Engineering and Technology Journal e-ISSN: 2456-3358

Volume 09 Issue 09 September-2024, Page No.- 5164-5182

DOI: 10.47191/etj/v9i09.19, I.F. – 8.227

Sustainable Development Interaction between Humans and the Interior Architecture

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ABSTRACT: This research explores the evolution of sustainability in interior architectural environments by analysing four distinct settings: Egyptian, African, Japanese, and Chinese. These environments were chosen due to their climatic similarities and shared characteristics. The study examines representative dwelling models from each environment to understand how advanced sustainability can be tailored to each context.

The research follows a structured approach, beginning with analysing human-environment interactions and the influence of culture on these dynamics. It delves into the evolution of interior architecture through various historical stages, considering factors like urban expansion, globalization, contemporary design, and technological advancements. The study also looks at the economic and social changes that have shaped interior architecture in these diverse environments.

By creating a line graph illustrating these developments, the research highlights the progression of interior architecture across different historical periods. The findings suggest that sustainable development in interior architecture can be enhanced by drawing inspiration from ancient cultures. Traditional design elements, such as natural materials, symbolic colours, and energy-efficient layouts, offer valuable lessons for contemporary architects and designers. By integrating these time-tested techniques, modern interior architecture can achieve a balance between cultural heritage preservation and ecological sustainability, leading to designs that are harmonious with the environment.

KEYWORDS: the impact of culture, the evolution of interior architecture, types of environment, Sustainable Practices, sustainability, Key Developments in Sustainable

I. INTRODUCTION

The research addresses the interior architecture of dwellings in two distinct environments: one in Egypt and Africa, and the other in China and Japan, given the similarity of environmental conditions in both regions [15] ,The study focused on identifying the development in each historical period and examining its reflection on the dwelling and its interior architecture. The sustainable practices of interior architecture were studied for each period from ancient times to the present, providing a model for designers to achieve sustainability in interior architecture [30]

The study examined the main factors influencing the evolution of interior architecture across different historical periods, including urban expansion and renaissance, globalization, contemporary architecture, sustainable development, smart technology, and economic factors in Egypt, as well as economic changes, social changes, and technological changes in the other environments. Specific percentages were determined for each factor, and key developments in sustainable interior architecture were mapped out through a timeline for each period. [24]

Finally, a line graph was created to illustrate the evolution of interior architecture over different historical periods, demonstrating the continuous development towards sustainability from past to present (author,2024)

Data and Methods.

The steps for the methodology were as follows:

Observation: The investigation delved into issues concerning the Sustainable development interaction from various sources including books, academic articles, and online resources

Data collection: data were accurately and precisely beside examination the interaction between humans and the environment in different cultures.

Assumption: This paper has assumed six keys to achieve advanced sustainability.

Analysis: includes the analysis of culture on humans across different historical periods.

Evaluation: sustainable practice for each period

Body Text.

1. Examine the interaction between humans and the environments (Ancient Egyptian)

This part addressed the interaction between humans and the environment across different cultures and environments, to show its impact on the interior architecture of the dwelling among the ancient Egyptian, Japanese, and Chinese. It will study the characteristics of

the dwelling and the reflection of the environmental impact on its interior spaces. Then, at the end of each specific environment that has been studied, a clear conclusion will be presented on the reflection of the interaction between the chosen environment and the dwelling so that those interested in it can benefit from it. [25]

2. Analyze the impact of culture on the interaction between humans and the environment (Ancient Egyptian)

Ancient Egyptian cultural practices significantly influenced their dwellings, reflecting their societal structure, religious beliefs, and environmental adaptation:

- **Material Usage**: The transition from oval-shaped huts to mud and stone houses showcases the Egyptians' evolving relationship with their environment and advancements in construction techniques. The use of local materials like clay and stone highlights their adaptation to their surroundings [9]
- **Color Symbolism**: Colors in Egyptian dwellings were not merely decorative but also symbolic. For instance, blue symbolized the Nile and the heavens, while green represented fertility and rebirth. These colors, derived from natural minerals and plants, demonstrate the Egyptians' reverence for their natural environment [9]

This table (Table.1), highlights the progression from ancient methods to modern innovations, showing how cultural influences and environmental considerations continue to shape human dwellings in ancient Egyptian.

Table 1: Ancient Egyptian Dwellings &Modern Culture. (author,2024)

Aspect	Ancient Egyptian Dwellings	Modern Culture
Material Usage	Transitioned from oval-shaped huts to mud and stone houses using local materials like clay and stone [9]	Diverse materials including concrete, steel, glass, and composites; emphasis on sustainability with recycled materials and green building certifications.
Colour Symbolism	Colours were symbolic: blue symbolized the Nile and heavens; green represented fertility and rebirth. Derived from natural minerals and plants [9]	Colours often influenced by trends, psychological effects, and personal preferences; still hold cultural significance (e.g., blue and green for tranquillity and growth).
Technological Integration	Limited to basic construction techniques and natural ventilation methods.	Advanced technologies for improved living conditions, such as smart home systems, climate control, and renewable energy sources (e.g., solar panels).
Cultural Influence	Design deeply influenced by societal structure, religious beliefs, and reverence for nature.	Incorporates global cultural trends; principles like Feng Shui and minimalist aesthetics from various cultures; emphasis on harmony, simplicity, and connection to nature.

3. Study the clear interaction between humans and interior architecture (Ancient Egyptian)

The ancient Egyptian used in his interior architecture for his dwelling starting from the oval-shaped hut of the material of the environment to the mud houses that he used in clay molds size 28X14X11 cm, and finally, he used stones, especially in the entrances of luxury homes, and used wood in the columns, ceilings and railings, and mats in making curtains. [9]

The simple thing noticeable in expressing this interaction between ancient Egyptians and environment are colours, which were justified by many researchers that some of the colours were extracted from plants and others were extracted from minerals, and that the colours extracted from minerals, especially the blue colour, remained shiny and unaffected by weathering factors, and that the colours were prepared on a small colour palette and that iron oxides of yellow, red and brick red were from earth pigments and did not change much over the years.

As for the green colour, because it was prepared by mixing blue and yellow iron oxide or yellow colour, and sometimes it was prepared from copper salts, but copper salts were not stable, so the green colour derived from them turned to rust, while the blue colour, because it was composed of copper and calcium salicylate, remained stable, yet all these theories did not the confirmed facts and the secret of the stability of colours in ancient Egypt is still a secret that needs more studies or a richer discovery that reveals this secret. [36]

Hassan Fathy, a prominent architect (Fig. 1), stands out for his advocacy of harmonizing human needs with the environment in architectural design. He championed the use of clay, leveraging its natural appeal and functionality to meet human requirements within his interior architecture. Fathy emphasized the importance of maintaining compatibility with nature, stating that even a slight increase in temperature or reduction in air movement due to design elements is a significant error. [12]

From Hassan Fathy's architectural works, we observe his ability to imbue both aesthetic appeal and functional efficiency. He famously stated that straight lines signify function, while curved lines embody beauty, believing that architecture springs from dreams, which account for each building's unique essence on the landscape
Similarly, Dr. Nabil Hassan introduced an innovative architectural style known as "pottery architecture." This approach deepens the connection between humans and the natural world, using pottery and clay vessels, and follows Hassan Fathy's use of domes to create ceilings. [13]

Throughout the ages, dwellings have evolved and diversified, shaped significantly by the personalities of their inhabitants and the surrounding environments. Since ancient times, humans have maintained a deep connection with their homes, viewing them as sanctuaries for rest and relaxation. In ancient Egypt, this connection was exemplified by the use of hieroglyphic language within dwellings to document life events and beliefs about the afterlife.

[11]

Figure 1: Pottery architecture is both eco-friendly and cost-effective

Sustainable development in interior architecture has progressed (Table. 2), through various stages since the 1950s, shaped by socio-economic factors, technological advancements, and growing environmental consciousness. The following chart outlines significant developments in sustainable interior architecture from the 1950s onward, highlighting key trends and milestones. [5]

Table 2: Decade, key development &sustainable practices (Ancient Egyptian). (author,2024)

Decade	Key Developments	Sustainable Practices
1950s	Post-war economic recovery; rise of modernism	Introduction of locally sourced materials; emphasis on functional design; early adoption of natural materials like wood.
1960s	Emergence of environmental movements; cultural shifts	Adoption of energy-efficient technologies; increased awareness of material lifecycle; incorporation of recycled materials in design.
1970s	Growing environmental awareness; oil crisis	Focus on energy conservation; development of regulations promoting sustainable practices; rise of ecological design principles.
1980s	Expansion of green building concepts	Introduction of certifications like LEED; emphasis on indoor air quality and non-toxic materials.
1990s	Globalization and technological advancements	Integration of sustainable technologies (e.g., energy-efficient lighting); emphasis on social sustainability and community engagement in design.
2000s	Mainstreaming of ustainability in design	Widespread adoption of sustainable materials; focus on holistic design approaches incorporating

Decade	Key Developments	Sustainable Practices
		environmental, economic, and social factors.
2010s	Rise of smart technologies and biophilic design	Increased use of smart materials and technologies; emphasis on creating spaces that enhance well-being and connection to nature.
2020s	Continued innovation in sustainable practices	Focus on circular economy principles; integration of cultural sustainability; emphasis on resilience and adaptability in design.

Summary of Trends

1950s-1960s: The groundwork for sustainable practices (Fig. 2) was established, focusing on functionality and the use of natural materials, influenced by the post-war context and the rise of modernism. [5]

1970s-1980s: Environmental movements began to shape design (Fig. 3), leading to energy conservation efforts and the introduction of green building regulations. [16]

Figure 3: Sustainable development in ancient Egyptian 1970s-1980s

1990s-2000s: Sustainability became mainstream consideration (Fig. 4), marked by the introduction of certifications and a broader understanding of the social

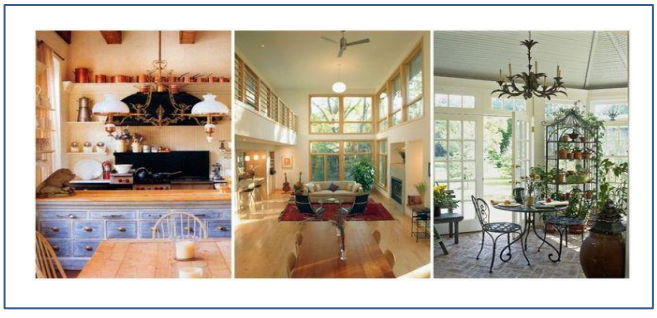

Figure4: Sustainable development in ancient Egyptian 1990s-2000s

2010s-2020s: The emphasis shifted towards integrating smart technologies and biophilic design (Fig.5), highlighting the importance of well-being and resilience in interior spaces. [16]

Figure5: Sustainable development in ancient Egyptian 2010s-2020s

5.The influence of specific factors on the evolution of interior architecture across different historical periods (Ancient Egyptian)

Here is (Table.3), a detailed matrix showing the influence of the urban expansion a Renaissance, globalization and contemporary architecture & sustainable development and smart technology (Table. 3), from the 1950s to the present, categorized by key developments and sustainable practices, with percentages: [23]

Table 3: the influence developments on sustainable practices (Ancient Egyptian). (author,2024)

Category	1950s - 1980s	Urban Expansion and Renaissance Period (1980s - 2000s)
Key Developments (%)	20%	30%
Sustainable Practices (%)	15%	20%
Detailed Key Developments	Post-war economic recovery; rise of modernism; emergence of environmental movements; cultural shifts; growing environmental awareness; oil crisis.	Expansion of green building concepts; introduction of certifications like LEED; emphasis on indoor air quality and non-toxic materials.
Detailed Sustainable Practices	Introduction of locally sourced materials; emphasis on functional design; early adoption of natural materials like wood; adoption of energy-	Introduction of locally sourced materials; emphasis on functional design; early adoption of natural materials like wood.

Category	1950s - 1980s	Urban Expansion and Renaissance Period (1980s - 2000s)
	efficient technologies; increased awareness of material lifecycle; incorporation of recycled materials in design; focus on energy conservation; development of regulations promoting sustainable practices; rise of ecological design principles.	

Globalization and Contemporary Architecture (2000s - 2010s)	Sustainable Development and Smart Technology (2010s - Present)
25%	25%
30%	35%
Globalization and technological advancements; integration of sustainable technologies (e.g., energy-efficient lighting); emphasis on social sustainability and community engagement in design.	Rise of smart technologies and biophilic design; increased use of smart materials and technologies; emphasis on creating spaces that enhance well-being and connection to nature.
Widespread adoption of sustainable materials; focus on holistic design approaches incorporating environmental, economic, and social factors.	Focus on circular economy principles; integration of cultural sustainability; emphasis on resilience and adaptability in design.

Explanation of Percentages:

1. **1950s - 1980s:**
   - **Key Developments (20%):** This period includes the post-war economic recovery, the rise of modernism, the emergence of environmental movements, cultural shifts, growing environmental awareness, and the oil crisis.
   - **Sustainable Practices (15%):** Early sustainable practices involved the introduction of locally sourced materials, an emphasis on functional design, early adoption of natural materials like wood, adoption of energy-efficient technologies, increased awareness of material lifecycle, incorporation of recycled materials in design, focus on energy conservation, and the development of regulations promoting sustainable practices. [23]
2. **Urban Expansion and Renaissance Period (1980s - 2000s):**
   - **Key Developments (30%):** This period saw the expansion of green building concepts, the introduction of certifications like LEED, and an emphasis on indoor air quality and non-toxic materials.
   - **Sustainable Practices (20%):** Sustainable practices during this period included the introduction of locally sourced materials, an emphasis on functional design, and the early adoption of natural materials like wood. [8]
3. **Globalization and Contemporary Architecture (2000s - 2010s):**
   - **Key Developments (25%):** This era was characterized by globalization and technological advancements. Sustainable technologies, such as energy-efficient lighting, were integrated into designs, and there was an emphasis on social sustainability and community engagement in design.
   - **Sustainable Practices (30%):** The widespread adoption of sustainable materials became mainstream. Holistic design approaches were emphasized, incorporating environmental, economic, and social factors. [1]
4. **Sustainable Development and Smart Technology (2010s - Present):**
   - **Key Developments (25%):** The rise of smart technologies and biophilic design marked this period. Smart materials and technologies became more prevalent, with an emphasis on creating spaces that enhance well-being and foster a connection to nature.
   - **Sustainable Practices (35%):** The focus shifted towards circular economy principles and integrating cultural sustainability. There was a strong emphasis on resilience and adaptability in design. [32]

6. Create a line graph that illustrates this evolution across different historical periods (ancient Egyptian)

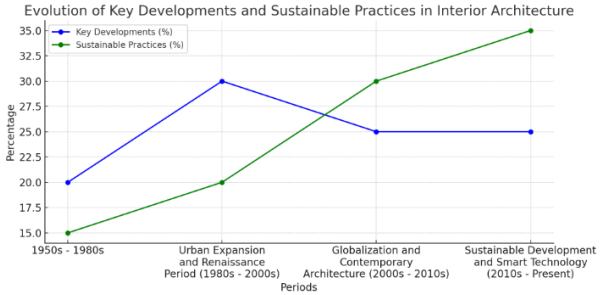

Figure 6: Graph of sustainable development in (ancient Egyptian) 1950s-2020s(author,2024)

The graph above depicts the progression of key developments and sustainable practices in interior architecture over various periods. The blue line indicates the percentage of key developments, while the green line reflects the percentage of sustainable practices. This visualization demonstrates the evolution of these elements over time, highlighting notable changes and trends in each era. **(author,2024)**

1.1 Examine the interaction between humans and the environments (Japanese)

The Japanese dwelling combines the Arab character and the Japanese style in the design of its rooms, and every dwelling must contain at least one room that carries the traditional Japanese character, older people prefer in their choices for the dwelling rooms spacious rooms containing

mats (tatami), cushions(zabuton). [20] The overall effect is completed with a curtain kakariki (wall carpet), and the gap in the wall (chigai-dana), and the shelves attached to the wall. The Japanese use the partitions that separate the rooms called fusuma and the sliding partition called shoji, all of which are structures of light-colored wood and covered with dark paper that allows light to pass, but it obscures the vision and if these barriers are removed we can link the rooms together to be a larger space that allows air to pass through the spaces of the dwelling to expel the bad air and cool the air inside . [27]

The design of the Japanese room(Fig. 6), in this way works to achieve the functional and aesthetic aspect, as it gives peace and tranquillity and the use of paper through the sliding wooden beams with different proportions of length and width and the difference in texture resulting from the difference in material gives the opportunity to create simple and attractive designs especially with the presence of shadow and light penetrating from the mat and paper. And plant life has a priority in the lives of the Japanese, as they care about plants and coordinate gardens and flowers and bring them to their homes for their strong belief that energy and its flow is what makes these flowers alive, and the roots of this art go back to the tradition of offering sacrifices to the gods that appeared in Japan with the beginning of the emergence of Buddhism coming from China in the eighth century AD, which increased interest in it in the upper classes among women as a kind of simple decorative art [26]

The Japanese used partitions, which are beams inside a freeze that hang down to reduce the intensity of sunlight penetrating, and they used mosquito nets, which are a network that is installed around the bed to allow air to enter and prevent insects.

which is a network that is installed around the bed to allow air to enter and prevent insects. [33]

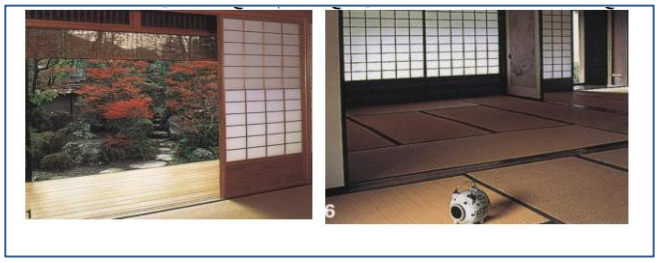

Figure 6: the sun through the sliding doors

2.1Analyze the impact of culture on the interaction between humans and the environment (Japanese)

Cultural Impact on Japanese Interior Architecture, (Table.4)

- **Traditional Elements**: Features like tatami mats, zabuton cushions, and fusuma partitions are integral to Japanese interiors, reflecting cultural values of simplicity, functionality, and harmony with nature [27], [33]

Plant Life and Energy Flow: The Japanese belief in the flow of energy (qi) and the importance of nature is evident in their homes, which often include plants and natural materials. This practice, rooted in Shinto and Buddhist traditions, underscores the cultural significance of maintaining a connection with nature [33]

Japanese culture, deeply rooted in tradition and nature, has a significant impact on the interior architecture of their homes:

Table 4: Traditional Japanese Interior Architecture &Modern Culture. (author.2024)

Aspect	Traditional Japanese Interior Architecture	Modern Culture
Traditional Elements	Japanese interiors traditionally feature tatami mats, zabuton cushions, and fusuma partitions. These elements embody the cultural values of simplicity, functionality, and	In contemporary culture, Japanese interior design often combines traditional features with modern elements. While some homes retain traditional aspects, many now include modern furniture, open

Aspect	Traditional Japanese Interior Architecture	Modern Culture
	harmony with nature [27], [33]	floor plans, and advanced technology, reflecting a blend of historical and contemporary influences.
Plant Life and Energy Flow	The Japanese emphasis on the flow of energy (qi) and the integration of natural materials is evident in their interiors, reflecting Shinto and Buddhist traditions and highlighting the importance of a connection to nature [33]	Modern design trends often incorporate biophilic principles, which focus on integrating natural elements such as plants, natural light, and water features to enhance well-being. Although the cultural context may differ, the core idea of incorporating nature into living spaces is still prevalent.

CONCLUSION

This comparison illustrates that while traditional Japanese interior architecture is deeply influenced by cultural values and a connection to nature, modern design adapts these principles to contemporary needs. It combines traditional elements with modern conveniences to create functional and aesthetically pleasing environments that maintain a connection to the natural world

3.1Study the clear interaction between humans and interior architecture (Japanese)

Japanese housing characteristics.

Japanese housing varies to suit the needs of its residents as follows : It shows the features of the traditional Japanese character, which is preferred by the elderly and the elderly, which achieves them comfort, as it contains carpets**(tatami).** [33]

Figure 7: A living room in the Japanese style

The contents of the room (Fig. 7), are comfortable in their internal components, as they contain cushions Zabuton, and exclusive **tatami** that make them more comfortable and the aesthetic effect is completed by the wall carpet and the **niche Tokonoma** in the wall and the staggered shelves **dana-chihai.**

through thermal adaptation, as air conditioners with heat pumps are usually used, and when it gets cold, the families turn to use the **kotatsu,** which is a low table attached to an electric table that the family members gather around to chat and eat, and in the past, the Japanese used **irori**, which is a stove buried in the centre of the house. [18]

The dwelling features shaded interiors without windows or glass panels, enclosed by tall walls interrupted only by longitudinal strips spaced at intervals from floor to ceiling. At night, the dwelling appears as a dark block with faint glowing strips inside, while during the day, these strips cast shadows on the inner walls, creating an effect as if the spaces were sliced open to admit light. Surrounding the dwelling are gardens and plants, yet the height of the ceilings and the spaciousness of the interiors hinder easy communication and integration with the external environment. [4]

Table 5: Key developments from Jomon Period till Post-World War(author,2024)

Edo Period	1603 – 1868	growth and evolving social structures.
Meiji Restoration	1868 – 1912	Integration of Western architectural styles with traditional Japanese elements; focus on natural materials and design harmony; early technological advancements began to influence architectural practices.
Post-World War II	1945 – Present	Era of rapid modernization and urbanization; blend of traditional elements with contemporary innovations; architects like Tadao Ando and Kengo Kuma focus on creating spaces that balance modern needs with natural harmony, reflecting technological progress and a renewed focus on environmental awareness.

This table summarizes the progression of sustainable development in Japanese interior architecture (Table. 6) emphasizing key developments and the consistent focus on harmony with nature and the use of natural materials across various historical periods. [31]

Table 6: the progression of sustainable development in Japanese interior architecture(author,2024)

Period	Timeline	Key Developments in Sustainable Interior Architecture
Jomon Period	14,000 – 300 BCE	Utilization of locally sourced natural materials; construction of homes using wood, bamboo, and thatch; integration of dwellings with the natural environment.
Yayoi Period	300 BCE – 300 CE	Continued use of natural materials; development of more sophisticated wooden structures; incorporation of homes into the natural landscape.
Kofun Period	300 – 710	Advanced wooden architecture development; construction of ceremonial sites and tombs that harmonize with the natural surroundings.
Asuka and Nara Periods	538 – 794	Introduction of Buddhist temple architecture that emphasizes harmony with nature; use of natural materials such as wood and stone.
Heian Period	794 – 1185	Emergence of the shinden-zukuri style; seamless integration of indoor and outdoor spaces; incorporation of natural elements in gardens and interiors.
Kamakura and Muromachi Periods	1185 – 1573	Development of the shoin-zukuri style; introduction of tatami mats and fusuma (sliding doors); close relationship between garden design and interior spaces.
Edo Period	1603 – 1868	Popularization of the sukisha style; minimalist aesthetic; integration with nature; use of shoji screens, engawa (verandas), and natural views in interiors.
Meiji Restoration	1868 – 1912	Western influences begin to integrate with traditional Japanese architecture; continued emphasis on natural materials and harmony with the environment.
Post-World War II	1945 – Present	Modernization and urbanization; preservation of traditional elements such as the use of natural materials and seamless connection between indoor and outdoor spaces; contemporary architects like Tadao Ando and Kengo Kuma emphasize interaction with nature in their designs.

5.1The influence of specific factors on the evolution of interior architecture across different historical periods (Japanese)

This matrix outlines how Japanese interior architecture has evolved across historical periods, (Table. 7) reflecting the interplay of economic, social, and technological influences.

Table 7: the progression of sustainable development in Japanese interior architecture(author,2024)

Period	Timeline	Economic Changes	Social Changes	Technological Changes
Jomon Period	14,000 – 300 BCE	Minimal economic development; subsistence-based economy.	Early society focused on survival and communal living.	Basic construction techniques using natural materials.
Yayoi Period	300 BCE – 300 CE	Introduction of agriculture led to gradual economic growth.	Development of structured social organization and craft specialization	Improved wooden construction techniques, though still basic.
Kofun Period	300 – 710	Rise of powerful clans and increased	Emergence of ceremonial and ritualistic	Advanced wooden construction techniques for

Period	Timeline	Economic Changes	Social Changes	Technological Changes
		social complexity.	architecture reflecting social stratification.	ceremonial sites and tombs.
Asuka and Nara Periods	538 – 794	Early stages of state formation and economic centralization	Introduction of Buddhist influences leading to new cultural and architectural practices.	Adoption of new architectural styles and materials.
Heian Period	794 – 1185	Economic prosperity under a stable imperial court; flourishing of arts.	Development of an aristocratic culture with a focus on aesthetics and nature.	Creation of the shinden-zukuri style, blending indoor and outdoor spaces.
Kamakura and Muromachi Periods	1185 – 1573	Growth of the samurai class and feudal economy.	Transition to samurai culture with a focus on functionality and design.	Introduction of tatami mats and sliding doors (fusuma) allowing flexible design.
Edo Period	1603 – 1868	Economic expansion during the Tokugawa shogunate and urban growth.	Rise of the merchant class and emphasis on simplicity and nature.	Emergence of the sukisha style featuring minimalist design and natural views.
Meiji Restoration	1868 – 1912	Westernization and industrialization leading to economic modernization.	Cultural shift incorporating Western influences, blending traditional and modern aesthetics.	Introduction of Western architectural techniques and materials alongside traditional ones.
Post-World War II	1945 – Present	Rapid economic growth and urbanization; advancements in technology	Shift towards contemporary design while preserving traditional elements.	Modern construction technologies and focus on sustainable, innovative designs by architects like Tadao Ando and Kengo Kuma.

6.1Create a line graph that illustrates this evolution across different historical periods (Japanese)

The graph (Fig. 8), illustrates the progression of economic, social, and technological changes in Japanese history. Each line represents the development of these factors across various historical periods, highlighting their influence and contributions to the evolution of interior architecture over time

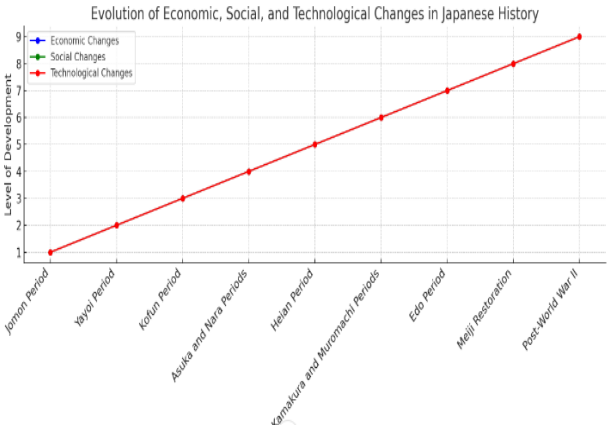

Figure8: Graph of sustainable development in Japanese Jomon Period Post-World War (author,2024)

Period	Timeline	Influences on Interior Architecture
Jomon Period	14,000 – 300 BCE	Early architecture with a focus on basic needs and available resources; use of natural materials like wood, bamboo, and thatch; design harmonized with the natural environment due to limited technological development.
Yayoi Period	300 BCE – 300 CE	Advancements in architectural techniques; more sophisticated wooden structures; continued integration with the natural

		surroundings, reflecting a developing understanding of environmental harmony.
Kofun Period	300 – 710	Enhanced wooden architecture; construction of ceremonial sites and tombs that blend with the environment; social and religious practices influenced the integration of architecture with natural settings.
Asuka and Nara Periods	538 – 794	Adoption of Buddhist architectural styles that emphasize harmony with nature; use of natural materials such as wood and stone; cultural and religious changes influenced design principles, blending traditional aesthetics with new religious elements.
Heian Period	794 – 1185	Development of the shinden-zukuri style, emphasizing a seamless connection between indoor and outdoor spaces; integration of natural elements reflecting evolving social and cultural contexts; architectural adaptation to changing cultural preferences.
Kamakura and Muromachi Periods	1185 – 1573	Emergence of the shoin-zukuri style; incorporation of tatami mats and sliding doors (fusuma) for flexible living spaces; architectural design influenced by the samurai class and the need for both practicality and aesthetics.
Edo Period	1603 – 1868	Rise of the sukisha style with a minimalist and nature-integrated approach; use of shoji screens and engawa (verandas) reflecting societal emphasis on simplicity and harmony; architecture adapted to urban

1.2 Examine the interaction between humans and the environments (Chinese)

The Chinese dwelling possesses a distinct character, as the Chinese adhere to theories that influence the internal spaces of their homes and their connection to the inhabitants' spirits, thereby achieving psychological comfort.

Figure 9: glass strips along the facade.

One of the oldest and most profound philosophical theories is the concept of yin and yang (Fig. 9), which has a robust mathematical foundation that has fascinated contemporary designers.[21]

This theory posits that everything in the universe—matter, energy, time, and space—originates from a single point known as singularity, from which an inherent energy called Chi emanates.

Everything in the universe, whether it is stationary or moving, is part of the eternal flowing energy, and this energy is divided into positive energy (yang), and negative energy (yin) (Fig. 10), and that there is a great influence on the mood and psychological state of individuals from the design of the interior spaces of the house in addition to the electrical connections and magnetic energy that emits either negative or positive energy and varies depending on each person and use lighting, plants, surrounding environment, water fountains and others and can be used in interior spaces that have an effect on human health. [14]

Figure 10: Feng Shui and the ability to communicate.

This is evident in the design works of Feng Shui (Feng Shui Design), which relies on spiritual studies that analyse the spaces of the house and provide solutions to achieve

satisfaction for the soul and pleasure for the self, thus ensuring the health of its occupants. [6]

The philosophy of Feng Shui and its relationship with the environment

-Is a Chinese art that relies on the Taoist philosophy of human observation and knowledge of the use of shapes and colours.

-The principle of yin and yang, everything is known by its opposite, yang and yin are relative things.

- Everything in nature revolves and transforms from contraction to expansion and this transformation is known as the principle of the five transformations and symbolizes the circle of transformation by the energy of the five materials (water-wood-fire-earth-metal), and the five elements are related to certain feelings and sensations. [35]

Figure 11: The inner courtyard in the Chinese house

The human has the ability to communicate with things and feel them and know their language and all things are connected to each other, so the movement of anything affects everyone. [2]

Houses in China were similar for the rich and the poor in ancient times, whether by paying attention to some basic design principles in the design, such as focusing on orientation (Fig. 10), and planning, such as orienting the houses towards the south or using technological aspects of materials such as wooden floors. [34]

2.2Analyze the impact of culture on the interaction between humans and the environment (Chinese)

Chinese culture, with its rich philosophical and spiritual traditions, profoundly impacts the design of their dwellings (Table. 8):

- Philosophical Foundations: Concepts like yin and yang and the principles of Feng Shui shape Chinese interiors, emphasizing balance, harmony, and the flow of energy (Chi), which are crucial for psychological and physical well-being [21], [14], [6]
- Symbolism and Orientation: The orientation of houses and the use of specific materials and colours are guided by cultural beliefs. For instance, homes are often oriented towards the south to maximize sunlight, reflecting the cultural importance of harmony with the environment [34]

Chinese culture, rich in philosophical and spiritual traditions, significantly influences the design of their dwellings:

Table 8: Traditional Chinese Interior Architecture and modern Culture(author,2024)

Aspect	Traditional Chinese Interior Architecture	Modern Culture
Phosophical Foundations	Traditional Chinese interiors are guided by principles such as yin and yang and Feng Shui, focusing on balance, harmony, and the flow of energy (Chi) for overall well-being [21], [14] ,[6]	Modern Chinese interior design still values Feng Shui but often integrates global design trends. Contemporary spaces may combine traditional principles with modern elements, including advanced technology and minimalist aesthetics.
Symbolism and Orientation	Historically, Chinese homes are oriented towards the south to maximize sunlight and align with cultural beliefs about harmony and good fortune [34]	In today's architecture, while orientation and symbolism remain relevant, there is a growing emphasis on energy efficiency and sustainability. Modern designs often blend traditional principles with eco-friendly practices and contemporary environmental concerns.

Conclusion

This comparison shows that while traditional Chinese interior design is deeply rooted in cultural philosophies and beliefs, modern practices adapt these principles to current needs. Modern Chinese interiors merge Feng Shui and orientation practices with modern technology and sustainable solutions, reflecting a balance between cultural heritage and contemporary requirements.

3.2 Study the clear interaction between humans and interior architecture (Japanese

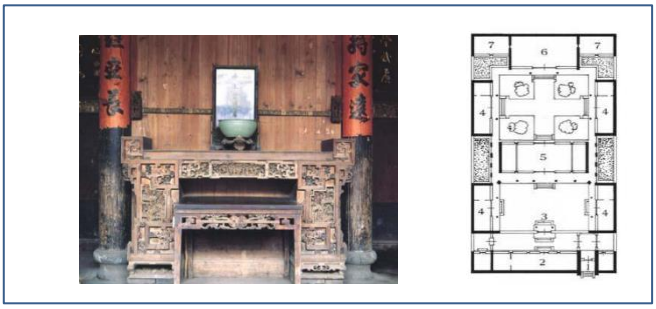

Figure 12: a traditional Chinese house [34]

Achieving the interaction between Interior architecture of Chinese and the environment where the shape of the

interior spaces appears with vocabulary from Chinese art (Fig. 13), and motifs from society and the environment that help humans to interact and integrate with them and achieve a sense of belonging to the place [29]

4.2Investigate the evolution of interior architecture through various stages (Chinese)

1-The main entrance.
2- The front rooms, which were used for sleeping.
3-The courtyard, which represents a good element to show the interaction of humans with the surrounding environment, where it is used as a place for cooking and preparing food, and the other courtyard as a place for living, thus integrating the environment with human life activities and interacting with them.
4- The eastern and western rooms for sons and daughters.
5- A place for receiving guests, which is directly connected to a front and back garden, and is also suitable for holding family celebrations and occasions.
6- A main building that contains the parents' rooms.
7- A small side room that is used for children and grandchildren [19]

This table (Table. 9) rephrases the key influences, sustainability practices, and examples for each historical period in the evolution of sustainable development in Chinese interior architecture.

Table 9: sustainability practices, and examples for each historical period in in Chinese interior architecture. (author,2024)

Historical Period	Influences	Sustainability Practices	Examples
Ancient Periods (up to 1911)	- Cultural and philosophical principles (Confucianism, Daoism, Feng Shui)	- Use of local materials (wood, stone, clay- Promotion of natural ventilation and lighting (courtyards, open layouts) - Thermal insulation and mass (thick walls, elevated floors)	- Siheyuan - Yingzao Fashi
Republican Period (1912-1949)	- Influence of Western architectural styles and construction techniques	- Hybrid designs blending traditional Chinese elements with modern materials and methods - Early urban planning initiatives	- Republican-era buildings
Maoist Period (1949-1978)	- Emphasis on socialist realism and mass housing to support rapid urbanization	- Utilitarian, efficient designs - Collective living setups (dormitory-style housing)	- Danwei housing
Reform and Opening-Up Period (1978-Present)	- Economic reforms leading to modernization, heavily influenced by Western styles	- Introduction of green building standards and certifications (LEED, China's Green Building Evaluation Label) - Focus on energy-efficient designs and sustainable materials	- Shanghai Tower - Tianjin Eco-City
Contemporary Period (2000s-Present)	- Growing environmental awareness and supportive government policies	- Use of smart technology for energy management - Incorporation of renewable energy sources (solar panels, green roofs) - Advanced waste management solutions	- Vertical forests - Green skyscrapers
Future Trends	- Continued government support and technological advancements	- Development of net-zero buildings - Adoption of circular economy principles - Integration of	- Xiong'an New Area - Application of AI and IoT in architecture

Historical Period	Influences	Sustainability Practices	Examples
		biophilic design	

This table rephrases the key influences, sustainability practices, and examples for each historical period in the evolution of sustainable development in Chinese interior architecture.

5.2The influence of specific factors on the evolution of interior architecture across different historical periods (Chinese)

A matrix (Table. 10) depicting the evolution of interior architecture in China, reflecting the impact of economic, social, and technological changes across different historical periods:

Table 10: The impact of economic, social, and technological changes across different historical periods(author,2024)

Period	Timeline	Economic Changes	Social Changes	Technological Changes
Neolithic Period	10,000 – 2,000 BCE	Subsistence economy with limited economic development.	Early agricultural societies with communal living.	Basic construction using locally sourced materials.
Shang Dynasty	1600 – 1046 BCE	Emergence of a complex state-controlled economy.	Development of early state structures and social hierarchies.	Advances in wooden construction and rammed earth techniques.
Zhou Dynasty	1046 – 256 BCE	Expansion of trade and economic networks.	Establishment of Confucian values and social order.	Improvement in wooden and brick construction techniques.
Qin and Han Dynasties	221 BCE – 220 CE	Centralized economy with significant infrastructure development.	Consolidation of bureaucracy and cultural norms.	Innovations in architecture and materials, including large-scale projects like the Great Wall.
Tang Dynasty	618 – 907	Economic prosperity driven by Silk Road trade.	Flourishing of arts and a cosmopolitan cultural environment.	Advances in construction methods and decorative arts.
Song Dynasty	960 – 1279	Economic growth and increased urbanization.	Rise of the scholar-official class and emphasis on education.	Innovations in building techniques, including improved timber framing.
Yuan Dynasty	1271 – 1368	Integration of Mongol economic practices; increased trade.	Cultural exchange between Mongols and Han Chinese.	Adoption of diverse architectural styles and techniques.
Ming Dynasty	1368 – 1644	Economic growth and consolidation of traditional practices.	Revival of traditional Han culture and architectural styles.	Development of classic architectural features, including elaborate wooden structures and detailed decorative arts.
Qing Dynasty	1644 – 1912	Economic development through trade and imperial expansion.	Continuation and adaptation of traditional architecture with Western influences.	Introduction of Western architectural techniques and materials blended with traditional methods.
Republican Era and Early PRC	1912 – 1949	Economic instability followed by modernization efforts.	Social upheaval and modernization initiatives.	Shift towards modern construction techniques and industrial materials.
People's Republic of China (Modern Era)	1949 – Present	Rapid economic growth and urbanization; economic reforms.	Transition to contemporary urban living with global influences.	Focus on modern architectural styles, sustainable practices, and high-tech construction methods.

6.2 Create a line graph that illustrates this evolution across different historical periods (Japanese)

The graph above illustrates the evolution of economic, social, and technological changes in Japanese e history across different historical periods. Each line tracks the progression of these factors, showing their development over time. The blue line represents economic changes, the green line denotes social changes, and the red line reflects

technological changes. This visualization highlights the continuous development and interplay of these elements throughout China's historical timeline

1.3 Examine the interaction between humans and the environments (African society).

Achieving the interaction between Interior architecture of African and the environment ,you are asking about how the artist and designer adhered to the artistic traditions and fulfilled the requirements of society and the environment with attention to simplicity and authenticity, and how that was reflected on the designs of their interior architecture that were characterized by innocence and beauty and influenced by the spirit derived from African art and its spontaneity and the influence of the memories of the ancestors that are full of wisdom and moral strength . [7]

The designer's desire to please the upper world of art derived from the Creator, so the designer resorted to using primary materials in his environment such as wood, metals, stones, and ivory to express the unity of the universe [17]

The designer used masks and their various shapes and statues (Fig. 15), that are in harmony with the African thought in interior architecture and excelled in wood carving art and dance and singing and ornaments rich in symbolic vocabulary and smart implications. [17]

The designer cared about perspective and anatomical proportions of humans and reflected human's quest for knowledge and search for cosmic truth in linking the aesthetic characteristics of interior architecture elements with African society and its distinctive vocabulary. [17]

Figure 15: works used in African house

The African artist tries to combine elements of the natural environment in the design of the interior spaces, such as using tribal spears, wood carving, African masks, palm fronds (mats), animal skins such as gazelle and zebra, elephant tusks, African textiles full of patterns and ornaments, wooden dolls, and using beige, brown, chocolate, and orange colors to paint the walls, while the floors are often in natural colors and use wooden floors such as mahogany, bamboo, and pine, and use carpets to cover the floors that are cheerful colors and made of wool as well as animal skins, and the furniture is made of wood and dark in color and covered with upholstery and cushions decorated with African pattern. [17]

2.3Analyze the impact of culture on the interaction between humans and the environment (African society).

Cultural Impact on African Interior Architecture

African interior architecture is heavily influenced by cultural traditions and societal values(Table. 11):

- Use of Natural Materials: African designers use locally available materials such as wood, metals, stones, and ivory, symbolizing a connection to the natural world and reflecting cultural heritage [7] ,[17]
- Symbolic Decor: The use of masks, statues, tribal spears, and animal skins in interior spaces reflects African traditions and beliefs. These elements are not merely decorative but also carry cultural significance and historical narratives [17]
- Color and Pattern: The vibrant colors and intricate patterns used in African interiors express cultural identity and heritage, creating a unique aesthetic that resonates with the values and history of African people [17]
- African interior architecture is deeply influenced by cultural traditions and societal values:

Table 11: Analyze the impact of culture (African society) (author,2024)

Aspect	Traditional African Interior Architecture	Modern Culture
Use of Natural Materials	Traditional African designs often utilize locally sourced materials such as wood, metals, stones, and ivory. These materials symbolize a strong connection to nature and reflect cultural heritage [7], [17]	In contemporary design, natural materials are still important, but there is a growing use of modern and sustainable materials. This includes recycled products and advanced construction techniques, blending traditional values with current practices.
Symbolic Decor	Traditional interiors feature items like masks, statues, tribal spears, and animal skins, which carry significant cultural and historical meanings [17]	Modern African interiors continue to incorporate symbolic decor but often mix these with contemporary art and design elements. This approach combines traditional significance with modern aesthetics and functionality.

Aspect	Traditional African Interior Architecture	Modern Culture
Colour and Pattern	Traditional African interiors are known for their vibrant colours and intricate patterns, which express cultural identity and heritage [17]	While modern interiors still embrace vibrant colours and patterns, they are often combined with more neutral tones to suit contemporary tastes. This fusion helps create a distinctive look that honors traditional aesthetics while incorporating modern design trends.

3.3Study the clear interaction between humans and interior architecture (African society).

Here is the rephrased table outlining the evolution of sustainable development in African interior architecture:

Historical Period	Influences	Sustainability Practices	Examples
Ancient Periods	- Indigenous cultural practices and environmental adaptation	- Use of locally sourced materials (mud, thatch, wood) - Natural cooling and ventilation (high ceilings, open spaces) - Thermal mass and insulation (thick walls, earthen floors)	- Great Zimbabwe - Nubian architecture
Colonial Period (19th - mid-20th century)	- European colonial influence and the introduction of new building materials and techniques	- Blending of traditional and colonial architectural elements - Use of modern construction materials (cement, brick)	- Colonial-era government buildings - Hybrid residential structures
Post-Independence Period (1960s - 1980s)	- National identity and modernization efforts	- Focus on modernist styles and urban planning - Use of local materials combined with modern techniques - Development of public infrastructure	- Independence-era civic buildings - Modernist urban housing projects
Late 20th Century (1990s - 2000s)	- Globalization and economic reforms	- Adoption of international building standards and practices - Emphasis on sustainable urban development - Incorporation of environmental design principles	- Eco-friendly residential complexes - Sustainable commercial buildings
21st Century (2000s - Present)	- Environmental awareness and technological advancements	- Use of green building technologies and renewable energy sources - Smart design for energy efficiency - Emphasis on sustainable and resilient architecture	- LEED-certified buildings - Solar-powered community projects
Future Trends	- Continued innovation and government policies supporting sustainability	- Development of net-zero energy buildings - Implementation of circular economy in construction - Increased use of bioph	

4.3Investigate the evolution of interior architecture through various stages (African society).

African houses are constructed using wood, pottery, clay, and leather materials. Pottery serves as a fundamental building material in tropical areas, while bamboo is commonly used in equatorial regions. These dwellings are known for their straightforwardness yet exhibit a variety of shapes and appearances. Mertib categorizes them into four primary groups based on their architectural styles.) [28]

The group (1): The walls and roofs are composed of a single piece, and the houses take a rectangular or square shape and are built on four raised pillars, and in humid or agricultural areas they are usually built in a circular way and have conical roofs or in the form of cubes and flat roofs as in the dry Sudanese regions or the regions of the Dogon people in Mali. [3]

The group (2): Elsewhere, various types of houses and military structures emerged that were fortified against hostile attacks, often enclosed by defensive walls and extensive trenches. Additionally, numerous villages and cities were fortified with walls to safeguard against intruders and protect their inhabitants. [17]

The group (3): The layers of these houses are multiplied and spread in the commercial cities and they originated in the Middle Ages such as the cities of Jenne, Kano, and Timbuktu [17]

The group (4): Ine royal palaces are distinguished by their spaciousness and colorful wall paintings, such as the palaces of the Bamileke leaders in Cameroon.) [7]

5.3The influence of specific factors on the evolution of interior architecture across different historical periods (African society)

Here is a matrix (Table. 12) illustrating the evolution of interior architecture in Africa, highlighting the impact of economic, social, ad technological changes across various historical periods:

Table 12: The impact of economic, social, ad technological changes across various historical periods(African society) (author.2024)

Historical Period	Economic Impact	Social Impact
Ancient Periods	- Subsistence economies with limited resources	- Strong communal living and cultural traditions
Colonial Period mid-20th centur	- Introduction of new economic activities by European colonizers	- Cultural blending and social stratificatio
Post-Independer Period (1960s -	- Economic development and modernization effort	- Rise of national ide independence moveme
Late 20th (1990s - 2000s)	- Economic liberalization and globalization	- Increased urbanizat changing social dynan
21st Century (Present)	- Economic growth and increased investment infrastructure	- Greater envirc awareness and demanc for sustainable living
Future Trends	- Emphasis on sustainable e development and innovatio	- Rising importance sustainability and community-centric de

Technological Impact	Architectural Evolution
- Basic tools and construction techniques	- Use of local materials (mud, thatch, wood) - Natural ventilation and cooling (high ceilings, open spaces- Thick walls for thermal insulation
- New building materials and construction techniques	- Hybrid architectural styles combining traditional and colonial elements - Use of modern materials like cement and brick
- Adoption of modern construction methods	- Focus on modernist architectural styles - Urban planning and development of public infrastructure

Technological Impact	Architectural Evolution
- Introduction of international building standards and sustainable practices	- Emphasis on sustainable urban development - Use of eco-friendly materials and designs
- Technological advancements in construction and green building technologies	- Implementation of green building technologies - Smart design for energy efficiency - Integration of renewable energy sources
- Advanced technologies for smart and sustainable building practices	- Development of net-zero energy buildings - Circular economy principles in construction - Biophilic and regenerative design practices

This matrix outlines the evolution of interior architecture in Africa, showcasing the influence of economic, social, and technological changes across different historical periods.

6.3Create a line graph that illustrates this evolution across different historical periods (African society)

The graph (Fig. 16), illustrates the evolution of interior architecture in Africa, highlighting the impact of economic, social, and technological factors, as well as architectural development across different historical periods. Each line depicts the progression of these influences, showing how they have evolved and contributed to sustainable practices in interior architecture over time

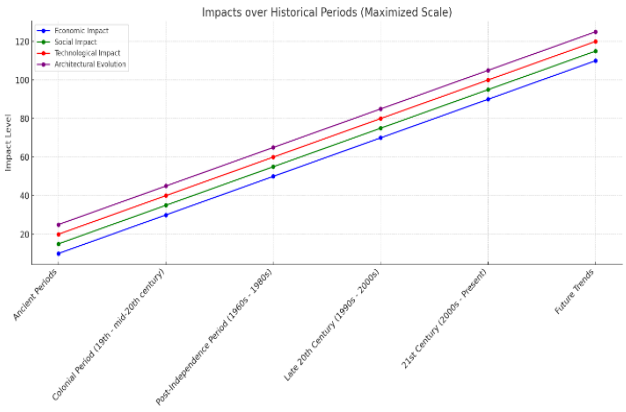

Figure16: Graph of sustainable development in African society from Ancient periods to Future Trends(author,2024)

RESULT AND DISCUSSION

The interaction between humans and their environment is profoundly influenced by cultural practices, beliefs, and values. Ancient Egyptians, Japanese, Chinese, and Africans integrate their cultural heritage into their dwellings, reflecting their relationship with the environment. These cultural impacts shape the physical structure and aesthetics of their homes, contributing to the occupants' psychological and emotional well-being. Understanding these cultural influences highlights the significance of cultural heritage in shaping human-environment interactions in interior architecture.

The interaction between humans and their environment is greatly shaped by cultural practices, beliefs, and values. This is especially evident in the architectural traditions of various civilizations, such as the Ancient Egyptians, Japanese, Chinese, and African cultures. These societies incorporate their heritage into their architectural styles, reflecting their relationship with the environment and influencing both the physical structure and aesthetic qualities of their homes.

Cultural Heritage and Architecture

Ancient Egypt

In Ancient Egypt, architecture was not only functional but also deeply intertwined with spiritual and cultural values. The design of both residential and public buildings was heavily influenced by religious beliefs, often orienting structures toward the Nile and ensuring they harmonized with the surrounding landscape. The choice of materials and construction methods was closely connected to the environment, demonstrating a profound respect for natural resources and their significance in everyday life and spirituality.

Japanese Architecture

Japanese architecture focuses on harmony with nature, a principle evident in traditional homes that use natural materials and feature designs that blend seamlessly with their surroundings. The concept of "wabi-sabi," which finds beauty in imperfection and transience, permeates Japanese aesthetics and architecture. This cultural principle enhances the psychological well-being of occupants by fostering a sense of tranquility and connection to the natural world.

Chinese Architecture

Chinese architecture is marked by its emphasis on balance and harmony, often guided by the principles of Feng Shui. The layout of homes and buildings is meticulously planned to ensure the flow of positive energy, believed to influence the health and happiness of the inhabitants.

Traditional Chinese homes typically include elements like courtyards and gardens, reinforcing the connection between indoor and outdoor spaces and reflecting the cultural importance of nature and family harmony.

African Architecture

African architectural styles are diverse, shaped by local materials, climate, and cultural practices. Many African homes are designed to promote community and social interaction, with communal spaces often forming the core of the layout. The use of vibrant colors and patterns in home

design reflects cultural identity and heritage, enhancing the emotional well-being of residents by fostering a sense of belonging and pride in their cultural roots.

The integration of cultural heritage into architectural practices has a significant impact on psychological and emotional well-being. Homes that reflect cultural identity provide comfort and reinforce social connections and a sense of belonging. This effect is particularly strong in communities that preserve traditional architectural styles, as it allows residents to maintain a tangible link to their history and cultural narratives.

Understanding these cultural influences is crucial for recognizing the importance of cultural heritage in shaping human-environment interactions in interior architecture. It underscores how architectural design can serve as a medium for expressing cultural values and beliefs, ultimately enhancing the well-being of individuals and communities.

CONCLUSION

This comparison highlights how traditional African interior design, with its focus on natural materials, symbolic decor, and vibrant colors, is evolving in the modern context. Today's interiors blend these traditional elements with contemporary materials, art, and color schemes, resulting in spaces that respect cultural heritage while adapting to modern trends and technologies.
illustrate the interaction between African architecture and the environment using diagrams, you can employ various visual tools to represent how traditional and contemporary architectural practices in Africa are influenced by environmental factors. Here are some diagram types and examples.

ACKNOWLEDGMENT

"I would like to extend my gratitude to all the esteemed professors in my field of specialization and in the field of architecture who have helped me in discussion and their advices to reach this refined presentation of the research."

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