo, aiming for the displayed installation to be unique and different while highlighting bamboo as a new material theme. As an illustration, one of the locations is situated near the beach, inspiring the design to be based on the shape of a sea creature, specifically a conch shell. The resulting design is dominated by curved forms resembling a dome, similar to the shape of a conch shell. The installations during this period are placed in public spaces that are frequently visited, allowing many people to enjoy them, especially young children who are naturally curious and eager to interact using their sense of touch with unique objects in their perspective.

Fig. 10: Installation Result from 2024
(Source: Student's Installation)

The presence of installation design in public spaces successfully fosters interaction between visitors and the installation. Simple interactions occur, for example, when visitors capture the shape of the installation using their cameras. A deeper interaction emerges when visitors' curiosity invites them to enter the installation. By entering the installation, the success of the installation in introducing the

use of bamboo as a material is already considered quite successful because visitors can experience being under a creation made of bamboo.

5.0 Discussion

In the design and installation process, several factors influence the form of the installation. The initial design created by students uses sketches that are later developed into prototypes and ultimately translated into working drawings to be used as references in constructing the 1:1 scale installation. Design testing is first carried out on the prototype, using human-scale models representing the users or visitors who will eventually interact with the installation. During this testing phase, considerations include how users or visitors enter, move within, and exit the installation. Interaction possibilities between users or visitors and the installation are also examined. Prototypes are crucial for assessing the feasibility of constructing the full-scale installation (1:1). Efforts are made to replicate the original installation conditions as closely as possible during prototype construction to minimize issues during installation.

The results from prototype testing are used to refine the installation design. Several student designs undergo development during this phase. Once the prototypes and drawings are finalized, construction of the 1:1 installation begins. Throughout this project, students learn how initial design ideas, initially conceptual, are developed, tested, and refined until successfully built and utilized by the public. During the installation process, students also study how local craftsmen employ bamboo processing techniques to be integrated into their designs, thereby promoting bamboo processing techniques, such as joints, within their installation.

6.0 Conclusion and Recommendation

In creating installations that serve as agents in promoting bamboo as a substitute for conventional materials, several challenges are faced, including:

(1) Local craftsmen have strong skills in bamboo processing techniques but often need more creativity in design.

(2) Design students possess creativity and strong design skills but often need more skills and knowledge about bamboo construction techniques.

(3) The location of the installation influences the success of promoting bamboo's advantages as a local and environmentally friendly material.

The success of using installations as promotional agents for bamboo as a local and environmentally friendly material heavily depends on collaboration among designers or artists and local craftsmen to produce more advanced works using bamboo materials with more advanced processing and manufacturing techniques. Designers or artists need to have skills and knowledge in bamboo joining and construction techniques, which can be obtained from local artisans. The transfer of such knowledge or skills needs to be done regularly and periodically. With the abundance of local bamboo artisans in each region, it is not difficult to collaborate with local artisans in the designer's creative process.

There are still many aspects of bamboo's uniqueness that have not been explored. For example, each region has distinctive methods and techniques for processing, joining, and constructing bamboo. In Indonesia, there are numerous traditional methods and techniques for bamboo processing, joining, and construction that have been passed down through generations by local artisans in each region. The uniqueness of methods and techniques from each region produces works with different aesthetic qualities. In promoting bamboo as a substitute for conventional materials, these distinctive methods and techniques can be leveraged, or even combined from various regions to create a composition that differs from what has existed so far.

Acknowledgments

This paper and the community service-learning activities would not have been possible without the support and funding from the Interior Design Department – Faculty of Design and Lembaga Penelitian dan Pengabdian kepada Masyarakat (LPPM) Universitas Pelita Harapan. We would also like to express our gratitude and appreciation to Dinas Kebudayaan dan Pariwisata Kota Tangerang, Indonesia Design District PIK2, and The Breeze BSD, which allows our installations to engage within their community. This paper was developed efficiently thanks to the hard work of first-year students from the 2017, 2018, 2022, and 2023 cohorts, as well as the teaching team from the Interior Design Department – Faculty of Design, Universitas Pelita Harapan, in understanding bamboo as a material and creating great works using bamboo.

Paper Contribution to Related Field of Study

This paper contributes to the study on (1) the use of art installations as an agent to introduce bamboo as a local and environmentally friendly material that can replace conventional materials such as wood and steel; and (2) the application of the experience design process method in-studio learning that emphasize hands-on experimentation while utilizing the advantages of the material in designing artworks.

References

Adina, H., & Cuffie, T. (n.d.). Public Art and The Impact It Has on The Society. *Journal of Contemporary Indonesian Art*, *7*(2), 2021.

Basari, E., & Pari, R. (2017). Sifat Fisis dan Pengeringan Lima Jenis Bambu. *Jurnal Penelitian Hasil Hutan*, *35*(1), 1–13. https://doi.org/10.20886/jphh.2017.35.1.1-13

Caldarola, E. (2020). On Experiencing Installation Art. *The Journal of Aesthetics and Art Criticism*, *78*(3), 339–343. https://doi.org/10.1111/jaac.12734

Camere, S., & Bordegoni, M. (2015). A strategy to support Experience Design process: the principle of Accordance. *Theoretical Issues in Ergonomics Science*, *16*(4), 347–365. https://doi.org/10.1080/1463922X.2015.1014069

Honta, Z. L. (2024). *Analisis Kinerja Struktur Bambu Sebagai Alternatif Ramah Lingkungan Dalam Pembangunan Bangunan Hunian*.

Kementerian Koordinator Bidang Perekonomian Republik Indonesia. (2021, May 4). *Pengembangan Bambu Berkelanjutan*. Ekon.Go.Id.

Liu, D., Song, J., Anderson, D. P., Chang, P. R., & Hua, Y. (2012). Bamboo fiber and its reinforced composites: structure and properties. *Cellulose*, *19*(5), 1449–1480. https://doi.org/10.1007/s10570-012-9741-1

Muttaqin, Z., Rusli, A. R., & Supriyanto, B. (2023). The potential of bamboo and the contribution of bamboo craftsmen to the community's income in Cibadak Village, Bogor City, Indonesia. *Biodiversitas*, *24*(10), 5796–5807. https://doi.org/10.13057/biodiv/d241062

Pramono, R., Hidayat, J., Dharmawan, C., & Juliana. (2021). Hybrid bamboo and batik handicraft development as creative tourism product. *International Journal of Design and Nature and Ecodynamics*, *16*(5), 601–607. https://doi.org/10.18280/ijdne.160515

Putro, D. S., Jumari, & Murningsih. (2014). Keanekaragaman Jenis dan Pemanfaatan Bambu di Desa Lopait Kabupaten Semarang Jawa Tengah. In *Jurnal Biologi* (Vol. 3, Issue 2).

Setiawan, A. (2023, March 13). *Bambu sebagai Mitigasi Perubahan Iklim*. Indonesia.Go.Id.

Sharma, P., P, S., & KP, S. (2016). Diversity, Uses and In vitro Propagation of Different Bamboos of Sonitpur District, Assam. *Journal of Ecosystem & Ecography*, *6*(2). https://doi.org/10.4172/2157-7625.1000184

Shukla, P., & Joshi, M. (2020). *Social, Environmental and Economic Impact of Promoting Bamboo Furniture Industry in India* (Vol. 19, Issue 2). www.jbronline.org