Acta Sci. Pol.
Architectura 24 (2025), 183–204
aspa.sggw.edu.pl ISSN 1644-0633 (suspended) eISSN 2544-1760 DOI: 10.22630/ASPA.2025.24.14

ORIGINAL PAPER

Received: 02.06.2025
Accepted: 01.07.2025

ZEN TEMPLE ARCHITECTURE AND SUSTAINABILITY: EXAMINING TRADITIONAL DESIGNS AND CONTEMPORARY ADAPTATIONS IN JAPAN

Natálie Dobrovolná[1], Maja Sutkowska[2, 3]✉, Magdalena Daria Vaverková[2, 4]

[1] Faculty of Arts, Masaryk University, Brno, Czech Republic
[2] Institute of Civil Engineering, Warsaw University of Life Sciences – SGGW, Warsaw, Poland
[3] Graduate School of Environmental, Life, Natural Science and Technology, Okayama University, Okayama-city, Okayama, Japan
[4] Faculty of AgriSciences, Mendel University in Brno, Brno, Czech Republic

ABSTRACT

Zen Buddhism originated in China and profoundly influenced Japanese architecture. To this day, *Zen no Kenchiku* [English: *Zen architecture*] by Hideo Yokoyama is considered the most authoritative publication on the elements of Japanese Zen architecture. However, contemporary Zen temples have undergone numerous reconstructions and modifications, raising the question of how closely their current forms adhere to the original designs. This study aims to compare the contemporary architecture of selected Zen temples with the architectural features recognised as fundamental to the Zen style in the 1960s. The temples were chosen based on their historical and contemporary significance, with a focus on the Rinzai and Sōtō schools. We reviewed the architectural elements described in *Zen no Kenchiku* and supplemented them with information from other sources and secondary literature. Our analysis revealed that none of the temples we examined contained all of the Zen architectural elements identified by Yokoyama. As demonstrated, Zen architecture is evolving and may contribute to sustainable building practices. These findings lay the groundwork for further research on Zen temples, particularly in the context of sustainable architecture.

Keywords: Japanese architecture, natural material, sustainability, Zen Buddhism

INTRODUCTION

Renowned for its simplicity and austerity, Zen Buddhism is one of the most significant Buddhist traditions in Japan (Nagatomo, 2006). Zen temples in Japan reflect religious doctrine as well as centuries of cultural, aesthetic, and technological adaptation. Influenced by Chinese Chan, Zen architecture developed its own identity in Japan, guided by principles of simplicity, functionality, and spiritual symbolism. These forms embody religious values, with spatial organisation and material choices serving ritualistic, meditative, and didactic purposes.

Given Zen Buddhism's historical impact and architectural legacy, this study examines how contemporary Zen temple design reflects or diverges from traditional, religiously grounded architectural principles.

This study aims to analyse how selected contemporary Zen temples from the Rinzai and Sōtō schools retain, reinterpret, or abandon traditional architectural features associated with Zen design. The study poses two key research questions to guide the analysis: (i) To what extent do selected contemporary Zen temples conform to the characteristics outlined by Yokoyama? This question assesses the continuity and transformation

Maja Sutkowska https://orcid.org/0009-0000-4706-5029; Magdalena Daria Vaverková https://orcid.org/0000-0002-2384-6207
✉p7da8qzd@s.okayama-u.ac.jp

of Zen architectural forms from the 1960s to the present. The study also examines differences in architectural features between modern and historical temples, as well as how interpretation or adherence to specific elements varies between the Rinzai and Sōtō schools. The second question is (ii): Can the architectural features identified in this study reliably indicate a temple's adherence to the Zen architectural style in the contemporary context?

By addressing these questions, the study contributes to a deeper understanding of how religious values are expressed architecturally in a contemporary context. Additionally, it explores how tradition can be reconciled with innovation in sustainable and culturally respectful design.

LITERATURE REVIEW

Origins of Zen and its architecture in Japan

Zen, originating in India, spread to China in the 6th century, where it became known as Chan. The Chan Buddhist tradition in China evolved over several centuries before it was introduced to Japan by Japanese monks during the Kamakura period (1185–1333). The Zen style that Japan adopted was that of the Southern Song Dynasty (1127–1279). In replicating this tradition, Japanese monks sought to preserve both the practice and the environment in which Zen was practised, including the architecture. Initially, Japanese Zen architecture closely followed Chinese models, with notable Chan temples serving as key influences on the design of Japanese Zen temples. Japanese craftsmen, having studied these structures in China, brought back detailed blueprints and knowledge, including the expertise of Chinese artisans skilled in Chan temple construction (Ku, 2016).

Over time, however, Zen architecture in Japan began to evolve, reflecting the Buddhist emphasis on simplicity and austerity. This simplicity, a characteristic of Zen, gradually became more pronounced in certain elements of Zen buildings, resulting in a shift that altered the strict minimalism originally intended (Sun, 2025).

Zen style, known as *kara-yō* (Chinese style) in Japanese (Bodiford, 2025), was introduced alongside Indian architectural influences. While the Indian style did not persist long in Japan, eventually merging into the broader Japanese style, Zen architecture became a dominant influence, especially during Japan's medieval period. It maintained a distinct identity, coexisting with the traditional Japanese architectural style, leading to the development of hybrid styles, such as the eclectic *sechūjō* style, which merged Zen and Japanese elements (Young & Young, 2019).

The Rinzai school

The Rinzai school is one of the two main branches of Zen Buddhism in Japan, introduced by Eisai (1141–1215 AD) during the Kamakura period. Having previously studied Tendai Buddhism, Eisai brought Rinzai teachings from China, where they were initially mingled with elements of Shingon and Tendai traditions. The Rinzai school became particularly favoured by the ruling classes in Japan, who provided substantial financial support. The core of Rinzai practice emphasises sudden enlightenment, with meditation on koans playing a central role in achieving this realisation. Unlike the Sōtō school, which has a centralised temple system, Rinzai is organised into a network of 15 branches, each with its own central temple. Major temples in this network include Nanzen-ji, Tōfuku-ji, and Kennin-ji. During the medieval period, the Rinzai school operated under a hierarchical system called *gozan*, which classified temples into three categories based on their influence and importance (Dumoulin, 2005; Welter, 2006).

Gozan system

The *gozan* system, active from the early 14th century until the Ōnin War (1467–1477), played a significant role in organising Zen temples in Japan. Derived from the Chinese Chan model, the system initially involved five major temples known as *gozan*, with these temples situated at the top of the hierarchy. The *gozan* system extended to include hundreds of temples, each governed by a hierarchy that reflected the political preferences

of the ruling shogunate. These temples not only provided spiritual guidance but also influenced Japanese society and culture, with some maintaining their prominent status into the modern era (Goble, 2007; Kage, 2022).

The Sōtō school

The Sōtō school is the largest Zen school in Japan, founded by Dōgen (1200–1253 AD) during the Kamakura period. Dōgen, initially a Tendai monk, travelled to China to study Chan Zen, later returning to Japan to spread these teachings. Dōgen's disciple, Keizan (1268–1325 AD), is also considered a co-founder due to his role in expanding the Sōtō school during the 13th and 14th centuries. Unlike Rinzai, Sōtō Zen focused on meditation in a seated posture (*zazen*) as a means of achieving enlightenment, and its teachings became particularly popular among rural populations in Japan. Sōtō Zen is represented by two main temples, Eihei-ji, founded by Dōgen, and Sōji-ji, founded by Keizan. The school expanded significantly during the medieval period, gaining followers not only among common people but also among the local aristocracy. The Sōtō school's approach to Zen practice has gained worldwide recognition, contributing to its influence across the globe (Heine, 2021; Kase, Choi & Nonaka, 2022; Masaki, 2022).

Zen architectural style

The Zen architectural style, influenced by Chan temple architecture, is characterised by specific features that distinguish it from other architectural traditions in Japan. These include the arrangement of the temple complex, unique types of beams and columns, and other structural elements. This section discusses key aspects of Zen architecture, particularly the layout of buildings within the *shichidō garan* (temple complex of seven halls), a central concept in Zen Buddhist temple design (Heine, 2023).

Temple complex layout: shichidō garan

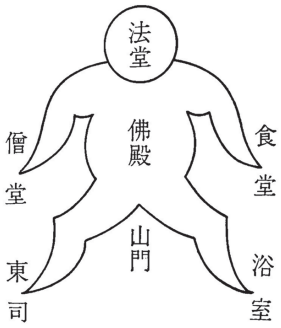
Shichidō garan, meaning "temple complex of seven halls", refers to a specific number and arrangement of main buildings within Zen Buddhist temples. Although the total number of buildings in a temple complex is typically higher, the core buildings, which form the essence of the Zen temple, remain constant (Borup, 2008). This concept, derived from Chan temples during the Southern Song period, was adapted by Zen Buddhism. The term *shichidō garan* was not initially used in Japan for Zen complexes but was instead applied to temples from the Nara period (710–784 AD). The layout of these temples differed from the Zen style, both in the composition of the halls and their positioning within the complex. Zen architecture is marked by a strict arrangement of temple buildings, which is evident in earlier Buddhist architecture from the Nara period. In contrast, the Tendai and Shingon schools of the Heian period (794–1185 AD) had more flexible layouts (Faulkes, 1994). Zen architecture, while returning to earlier traditions, established its own set of rules (Lomas et al., 2017). According to Helmut Brinker, a specialist in Zen art and architectural history, the standardisation of the Zen *shichidō garan* in Japan did not occur until the 15th century (Heine, 2015). Variations of the *shichidō garan* layout existed in earlier centuries, as the precise form was not yet fully established (Heine, 2023).

The *shichidō garan* layout places important buildings for Zen practice along the north–south axis, while less significant daily-use structures are positioned along the east–west axis. This layout, first used in Chan temples during the Southern Song period, distinguishes Zen architecture from earlier Buddhist styles (Stavros, 2017).

Throughout history, the layout of Buddhist temple complexes has varied significantly. One example of this variation is the placement of pagodas (Xie, 2024). In earlier periods, pagodas were located along the central axis with the most important buildings. During the Nara period, considered the "Golden Age of Buddhist Architecture" (Sadler, 2011), two pagodas were typically positioned symmetrically, one to the east and one to the west (Xie, 2024). However, in Zen architecture, the significance of pagodas is greatly reduced. Instead, buildings intended for everyday use, such as latrines and washrooms, often occupy these positions. This shift reflects the contrast between formerly sacred spatial arrangements and spaces now designated for worldly concerns and purification (Heine, 2011; Sadler, 2011).

Anthropomorphic significance of the building layout

The arrangement of buildings in Zen Buddhist complexes, particularly in the *shichidō garan,* is believed to carry anthropomorphic symbolism, representing different parts of the human body (Fig. 1). This feature distinguishes Zen *shichidō garan* from the Nara period interpretation of the term. Yokoyama (1967) presents a schematic where specific halls are associated with body parts: the mountain gate (*sanmon*) represents the crotch, the Buddha hall (*butsuden*) represents the heart, the Dharma hall (*hattō*) represents the head, the latrines and washrooms represent the feet, and the monk's hall (*sōdō*) and dining hall (*shokudō*) represent the hands. This anthropomorphic association, however, was likely introduced during the Edo period (1603–1868), despite the *shichidō garan* layout being used since the Kamakura period. Initially, this symbolic correspondence was likely a mnemonic tool for artisans during construction, rather than a core aspect of Zen teachings.



第１図　七堂人体表相図

Fig. 1. Anthropomorphic analogy of *shichidō garan*

Source: Yokoyama (1967).

Collcutt (1981) asserts that while Zen temples adhered to a building layout derived from Chan temples, neither the term *shichidō garan* nor the anthropomorphic analogy was used in Chinese Chan temples. Therefore, these innovations – both the use of the term *shichidō garan* and the anthropomorphic analogy – are unique to Japan. Had these Japanese rules been applied to Chan temples, the layout would have been similar, with slight variations. Chinese Chan temples, serving as models for Japanese Zen temples, were larger and more flexible due to their gradual development. For example, the placement of latrines in Chinese Chan temples was more pragmatic, while in Japanese Zen temples, the positions were fixed. This difference can be attributed to the fact that Chan Buddhism in China evolved over many centuries, while in Japan, it was adopted in a more standardised form.

An interesting exception to the strict layout is the Sōji-ji temple, closely associated with the well-planned Eihei-ji temple. Despite its non-compliant layout, the term *shichidō garan* is still applied to Sōji-ji, suggesting that the defining characteristic of a *shichidō garan* temple is simply the inclusion of seven main buildings, as argued by Winfield (2015).

Foundations of Zen temples

The foundations of Zen temples are often constructed with stone masonry, typically categorised into two types: *kiri-ishizumi* and *ransekizumi* (Yokoyama, 1967). *Kiri-ishizumi* refers to foundations using precisely cut stone (Fig. 2), while *ransekizumi* consists of irregularly shaped, uncut stones stacked randomly. The spaces between the larger stones are filled with smaller pebbles, ensuring structural stability. This distinction in masonry techniques contributes to the overall aesthetic and functional characteristics of Zen temple foundations.

Fig. 2. *Kiri-ishizumi* masonry: precisely cut stone foundation used in Zen temples

Source: photo by Natálie Dobrovolná 2024.

Floors of Zen temples: diagonal tiling as a traditional element

The floors of Zen temples, both internally and externally, are typically not made of wood. Instead, they are constructed from compressed earth, plaster, or, most commonly, paved with square stone tiles (Caname Jisha Co., 2017b). These tiles are laid at a 45° angle to the building's sides, a traditional practice known as *shihanjiki*, which is translated here as diagonal tiling (Fig. 3). This unique flooring design contributes to the distinct aesthetic of Zen temple architecture.

Fig. 3. Diagonal tiling (*shihanjiki*) in Zen temples, using square stone tiles laid at a 45° angle

Source: photo by Natálie Dobrovolná 2024.

Columns and their appearance in Zen temples

Columns in Zen temples are typically round, with rounded ends, and are referred to as *chimaki*, named after a rice dumpling that resembles their shape. According to Young and Young (2019), Zen temples are also characterised by square columns, which are thinner compared to earlier architectural styles. They are often painted in traditional Japanese vermilion. *Chimaki* columns are a distinctive feature of Zen architecture, as noted by Yokoyama (1967), and differ from those used in other Japanese architectural styles. The base of a column, called *soban* (or *sōban*), is placed between the column and the foundation stone. This base may be carved from stone or wood, with a concave upper part and a convex bottom.

Despite the typical prevalence of diagonal tiling and the *soban* base in Zen architecture (Fig. 4), Yokoyama (1967) also mentions rare cases where Zen temples, influenced by Japanese architectural styles, feature wooden floors rather than tiled ones, and consequently, the *soban* base is absent.

Fig. 4. Column base placed on a foundation stone (*soban*) – a characteristic feature of Zen temple architecture

Source: photo by Natálie Dobrovolná 2024.

Shrimp-shaped beam trusses as a typical element

Various types of beams, varying in size, shape, and ornamentation, are employed in temple construction. A characteristic beam in Zen temple architecture is the lobster or shrimp-shaped beam (*ebi koryō*) (Lin, 2017). This beam is named after its shape, which resembles the curvature of a shrimp's body, achieving two heights (Fig. 5). It is used where two points at different elevations need to be connected, and standard beams would be ineffective. Initially, the curvature of the beam was relatively subtle, but over time, as with other architectural elements, it became more pronounced. Although the shrimp-shaped beam is typical of Zen architecture and was first used in this style, it was later adopted by broader Japanese architectural traditions.

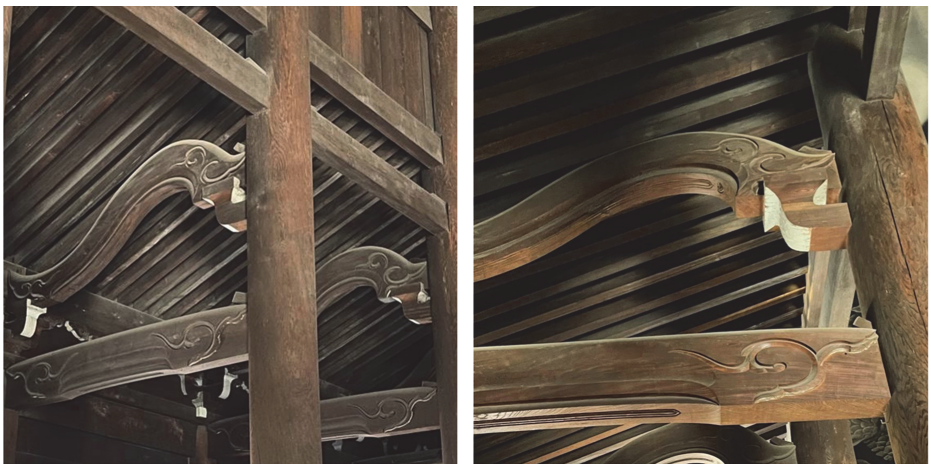


Fig. 5. Shrimp-shaped beam (*ebi koryō*) – a distinctive curved beam used in Zen temple architecture to connect different levels

Source: photos by Natálie Dobrovolná 2024.

Brackets and their use in Zen architecture

Brackets are structural elements protruding from walls designed to support roofs. Over time, as Buddhism influenced Japan, the design and complexity of brackets evolved. Zen-style brackets differ from those in Japanese and Indian styles primarily in their placement. In Japanese and Indian architecture, brackets are positioned solely on columns, while in Zen architecture, they are also placed in the spaces between the columns. Compared to earlier architectural styles, Zen brackets are more intricate, as it became customary to fill all the available space between the brackets positioned on the columns. This creates the illusion of a continuous element. This type of bracket is known as *tsumegumi* (bracket complexes). In contrast, other styles, such as Japanese, use short posts between beams for additional roof support, which developed into several variations over time.

In Zen architecture, due to the dense placement of brackets, there is minimal open space under the roof (Fig. 6). As a result, the ornamental element known as *shirin* (non-structural transition between the beams, traditionally used in other styles to fill this space) is typically absent in Zen temples. However, some sources in the Japanese Architecture and Art Net Users System (JAANUS) database argue that in Zen architecture, this element became more elaborate over time.

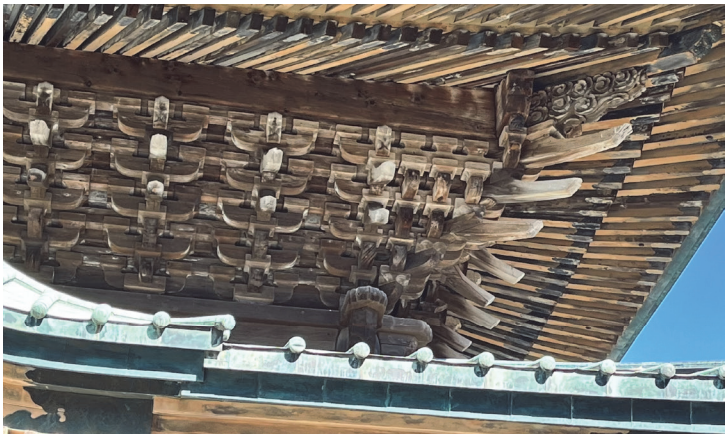


Fig. 6. Continuous brackets (*tsumegumi*) in Zen architecture create a dense, continuous structural support under the roof

Source: photo by Natálie Dobrovolná 2024.

Roofs in Zen architecture

One characteristic feature of Zen roof design is the use of rafters (*jidaruki*). These long wooden beams are placed at an angle, descending from the ridge and extending outward from the roof structure. Rafters are exposed under the eaves. They play a structural role as well as an aesthetic one. However, the second level of rafters is called *hien daruki* – these are flying rafters usually playing an aesthetic role while covering the roof structure above. Zen architecture utilises two types of rafter arrangements. The first type, parallel rafters, is also used in Japanese architecture and is easier to install. The second type, fan-shaped rafters, are more complex to install but provide the advantage of supporting the roof even at the corners, unlike parallel rafters (Fig. 7). The installation of fan-shaped rafters involves a uniform, radiating arrangement, with all rafters pointing outward from a central point at the building's centre, creating a fan-like shape. Fan-shaped rafters are typically used in multi-storey buildings under the roof of the second floor, while parallel rafters are installed on the first floor, and this rule applies even in the case of two-storey buildings (Discoe & Quinn, 2008; Lin, 2017).

Fig. 7. Parallel rafters (left) and fan-shaped rafters (right) in Zen architecture

Source: photos by Natálie Dobrovolná 2024.

According to Collcutt (1981), the mountain gates of Zen temples have two real floors, which distinguishes them from other buildings in the Zen style that typically feature smaller roofs called *mokoshi*, which only give the illusion of an additional floor. He further notes that these gates have tile roofs. Collcutt (1981) refers to *mokoshi* when mentioning that all preserved Dharma halls appear to have two floors from the outside, but in reality, they only have one. Young and Young (2019) also mention that most Zen buildings use *mokoshi* under the upper roof, which is a combination of gabled and hipped roof styles, referred to in Japanese as *irimoya*.

Ceilings in Zen temples

Ceilings in Zen architecture are typically simple, consisting of continuous smooth surfaces made from interlocking wooden planks. Unlike other architectural styles, which may feature more complex ceilings with decorative slats to support the ceiling panels, Zen ceilings are left minimalist. In buildings featuring *mokoshi*, there is typically no ceiling (Discoe & Quinn, 2008). In the vast majority of Zen buildings, ceilings maintain a plain appearance, preserving the natural wooden texture. In rare instances, however, a ceiling may feature a traditional ink painting, depicting a dragon in the clouds (*unryū*), applied using ink wash techniques (Fig. 8).

Fig. 8. Traditional ink painting of a dragon in the clouds on a mirrored ceiling, a rare decorative feature in Zen architecture

Source: photos by Natálie Dobrovolná 2024.

Windows and doors in Zen architecture

A prominent feature of Zen architecture is the *katōmado* windows, which are easily recognisable and often associated with flower-shaped or lantern-like designs. These wooden windows, exhibiting clear influences from Indian architecture, reflect the roots of Zen architecture in India. Initially, the bell-shaped curve at the top of the windows was subtle, but over time, the design expanded, and the windows became broader, deviating from the initial minimalist style of Zen architecture. The windows are made of wood with a lattice grid of thin wooden slats and are fitted with *akari shōji*, a type of *shōji* that allows light to pass through thanks to translucent Japanese paper covering (*washi*) (Discoe & Quinn, 2008; Fig. 9).

Fig. 9. *Katōmado* – distinctive wooden windows in Zen architecture, influenced by Indian design, featuring a bell-shaped curve and lattice grid with paper-covered *shōji* panels

Source: photos by Natálie Dobrovolná 2024.

In Zen architecture, panel doors, known as *sankarado* or *sangarado*, consist of planks arranged horizontally and vertically, with wooden panels inserted between them. The upper parts of these panels are often replaced with lattices or decorative carvings. The door hinges are mounted on large, ornamental wooden projections called *waraza*. Additionally, the space above the door is often filled with wavy wooden slats, a feature referred to as *namigata renji* or *tatewaki renji* (Discoe & Quinn, 2008; Fig. 10).

Fig. 10. Panel doors in Zen architecture, featuring lattice work, ornamental *waraza* projections, and wavy *namigata renji* slats above the door

Source: photos by Natálie Dobrovolná 2024.

Decoration and the influence of Zen minimalism

The natural appearance of wood is typically preserved, with little emphasis on ornamental hardware. One of the few exceptions is the use of coloured paint on the cut ends of wooden construction elements (Fig. 11). Occasionally, more elaborate details can be found in the interior, most notably in the form of dragon paintings on mirrored ceilings. However, Winfield and Heine suggest that this element likely arose from the influence of Japanese architectural styles blending with Zen aesthetics (Winfield & Heine, 2017).

Fig. 11. Minimalist decoration in Zen architecture, featuring coloured paint on wooden construction elements (left) and *kibana* protrusions at the ends of beams (right)

Source: photos by Natálie Dobrovolná 2024.

Kibana are decorative wooden protrusions typically found at the ends of beams or on consoles (Fig. 11). Various architectural styles exhibit different levels of intricacy in their carvings. Initially absent in Japanese architecture, these protrusions were introduced with the Zen style. In contrast, Indian architecture was known for its highly detailed carvings, often depicting animal motifs such as elephants. The Zen style occupies a middle

ground, with relatively understated protrusions and minimalist carvings resembling plants, clouds, or spirals. The carvings on their sides are known as *uzumaki* (spiral forms) and *karakusa* (repeating plant-like spiral motifs). A variation of *kibana*, which protrudes and resembles a fist, is referred to as *kobushibana* (Winfield & Heine, 2017).

MATERIAL AND METHODS

Study subject

This study investigates the architecture of Zen temples belonging to the Rinzai and Sōtō schools, which are the most influential Zen traditions in Japan. Temples were selected based on their historical significance, architectural importance, and their continued relevance in modern Zen practice. For the Rinzai school, three temples in Kyoto – Kennin-ji, Nanzen-ji, and Rokuon-ji – were selected. Kennin-ji, founded by the monk Eisai, is the oldest Zen temple in Japan and plays a central role in the *gozan* system. Nanzen-ji was the highest-ranked temple in the *gozan* system, a position it continues to hold. Rokuon-ji, famous for its Kinkaku-ji (Golden Pavilion), is a modern representative, rebuilt after a fire in 1950, and remains one of Japan's most iconic Zen architectural landmarks.

For the Sōtō school, two temples were selected: Eihei-ji, founded by Dōgen in 1244, and Sōji-ji, founded by Keizan in 1322. Eihei-ji represents the historical architecture of the Sōtō school, while Sōji-ji reflects the modern phase after Keizan's reforms. The original Sōji-ji complex was destroyed by fire in the late 19th century and rebuilt in the early 20th century, resulting in a complex approximately 100 years old.

The study primarily focuses on the contemporary architecture of these temples, given the lack of accessible records detailing their original designs. Scientific documentation and personal archives were used to compare the current state of the temples. Although this study does not aim for a comprehensive analysis of Zen architecture, it provides a foundational framework for future research on Zen temples, particularly in the context of sustainable architectural practices. Zen temple architecture, with its use of natural materials, minimalist design principles, and environmental integration, can serve as a model for contemporary sustainable building practices.

Justification for temple selection

Due to the complexity and variety of Zen temple complexes, this study focuses on the architecture of the seven main halls (*shichidō garan*) that are central to Zen practice. Other functional buildings, such as kitchens, dining halls, and latrines, were excluded due to their under-documentation or limited public access. The study expects to find architectural differences between the Sōtō and Rinzai schools, reflecting their distinct approaches to Zen practice. For example, Collcutt (1981) observes that the Rinzai school emphasises *kōan* practice, leading to the replacement of the monk's dormitory (*shuryō*) in favour of the Zen hall (*zendō*).

Table 1 presents the selection of Zen temples chosen for analysis, categorised by their affiliation with the Rinzai and Sōtō schools. The chosen temples represent both historical and modern examples within each tradition, offering a comprehensive view of the architectural evolution in Zen practice.

Table 1. Selected temples for the study

Temple	Rinzai	Sōtō
Historical	Kennin-ji 建仁寺	Eihei-ji 永平寺
	Nanzen-ji 南禅寺	
Modern	Kinkaku-ji 金閣寺	Sōji-ji 總持寺

Source: own work.

RESULTS AND DISCUSSION

Architectural characteristics of Kennin-ji (建仁寺)

Kennin-ji, one of the 15 main temples of the Rinzai school and a top-ranking temple in the *gozan* system, was founded in 1202 as one of Japan's first Zen temples (Lee, 2017). Its founding abbot was Eisai, and his successor, Enni Ben'en (1202–1280), later established the Tōfuku-ji temple. In the mid-13th century, Kennin-ji (Fig. 12) was destroyed by fires three times but was rebuilt under Enni Ben'en's leadership. Today, it remains one of Kyoto's most significant temples (Wrisley, 2023).

Fig. 12. Kennin-ji temple

Source: photo by Natálie Dobrovolná 2024.

Kennin-ji's layout suggests origins in the traditional *shichidō garan* design, though its current configuration differs significantly. The complex now consists of seven main structures, including the mountain gate, Dharma hall, and washrooms. A nearby monks' hall, once part of the main complex, is now associated with a sub-temple.

The mountain gate, originally from Annei-ji temple in Shizuoka Prefecture, was relocated in 1923. Its foundation is clad with *ishigaki-zumi*, also called *kikkō ishizumi*, named for its turtle-shell-like pattern. This technique, common in castles, involves shaping stones for a tighter fit. The gate's floor is diagonally tiled, and its rounded columns rest on elaborately shaped foundation stones resembling *soban* bases. The gate has two roofs: an upper saddle-gabled roof with fan-shaped rafters and a lower roof with parallel rafters. The lower-level consoles, placed only on columns, leave space for decorative posts, while the upper-level consoles include minimal decoration. Traditional features include *katōmado* windows, *waraza* panel doors, *kibana* beam projections, and simple spiral carvings. *Shirin* is absent under both roofs (Caname Jisha Co., 2017a).

The Dharma hall shares the mountain gate's *ishigaki-zumi* cladding. Its floor is diagonally tiled with black slate stone, incorporating *soban* bases. The columns, rounded at both ends like *chimaki*, support closely spaced, single-tiered consoles forming a continuous line. The roof is a false *mokoshi* with a saddle-gabled upper section,

supported by continuous consoles. The hall exemplifies Zen architecture, with parallel rafters under the lower roof and fan-shaped rafters under the upper roof. Architectural elements include *katōmado* windows, *waraza* panel doors, and worn white paint accentuating *kibana* projections with spiral carvings. The interior has a simple wooden aesthetic with minimal white paint highlighting details. Flooring and columns with *soban* bases match the interior. Some columns are reinforced by metal fittings due to visible cracks. Notable features include shrimp-shaped beams, a mirrored ceiling, and non-continuous consoles framing it. The ceiling features a dragon painting added in 2002, first painted on paper before being affixed (Stavros, 2017; Shokoku-ji school, 2020).

The washrooms are simple and functional, with a single-storey gabled roof and exposed wooden elements highlighted by white paint. Key features include *katōmado* windows, *waraza* panel doors with integrated hinges, round *chimaki* columns on *soban* bases and visible *kibana* beam projections. The roof is upheld by beams and posts instead of continuous consoles. The foundation sits at ground level, with only a curb separating it from the surroundings.

Architectural characteristics of Nanzen-ji temple (南禅寺)

Nanzen-ji temple in Kyoto holds historical and architectural significance. Founded in 1264 by Emperor Kameyama as a retreat, it later became a Zen temple and, in 1334, attained the highest rank in the gozan system, a status it still holds. During the Muromachi period (1336–1573), only monks with prior gozan experience could serve as abbots. Despite multiple fires, including the most recent in 1895, Nanzen-ji's architectural integrity remains a subject of study, though it was never fully restored to its original or largest form (Dougill, 2017).

The temple complex has been reconstructed several times, diverging from its original Zen *shichidō garan* layout. While the mountain gate, Dharma hall, and monk's hall remain properly positioned, the Buddha hall is absent, and essential facilities such as washrooms, latrines, kitchens, and dining areas are either missing or unmarked on the temple's current map, aside from visitor restrooms (Fig. 13).

Fig. 13. The mountain gate of Nanzen-ji temple (left) and the interior of the Dharma hall (right)

Source: photos by Natálie Dobrovolná 2024.

Nanzen-ji's wooden mountain gate features two storeys but lacks white detailing. Its saddle-hip roof is supported by fan-shaped rafters in the upper section and parallel rafters in the lower. The foundation follows the *kiri-ishizumi* style with diagonal stone flooring. *Soban* bases support the columns, which have angled tops but flat lower sections reinforced with metal fittings for stability. The gate includes panel-style doors with *waraza* elements for hinges and *katōmado* windows. Both upper and lower console beams are continuous (Richie & Georges, 2012).

The Dharma hall follows the traditional Zen style, with a finely cut stone foundation distinct from typical *kiri-ishizumi* but still adhering to traditional methods. Its *chimaki*-shaped columns rest on stone *soban* bases without reinforcement. The building features panel doors, *katōmado* windows, and *waraza* projections highlighted in white. Its upper saddle-hip roof is supported by continuous consoles, while the lower *mokoshi* roof rests on beams and posts, with decorative supports filling the gaps. Both roofs lack fan-shaped rafters, as well as the *shirin* element. The interior includes a mirrored ceiling with a circular dragon depiction, framed by continuous consoles decorated with *kibana*. Shrimp-shaped beams and *chimaki* columns provide structural support. The floor consists of diagonally laid stone tiles, though this is not visible from the exterior.

Nanzen-ji's architecture exemplifies traditional Zen aesthetics and the evolution of Buddhist temple construction in Japan. Its use of natural materials and adherence to structural elements such as fan-shaped rafters, parallel rafters, and *chimaki* columns highlight its significance in the Zen architectural tradition (Tezuka, Lee, Takakura & Kambayashi, 2021).

Architectural features of Kinkaku-ji temple (金閣寺)

Kinkaku-ji, the central pavilion of Rokuon-ji temple, is renowned for its golden exterior and stands as a key example of Japanese religious architecture. Originally built in 1397 as shogun Ashikaga Yoshimitsu's retirement villa, it was converted into a Zen temple after his death in 1408. By the late 15th century, Rokuon-ji influenced the design of Ginkaku-ji temple. The complex has been destroyed multiple times, most recently in 1950 when a monk set fire to the Kinkaku-ji. Rebuilt in 1955, it remains a major tourist attraction and a UNESCO World Heritage site (Dougill, 2017).

Despite its vast grounds, Rokuon-ji retains only the kitchen from its original Zen layout. Unlike traditional Zen temples, its buildings are not arranged along two axes, and the small, single-storey entrance gate does not conform to the typical mountain gate design. The temple kitchen, though built from traditional materials, is architecturally unremarkable, featuring a single-storey structure with a gabled roof, resembling the washrooms at Kennin-ji temple.

Kinkaku-ji itself deviates from typical Zen architecture. Though incorporating some Zen elements, its gilded upper floors contrast sharply with the minimalist Zen aesthetic. The lower floor, modestly decorated, does not follow Zen architectural conventions but instead blends three distinct styles. The top floor, following Zen principles, includes Zen-style windows (*katōmado*), panel doors, and *waraza* projections. The middle floor adopts *buke-zukuri*, the samurai residential style of the Muromachi period, while the ground floor reflects *shinden-zukuri*, the aristocratic style of the Heian period. However, the structure lacks key Zen architectural features such as round columns, *soban* stone bases, diagonal flooring, stone foundations, fan-shaped rafters and *kibana* decorative elements (Cram, 2011). Thus, Kinkaku-ji's architecture exemplifies an eclectic fusion of styles, setting it apart from traditional Zen temples. While its upper floor reflects Zen influences, its overall design contrasts with the simplicity typical of Zen temple architecture, mirroring the cultural and political dynamics of its time.

Architectural features of Eihei-ji temple (永平寺)

Eihei-ji temple, founded in 1244 by Zen master Dōgen, is a key site of the Sōtō school of Zen. After studying under Myōzen at Kennin-ji temple, Dōgen became a leading figure in Japanese Zen Buddhism. Originally named Daibutsudō, it was renamed Eihei-ji in 1246, cementing its role in the Sōtō tradition. Despite damage from fires and war in 1477, Eihei-ji remains a major Zen temple. Its layout follows the Southern Sung style, introduced by Gikai from China, with seven essential structures arranged in the traditional Zen anthropomorphic pattern (Dougill, (2017).

Eihei-ji's architecture primarily features wooden gable-roofed buildings, maintaining Zen simplicity (Yokoyama, 1967). The mountain gate has two true storeys, with parallel rafters on the lower roof and fan-shaped rafters above. It lacks *kibana* carvings and white-painted wood but includes *katōmado* windows and a visible *shirin* element in its console gaps.

The Buddha hall has one true and one false *mokoshi* roof, with fan-shaped rafters on top and parallel rafters below. The structure lacks continuous consoles but features intricate console gaps. Its *chimaki* columns rest on *soban* stone bases, and *kibana* spiral motifs decorate the beams. The *ishigaki-zumi* stone foundation enhances its minimalist aesthetic. While the exterior exemplifies Zen architecture, the interior deviates, replacing the mirrored ceiling with square-patterned wood panels and intricate Buddhist figure carvings on the beams.

The Dharma hall, though built from traditional materials, diverges from Zen conventions (Yokoyama, 1967). It sits on a high *ransekizumi*-style rough stone platform, with square pillars lacking *soban* bases and a single gable roof instead of the expected *mokoshi* structure. Parallel rafters have white-painted ends, and *katōmado*-style windows are rectangular and flush with the pillars. The panel doors lack *waraza* projections, and the upper panel matches the plaster walls, further straying from Zen norms. The plain exterior lacks carvings.

Inside, the Dharma hall does not follow Zen standards. While it has tatami flooring and round columns, they lack rounded ends. The beams feature latticework and carvings, but mirrored ceilings, *kibana*, and shrimp-shaped beams are absent. Instead, gold decorations, intricate beam carvings, and patterned wallpaper around the altar mark a shift from Zen minimalism. Eihei-ji exemplifies a fusion of traditional Zen principles with decorative deviations, reflecting both its historical importance and the evolution of Zen architecture over time. Though its exterior maintains key Zen features, its interior showcases a move toward elaborate designs, illustrating the dynamic nature of Japanese Zen temple architecture.

Architectural features of Sōji-ji temple (總持寺)

Sōji-ji, founded in 1322, is crucial in the history of Zen Buddhist temples, especially within the Sōtō school. Originally on the Noto Peninsula, it was relocated to Yokohama in 1911 after a fire in 1898. The temple's reconstruction, including the mountain gate completed in 1969, integrated both traditional and modern elements, marking a departure from conventional Zen architecture. The temple's layout deviates from the traditional *shichidō garan* (seven-hall) arrangement. Although it includes all seven structures, their placement and naming differ, with the Dharma hall and Monk's hall adopting non-traditional names. Modern features, such as the use of concrete instead of wood and the spread-out kitchen and dining areas, reflect a shift toward contemporary design (Irizarry, 2022).

The Sōji-ji mountain gate, built with concrete, mimics traditional features such as two storeys with parallel and fan-shaped rafters but departs from Zen norms through large gaps filled with supports between columns and consoles, and the inclusion of *shirin*, typically absent in Zen structures. The Buddha hall, made of wood, incorporates modern elements like white-painted beam ends and stone-like cladding, lacking traditional *shirin* under the roofs and featuring densely arranged upper-storey consoles. It also includes *kibana* and spiral carvings, adapted to the temple's modern design. The Dharma hall, constructed from concrete, uses square

columns instead of traditional rounded ones. Its *kiri-ishizumi* foundation is typical of Zen, but its low height and lack of a *mokoshi* roof set it apart. The doors are dark with gold insignia, further departing from traditional wooden panel doors (Heine, 2023).

The Monk's hall follows similar innovations, with sliding doors, concrete pillars, and a lack of the *mokoshi* roof. Its sparse interior and linoleum floor contrast with the traditional Zen features, such as diagonal tile patterns. Sōji-ji exemplifies a modern reinterpretation of Zen architecture, blending contemporary design elements with traditional features. Its reconstruction represents both a departure from and an adaptation of Zen architectural norms, marking a significant evolution in the architectural history of Zen temples. Table 2 presents a comparison of Zen features in studied temples.

Table 2. Comparison of Zen features in studied temples

Element	Definition	Rinzai			Sōtō	
		historical		modern	historical	modern
		Kennin-ji	Nanzen-ji	Kinkaku-ji (Rokuon-ji Complex)	Eihei-ji	Soji-ji
shichidō garan	temple complex with seven halls	yes, but different layout	no	yes, but different layout	yes	yes, but different layout
shihanjiki	tiles diagonally on the floor	–	yes	–	–	–
chimaki	columns with rounded ends	yes	yes	–	yes	–
soban	carved stone column base	yes	yes	–	yes	–
ebi koryō	curved shrimp-shaped beam	yes	yes	–	–	–
tsumegumi	bracket complexes	yes	yes	–	–	yes
shirin	non-structural transition between the beams	–	–	–	yes	yes
	parallel rafters	yes	yes	–	yes	yes
	fan-shaped rafters	yes	yes	–	yes	yes
mokoshi	decorative roof under the real roof	yes	yes	–	yes	no
kibana	beam endings with spiral motifs	yes	yes	–	yes	yes
unryū	painting of a dragon in the clouds	yes	yes	–	–	–
katōmado	wooden windows with flower-shaped or lantern-like designs	yes	yes	yes	yes	–
sankarad/sangarado	panel doors	yes	yes	yes	yes	–
waraza	ornamental wooden projections	yes	yes	yes	–	–
	material	wood and stone	wood and stone	wood and stone	wood and stone	concrete and wood
	square columns	–	–	–	yes	yes
	mirrored ceiling	yes	yes	–	–	–

Source: own work.

DISCUSSION

The architecture of Zen temples reflects a remarkable diversity, shaped by both historical traditions and contemporary adaptations, influenced by factors such as cultural shifts, aesthetic considerations, and the integration of modern practices. Temples like Sōji-ji and Muro-ji exemplify the historical evolution of Zen temple architecture, adapting to the changing social and religious landscapes in Japan (Fowler, 2005; Irizarry, 2022). The Four Great Temples of the 7th century laid the foundation for architectural styles that influenced later designs, underscoring the importance of historical context in understanding modern structures (McCallum, 2008). Aesthetic considerations are central to Zen temple architecture, with the concept of aesthetics merging beauty with spiritual truth, which continues to inform contemporary practices (Bäumer, 2010). The layout of Zen temples, including elements like the tea house, reflects a blend of functionality and symbolic meaning, serving both practical and spiritual purposes. In contemporary designs, Zen temples are increasingly being adapted to meet the diverse needs of modern communities, as seen in Sōji-ji's engagement with its local population (Irizarry, 2022). Despite these changes, some argue that the evolution of Zen temple architecture may dilute traditional practices, potentially leading to a loss of historical authenticity in favour of modern relevance.

Despite identifying several architectural features in the analysed temples, none of the buildings contained all of these elements simultaneously. Instead, the features appeared in varying combinations, accompanied by deviations from the traditional traits – some subtle and others more noticeable. While most of the analysed temples adhere to the most prominent architectural characteristics, Sōji-ji, one of the two central temples of the Sōtō school, notably deviates from the typical layout of *shichidō garan* and is constructed primarily from concrete rather than wood. This deviation challenges the typical architectural principles described by Yokoyama (1967) but also addresses the question of how modern Zen temples differ architecturally from historical ones. The arrangement of buildings within the Sōji-ji complex further demonstrates that the Sōtō school does not strictly adhere to the *shichidō garan* layout.

In contrast, the temples of the Rinzai school supported the hypothesis that the composition of their temple complexes historically followed the principles of *shichidō garan*. However, over time, the layout of these complexes has evolved to such an extent that none of the Rinzai temples studied can be precisely categorised as *shichidō garan*. This observation suggests that while Yokoyama (1967) outlines the *shichidō garan* layout as a key architectural characteristic of Zen temples, it does not apply to the Rinzai school. Additionally, the presence of a monk's hall in some of the Rinzai temples contradicts Collcutt's (1981) assertion that such halls had completely disappeared or were replaced by the Zen hall. Notably, no Zen hall was identified in any of the analysed Rinzai temples.

The diversity in Zen temple architecture complicates the assessment of how much it has evolved since Yokoyama's time (1967). His outlined features predominantly correspond to the architecture of historical temples, but more modern temples, such as Rokuon-ji, deviate significantly from these norms. It can be assumed that Zen architecture continues to evolve and is likely to move further away from these traditional features.

Furthermore, this study sought to determine whether the identified architectural features could reliably indicate whether a building was constructed in the Zen architectural style. When focusing on a single architectural element, the result may be inconclusive. However, the more elements that are considered in the analysis, the more reliably the building can be categorised as Zen. The Kinkaku-ji building at Rokuon-ji exemplifies that the presence of several Zen-style features does not necessarily mean that the building follows the purely Zen architectural style. In fact, Kinkaku-ji is constructed in an eclectic style.

The research suggests that the *shirin* element, which is typically used in other architectural styles to fill empty spaces under the roof, is not a typical feature of Zen architecture due to its minimal occurrence. This finding corroborates Yokoyama's assertion from 1967, though exceptions exist in which *shirin* can be

identified in Zen temple buildings. However, no instances were found in which the *shirin* appeared as complex as it is described in the JAANUS online dictionary. In general, the presence or absence of certain elements in the studied temples proved to be typical of Zen architecture, though not universal.

Integrating Zen architectural principles into contemporary building practices is a promising way to enhance architectural sustainability (Sinclair, 2016; Mazzola, 2022). This potential stems from the thoughtful use of natural materials, passive environmental controls, community-rooted design, and evolving technologies, which together reflect a holistic approach to sustainable development. By using natural materials such as wood and traditional designs, contemporary architecture can achieve a balance between environmental responsibility and cultural heritage. This synthesis of old and new approaches can lead to innovative solutions that address today's sustainability challenges. Zen temples often use wood, which not only provides aesthetic value, but also enhances sustainability due to its renewability and low carbon footprint (Zou & Bahauddin, 2024). In addition, the cultural significance of these materials fosters a connection between the community and their heritage, promoting a sense of place and identity (Zou & Bahauddin, 2024). Traditional temples, particularly in warm, humid climates, incorporate passive design features that optimise thermal performance and reduce reliance on mechanical cooling systems, which can be adapted to modern buildings to improve energy efficiency and occupant comfort while respecting local climatic conditions (Sarkar & Panicker, 2024).

Furthermore, adopting digital tools like building information modelling (BIM) enables the precise integration of traditional architectural elements into new designs. This enhances sustainability compliance without compromising cultural integrity (Bazerbashi, Olabi & Aslan, 2024). This approach not only preserves cultural identity but also improves the environmental performance of new buildings (Bazerbashi et al., 2024). Although BIM plugins for timber construction already exist, integration between timber construction governmental planning and BIM software is still needed. Finland's Construction 2000 classification system is an example of supporting the development of BIM in design, cost estimation, and production planning in timber construction (Calquin et al., 2024). Importantly, digital technologies enable detailed simulations of material efficiency, thermal performance, and life-cycle assessment. Prior digital-simulation-based studies have indicated that traditional Japanese residential architecture can significantly reduce energy use while improving indoor environmental quality (Pourbakht, 2025). Buragohain, Buragohain, Meng, Deng and Chaudhary (2025) evaluated scanning and three-dimensional modelling of temples as successful tools for heritage preservation. In addition, virtual reality with a digital representation of temples in Japan became a form of promotion. While it attracted a young audience, it may also contribute to the loss of the essence of traditional Zen teachings (Buragohain et al., 2025). Three-dimensional scanning may also be useful for analysis of the building elements and possibilities of further reuse of materials (Keulemans, Harle, Hashimoto & Mugavin, 2020). Innovation in technology is, therefore, essential to contemporary green building strategies and heritage preservation. Table 3 provides a concise overview of how Zen architectural principles relate to sustainability. It summarises key architectural features in relation to the environmental, societal, and economic dimensions of sustainable development.

This summary also emphasises the multifaceted nature of sustainability in Zen architecture and its potential to promote cultural preservation and ecological responsibility. Nevertheless, several challenges remain. One of them is ensuring disaster resilience as climate change brings more frequent and unpredictable weather events. Additionally, as wood plays a central role in the sustainable design of traditional Zen temples, sustainable forestry is a significant challenge that must be considered. The dangers of production-focused policies highlight the importance of flexible, locally tailored approaches to forest management (Yamada, Kanomata, Shimizu, Murakami & Yamaura, 2025). Moreover, advanced digital modelling and simulation studies are necessary to better quantify the impact of passive design elements on actual energy performance in Zen temples. Lastly, preserving the essence of Zen tradition is crucial, as its profound spatial symbolism is often lost on tourists unfamiliar with its deeper meaning.

Table 3. Sustainability in Zen temple architecture

Category	Features that support sustainable development		Challenges
Society	Preserving the architectural and cultural heritage		Need for innovation and natural disaster-resilient design
	Local craftsmanship		
	Local identity		
	A well-integrated indoor-outdoor flow with a mindfully designed garden promotes wellness and tranquillity		
Environment	Renewable and reusable materials (wood)		Rising wood demand requires changes in forestry policies
	Materials with low-embodied energy (wood, stone)		
	Non-toxic materials (wood, stone, paper, straw)		
Economy	Passive design strategies	Thermal mass (stone)	Need for further research to better understand the actual impact of passive design strategies on energy efficiency
		Elevated floor and open floorplan for improved ventilation	
		Focus on natural lighting	
		Broad eaves protect from solar radiation in summer and allow solar energy gain in winter, when the sun is lower	
	Recycling – using buildings from another location		
	Improvement of the attractiveness of the city and promoting tourism		Risk of loss of the essence by the commercialisation of the tradition

Source: own work.

Given that this study focused on a narrow range of temples, the results should not be viewed as definitive rules for all Zen architecture. Future research could expand the scope by including additional architectural elements or temple complexes, or it could focus on a more detailed study of a smaller subset, such as the central temples of the *gozan* system located in the cities of Kamakura and Kyoto. Other avenues for expanding the research could involve comparisons of potential differences between temples located in northern and southern Japan, influenced by the region's varying climates, or examining differences in the architecture of rural versus urban temples.

CONCLUSION

This study provides a comprehensive analysis of Zen temple architecture, revealing a significant evolution in the design of these temples. The architecture of the selected Zen temples demonstrates considerable variability in its adherence to traditional features, with no single building fully conforming to the historical architectural norms of Zen. While some temples retain key elements, others, particularly in the Rinzai school, have evolved further from the traditional *shichidō garan* layout, suggesting a growing divergence from historical conventions.

The study also highlights the incorporation of modern materials, such as concrete, and more flexible layouts in contemporary Zen temples. This shift marks a departure from the traditional use of wood and standardised design, reflecting broader changes in construction methods and materials. However, these innovations also offer opportunities to integrate sustainable practices into Zen architecture, combining traditional elements with modern environmental needs.

The findings demonstrate that Zen temple architecture can inform sustainable design methodologies, particularly through the use of natural materials, passive design principles, and cultural integration. These findings make Zen temple architecture a valuable reference for contemporary architectural practice, especially in the context of ecological design and wooden structures. Furthermore, the study emphasises the importance of incorporating these insights into architectural education. Integrating Zen architectural principles into teaching curricula can foster a deeper understanding of sustainable building strategies and enhance proficiency in designing with renewable, low-impact materials.

The findings underscore that Zen temple architecture, while maintaining its cultural and spiritual heritage, is evolving to meet contemporary needs. The integration of modern design and materials into traditional forms offers a path toward more sustainable and environmentally conscious architecture. More cross-cultural research is needed to compare how Zen architectural principles are interpreted and adapted in different regions and internationally. Future research could further explore how these principles can be adapted to balance sustainability with the preservation of cultural values, ensuring that Zen temples continue to evolve in harmony with both tradition and the pressing environmental challenges of our time.

Authors' contributions

Conceptualisation: N.D., M.S. and M.D.V.; methodology: N.D.; formal analysis: N.D., M.S. and M.D.V.; investigation: N.D.; data curation: N.D. and M.S.; writing – original draft preparation: N.D., M.S. and M.D.V.; writing – review and editing: M.D.V.

All authors have read and agreed to the published version of the manuscript.

REFERENCES

Bazerbashi, S., Olabi, S. & Aslan, H. (2024). Adapting Traditional Sustainable Architectural Elements in Modern Buildings Utilizing Modern BIM Technologies. *International Journal of BIM and Engineering Science (IJBES)*, *9* (1) 45–66. https://doi.org/10.54216/IJBES.090106

Bäumer, B. (2019). The Living Temple: Aesthetics n Śilpa Śāstra. In K.D. Tripathi, P. Ghosal (Eds), *Meaning and Beauty, Shastric Foundation of Indian Aesthetics* (pp. 181–215). New Delhi: IGNCA & Aryan Books International.

Bodiford, W. M. (2025, June 19). Zen. In *Encyclopedia Britannica*. https://www.britannica.com/topic/Zen [accessed: 28.06.2025].

Borup, J. (2008). *Japanese Rinzai Zen Buddhism: Myōshinji, a Living Religion* (Numen Book Series, 119). Brill.

Buragohain, D., Buragohain, D., Meng, Y., Deng, C. & Chaudhary, S. (2025). A metaverse based digital preservation of temple architecture and heritage. *Scientific Reports*, *15*, 15484. https://doi.org/10.1038/s41598-025-00039-w

Calquin, D. L., Mata, R., Correa, C., Nuñez, E., Bustamante, G., Caicedo, N., Fernandez, D. B., Díaz, M., Pulgar-Rubilar, P. & Roa, L. (2024). Implementation of Building Information Modeling Technologies in Wood Construction: A Review of the State of the Art from a Multidisciplinary Approach. *Buildings*, *14* (3), 584. https://doi.org/10.3390/buildings14030584

Caname Jisha Co. (2017a). 建仁寺　（けんにんじ [Kennin-ji]. Retrieved from https://www.caname-jisha.jp/cms/?p=916 [accessed: 28.06.2025].

Caname Jisha Co. (2017b). 基壇（きだん）とは [*What is Kidan?*] Retrieved from https://www.caname-jisha.jp/cms/?p=1117 [accessed: 28.06.2025].

Collcutt, M. (1981) *Five Mountains: The Rinzai Zen Monastic Institution in Medieval Japan*. Cambridge: Harvard University Press.

Cram, R. A. (2011). *Impressions of Japanese architecture and the allied arts*. North Clarendon: Tuttle Publishing.

Discoe, P. & Quinn, A. (2008). *Zen Architecture: The Building Process as Practice*. Layton: Gibbs Smith.

Dougill, J. (2017). *Zen Gardens and Temples of Kyoto: A Guide to Kyoto's Most Important Sites*. North Clarendon: Tuttle Publishing.

Dumoulin, H. (2005). *Zen Buddhism: Japan* (Vol. 2). Bloomington: World Wisdom.

Faulkes, B. D. A. (1994). *Politicized aesthetics: reclusion literature in the Late Heian and Early Kamakura eras of pre-modern Japan* (doctoral dissertation). University of British Columbia. http://hdl.handle.net/2429/5194

Fowler, S. D. (2005). *Muroji: Rearranging Art and History at a Japanese Buddhist Temple*. Honolulu: University of Hawaii Press. https://doi.org/10.1515/9780824874582

Goble, A. E. (2007). Medieval Japan. In W. A. Tsutsui (Ed.), *A Companion to Japanese History* (pp. 47–66). Wiley-Blackwell. https://doi.org/10.1002/9780470751398.ch4

Heine, S. (2011). *Sacred High City, Sacred Low City: A Tale of Religious Sites in Two Tokyo Neighborhoods*. Oxford University Press. https://doi.org/10.1093/acprof:oso/9780195386202.001.0001

Heine, S. (2015). *Dogen and Soto Zen*. Oxford: Oxford University Press.

Heine, S. (2017). *From Chinese Chan to Japanese Zen: a remarkable century of transmission and transformation*. Oxford University Press. https://doi.org/10.1093/oso/9780190637491.001.0001

Heine, S. (2021). *Dogen: Japan's original Zen teacher* (Vol. 8). Shambhala Publications.

Heine, S. (2023). "For the First Time in Japan": The Main Elements of Hangzhou-Based Zen That Dōgen Transmitted. *Religions*, *14* (8), 1021. https://doi.org/10.3390/rel14081021

Irizarry, J. A. (2022). *Sojiji: Discipline, Compassion, and Enlightenment at a Japanese Zen Temple* (Michigan Monograph Series in Japanese Studies, 94). Ann Arbor: University of Michigan Press.

Japanese Architecture and Art Net Users System [JAANUS] (2001). *Shirin* 枝輪. Retrieved from https://www.aisf.or.jp/~jaanus/ [accessed: 28.06.2025].

Kage, T. (2022). Japanese Daimyōs as Sea Lords in the 15th and 16th Centuries: Their Involvement in the Japan–Ming Trade. In M. Oka (Ed.), *War and Trade in Maritime East Asia. Palgrave Studies in Comparative Global History* (pp. 31–57). Singapore: Palgrave Macmillan. https://doi.org/10.1007/978-981-16-7369-6_3

Kase, K., Choi, E. & Nonaka, I. (2022). Ideology and Rules. In *Dr Kazuo Inamori's Management Praxis and Philosophy: A Response to the Profit-Maximisation Paradigm* (pp. 197–284). Singapore: Palgrave Macmillan. https://doi.org/10.1007/978-981-19-3398-1_4

Keulemans, G., Harle, J., Hashimoto, K. & Mugavin, L. (2020). Design considerations for the transformative reuse of a Japanese temple. *Proceedings of DRS*, *1*. https://doi.org/10.21606/drs.2020.183

Ku, Y. H. (2016). *History of Zen*. Singapore: Springer. https://doi.org/10.1007/978-981-10-1130-6

Lee, J. H. X. (Ed.) (2017). *Japanese Americans: The History and Culture of a People*. London: Bloomsbury Academic.

Lin, L. (2017). Roof Structure of Japanese Zen-Style Buddha Halls. In *International Conference on East Asian Architectural Culture* (pp. 502–513). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-030-75937-7_38

Lomas, T., Etcoff, N., Van Gordon, W. & Shonin, E. (2017). Zen and the art of living mindfully: The health-enhancing potential of Zen aesthetics. *Journal of Religion and Health*, *56*, 1720–1739. https://doi.org/10.1007/s10943-017-0446-5

McCallum, D. F. (2008). *The four great temples: Buddhist archaeology, architecture, and icons of seventh-century Japan*. Honolulu: University of Hawaii Press.

Masaki, A. (2022). Spirituality of Japanese Buddhism considered from enlightenment of nonsentient beings. *International Journal of Educational Research*, *115*, 102019. https://doi.org/10.1016/j.ijer.2022.102019

Mazzola, E. M. (2022). Implementing the lesson of early 20th century traditional buildings for a real sustainability. The examples of Corviale (Rome) and ZEN (Palermo) districts. In *Proceedings HERITAGE 2022 – International Conference on Vernacular Heritage: Culture, People and Sustainability* (pp. 879–887). València: Universitat Politècnica de València. https://doi.org/10.4995/HERITAGE2022.2022.15633

Nagatomo, S. (2006). Japanese Zen Buddhist Philosophy. In E. N. Zalta & U. Nodelman (Eds), *The Stanford Encyclopedia of Philosophy* (Fall 2024 Edition). Retrieved from https://plato.stanford.edu/archives/fall2024/entries/japanese-zen [accessed: 28.06.2025].

Pourbakht, M. (2025). Passive Design Strategies in Traditional Japanese Architecture: A Case Studies of the Chochikukyo House. *Open Science Journal*, *10*. https://doi.org/10.23954/osj.v10i1.3685

Richie, D. & Georges, A. (2012). *Temples of Kyoto*. North Clarendon: Tuttle Publishing.

Sadler, A. L. (2011). *Japanese architecture: a short history*. North Clarendon: Tuttle Publishing.

Sarkar, A. & Panicker, J. (2024). *Passive Designs and Thermal Performance of the Temples in the Warm-Humid Climatic Zone of South India*. https://doi.org/10.29121/shodhkosh.v5.i1.2024.2374

Shokoku-ji school (2020). 境内案内 | 臨済宗相国寺派 [*Temple grounds guide*]. Retrieved from https://www.shokoku-ji.jp/kinkakuji/guide [accessed: May 2024].

Sinclair, D. B. (2016). Japanese spirituality, flexibility and design: influences and impacts on agile architecture+ open building. In *International Research Conference: Architectural Research Centers (ARCC)/European Association of Architectural Educators (EAAE), University of Lisbon, Portugal*. Portugal: European Association of Architectural Educators (EAAE).

Stavros, M. (2017). Monuments and mandalas in medieval Kyoto: Reading Buddhist kingship in the urban plan of Ashikaga Yoshimitsu. *Harvard Journal of Asiatic Studies*, *77* (2), 321–361. https://doi.org/10.1353/jas.2017.0029

Sun, F. (2025). Zen emptiness: application and exploration of Zen philosophy in modern minimalist art design. *Trans/Form/Ação*, *48* (3), e025018.

Tezuka, T., Lee, R., Takakura, H. & Kambayashi, Y. (2001). Models for conceptual geographical prepositions based on web resources. *Journal of Geographic Information and Decision Analysis*, *5* (2), 83–94.

Welter, A. (2006). Zen Buddhism as the Ideology of the Japanese State: Eisai and the *Kōzen gokokuron*. In W. Albert, D. S. Wright (Eds), *Zen Classics: Formative Texts in the History of Zen Buddhism* (pp. 65–112). https://doi.org/10.1093/0195175255.003.0004

Winfield, P. D. (2015). Embodying Sōtō Zen. In S. Heine (Ed.), *Dōgen and Sōto Zen*. New York: Oxford University Press.

Winfield, P. D. & Heine, S. (Eds) (2017). *Zen and material culture*. Oxford University Press. https://doi.org/10.1093/acprof:oso/9780190469290.001.0001

Wrisley, G. (2023). Revitalizing the Familiar. In R. H. Scott & J. McRea (Eds), *Introduction to Buddhist East Asia*. State University of New York Press. https://doi.org/10.1515/9781438492438-008

Yamada, Y., Kanomata, H., Shimizu, K., Murakami, W. & Yamaura, Y. (2025). Assessing the Sustainability of Timber Production Under Policy-Driven Logging: A Spatial Analysis from Southwestern Japan. *Forests*, *16* (6), 989. https://doi.org/10.3390/f16060989

Yokoyama, H. (1967). 横山秀哉. 禅の建築 [*Zen Architecture*]. Tokyo: Shokokusha.

Young, D. & Young, M. (2019). *Art of Japanese Architecture: History/Culture/Design*. North Clarendon: Tuttle Publishing.

Xie, Y. (2024). From Pagoda to Pavilion: The Transition of Spatial Logic and Visual Experience of Multi-Story Buddhist Buildings in Medieval China. *Religions*, *15* (3), 371. https://doi.org/10.3390/rel15030371

Zou, M. & Bahauddin, A. (2024). The Creation of "Sacred Place" through the "Sense of Place" of the Daci'en Wooden Buddhist Temple, Xi'an, China. *Buildings*, *14* (2), 481. https://doi.org/10.3390/buildings14020481

ARCHITEKTURA ŚWIĄTYŃ ZEN A ROZWÓJ ZRÓWNOWAŻONY: ANALIZA TRADYCYJNYCH PROJEKTÓW I WSPÓŁCZESNYCH ADAPTACJI W JAPONII

STRESZCZENIE

Powstały w Chinach buddyzm zen wywarł silny wpływ na architekturę japońską. Do dziś najbardziej autorytatywną publikacją dotyczącą elementów japońskiej architektury zen pozostaje książka *Zen no Kenchiku* (pl. *Architektura zen*) Hideo Yokoyamy. Współczesne świątynie zen przeszły jednak liczne przebudowy i modyfikacje, co rodzi pytanie, w jakim stopniu ich obecny wygląd pozostaje wierny projektom pierwotnym. Celem niniejszego badania jest porównanie współczesnej architektury wybranych świątyń zen z cechami architektonicznymi uznanymi za fundamentalne dla stylu architektury zen w latach 60. XX wieku. Świątynie wybrano ze względu na ich znaczenie historyczne i współczesne, ze szczególnym uwzględnieniem szkół Rinzai i Sōtō. Opisane w książce *Zen no Kenchiku* elementy zostały zweryfikowane i uzupełnione informacjami z innych źródeł i literatury przedmiotu. W wyniku analizy wykazano, że żadna z badanych świątyń nie zawierała jednocześnie wszystkich elementów zen wymienionych przez Yokoyamę. Jak pokazano, architektura zen ewoluuje i może wspierać budownictwo zrównoważone. Wyniki badania stanowią podstawę do dalszych analiz świątyń zen, szczególnie w kontekście praktyk architektury zrównoważonej.

Słowa kluczowe: architektura japońska, materiał naturalny, rozwój zrównoważony, buddyzm zen