[WORLD ARCHERY HERITAGE: A COMPARATIVE ANALYSIS OF BOW DESIGNS AND TECHNOLOGIES ACROSS FIVE CONTINENTS]

WARISAN MEMANAH DUNIA: ANALISIS PERBANDINGAN REKA BENTUK DAN TEKNOLOGI BUSUR LIMA BENUA

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Abstract

The evolution and variation of traditional bows around the world reflect the sophistication and achievements of human civilisation throughout history. Numerous studies have explored the development, uniqueness, and adaptation of traditional bows as a technological heritage that shapes the identity of diverse societies. However, despite the long-standing presence of archery in human history, comprehensive comparative studies examining traditional bows across five continents remain limited. Therefore, this study analyses the content of the book Traditional Archery from Six Continents as the primary source to understand the diversity of traditional bows in five continents, namely East Asia, Oceania, Africa, the Americas, and Europe. The information obtained is further examined to assess the relevance of traditional bows in these regions from a modern perspective, including aspects of form, materials, manufacturing techniques, and function. This study employs a qualitative approach with a historical research design. Data are collected through documentation, focusing on the primary source Traditional Archery from Six Continents and supported by secondary sources. Data analysis is conducted descriptively and historically using a comparative method to identify similarities and differences in traditional bows across the five continents. The findings of this study are expected to provide a clearer understanding of the diversity, form, materials, construction techniques, and functions of traditional bows worldwide. The implications of this study include contributing to the documentation and preservation of cultural heritage as well as serving as a reference for education and research on traditional technological history. Consequently, this research may open new avenues for future scholarship and enhance public awareness of the importance of safeguarding traditional cultural heritage.

Keywords: *Traditional bows, technological heritage, five continents, traditional archery, archery techniques.*

Abstrak

Evolusi dan variasi busur tradisional di seluruh dunia mencerminkan ketajaman, kemampuan menyesuaikan diri, serta tahap kemajuan teknologi tamadun manusia sepanjang sejarah. Para sarjana telah lama mengkaji perkembangan, keunikan, dan peranan budaya busur tradisional dalam masyarakat tertentu. Namun begitu, kajian perbandingan yang komprehensif merangkumi tradisi busur dari lima benua masih terbatas. Oleh itu, kajian ini meneliti kepelbagaian busur tradisional di Asia Timur, Oceania, Afrika, benua Amerika, dan Eropah melalui analisis terhadap buku *Traditional Archery from Six Continents* sebagai sumber utama. Maklumat yang diperoleh turut diteliti bagi menilai kerelevanan busur tradisional dari perspektif moden, khususnya berkaitan aspek bentuk, bahan, teknik pembuatan, dan fungsi. Kajian ini menggunakan pendekatan kualitatif dengan reka bentuk penyelidikan sejarah.

Pengumpulan data dilaksanakan melalui kaedah dokumentasi yang memfokuskan teks utama, disokong oleh sumber sekunder. Analisis deskriptif dan sejarah dijalankan bersama kaedah perbandingan untuk mengenal pasti persamaan serta perbezaan busur tradisional merentas lima benua. Hasil kajian diharapkan dapat memberikan pemahaman yang lebih jelas dan terstruktur mengenai kepelbagaian bentuk, bahan, kaedah pembinaan, dan fungsi busur tradisional di peringkat global. Kajian ini juga menyumbang kepada usaha pendokumentasian dan pemeliharaan warisan teknologi tradisional, selain menjadi rujukan berguna untuk tujuan pendidikan dan penyelidikan. Akhirnya, penyelidikan ini berpotensi membuka ruang baharu dalam kajian akan datang serta meningkatkan apresiasi masyarakat umum terhadap kepentingan memelihara teknologi budaya tradisional.

Kata kunci: *busur tradisional, warisan teknologi, lima benua, memanah tradisional, teknik pembuatan.*

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INTRODUCTION

Archery is one of the earliest and most significant technologies in the history of human civilisation. Since prehistoric times, the bow and arrow have served as essential tools for hunting, self-defence, warfare, and as symbols of culture and social status among various societies across the world. Archaeological discoveries indicate the use of bows as early as 10,000–20,000 years ago, demonstrating that humans had already understood mechanical principles such as tension, compression, and potential energy long before the advent of metallurgy or firearms (Clunas, 1984). The presence of bows in nearly all civilisations from Asia to the Americas illustrates that this innovation emerged through *parallel evolution*, developing independently according to the needs and environmental contexts of each civilisation.

From an anthropological perspective, the bow is not merely a physical tool but also a reflection of the relationship between humans and their natural surroundings. Local resources such as wood, bamboo, horn, hide, and animal sinew were utilised to craft bow structures suited to the climate, geography, and lifestyle of each community. For example, the sophisticated composite bows of East Asia arose from the military needs of mounted warriors on vast grasslands, while the large bows of Melanesia were shaped by the demands of hunting within dense tropical forests. Each design not only fulfils mechanical functions but also embodies elements of identity, status, and aesthetic value that reflect the worldview of its respective society (Elmy, 1998).

In the context of military history, the bow played a crucial role in the formation of empires and the evolution of warfare strategies. Long-range bows such as the Manchu bow and the English longbow transformed battlefield tactics, whereas the small poison-tipped bows used in parts of Africa were highly effective in hunting and tribal defence. In addition, bows developed into ritual symbols, as seen among Indigenous American communities who associated archery with spirituality, and in Japanese tradition where the *Yumi* bow became a ritual instrument in *Kyudo*, emphasising the integration of physical, mental, and spiritual discipline.

The transition of the bow from a survival tool to a cultural symbol and modern sporting instrument demonstrates the dynamic evolution of this technology across time. Although firearms eventually replaced bows in warfare, interest in traditional archery continues to flourish through recreational activities, competitions, and cultural preservation efforts by global communities. Thus, examining the evolution of traditional bows not only enriches our understanding of technological development in weaponry but also provides insight into the deep connection between humans, nature, and cultural identity inherited across millennia.

METHODOLOGY

This research methodology outlines the approach and methods employed by the researcher in the process of collecting, evaluating, and analyzing data concerning the evolution and diversity of traditional bows across five continents. This study utilizes a qualitative approach, a form of inquiry that emphasizes in-depth textual analysis, document observation, and the examination of scholarly sources. In contrast to a quantitative approach, which focuses on numerical data, the qualitative method concentrates on understanding the meaning, context, evolutionary patterns, and the social and cultural functions of traditional bows.

This approach was selected because the research focuses on the historical and technical analysis of bows, including their form, materials, construction techniques, and function, as well as their connection to the culture of various societies. This method enables the researcher to meticulously evaluate information, distinguish between technical and social characteristics, and maintain data validity. This principle of rigor aligns with the scholarly traditions of historical and ethnographic studies, wherein all information is validated through authentic primary and secondary sources.

Research Design

This study employs a descriptive-historical qualitative design that emphasizes detailed reading, meticulous observation, and the systematic description of various written sources. This approach allows the researcher to investigate the evolution and diversity of traditional bows across five continents, East Asia, Oceania & Tribal Asia, Africa, the Americas, and Europe encompassing aspects such as form, materials, construction techniques, function, and socio-cultural values. The analysis also underscores the relationship between geography, environment, and bow design, including the role of the bow in warfare, hunting, rituals, and as a social symbol. All information is categorized thematically to ensure the resulting analysis is structured, comprehensive, and clear.

Data Collection Method

Data was collected through document analysis, focusing on the systematic observation and recording of written materials related to traditional bows. The primary source includes the book *Traditional Archery from Six Continents*, which provides technical specifications, illustrations, and historical records of bows across the five continents. Secondary sources consist of journal articles, academic theses, proceedings, and ethnographic studies that discuss the cultural and social aspects, as well as modern perspectives on the technology and function of bows.

Data was recorded in tables that classify information according to continent, materials, form, construction techniques, function, and ritual or social values. This method allows the researcher to obtain a comprehensive and accurate overview of the diversity of traditional bows worldwide.

Data Analysis Method

Data analysis was conducted using a content analysis approach, with a focus on understanding the meanings, themes, and evolutionary patterns contained within the primary and secondary sources. The data was critically examined to ensure that the facts were accurate, relevant, and aligned with the research objectives. The analysis includes the classification of technical characteristics such as materials, form, and construction techniques, as well as an assessment of the bow's social, ritual, and military functions.

Furthermore, historical analysis was employed to examine the socio-cultural and geographical contexts that influenced the design and use of the bow. A comparative analysis

was applied to identify similarities and differences between continents, assess evolutionary patterns, and understand how environmental factors, material technology, and cultural values shaped each archery tradition. The combination of these three approaches ensures that the research findings are comprehensive, valid, and authoritative.

FINDINGS AND DISCUSSION

High-Technology Composite Bows in East Asia

East Asia represents one of the most advanced centres for the development of composite bows in world history. Its bow-making traditions emphasise the combination of high-performance materials such as wood or bamboo as the core, horn for the belly, and sinew on the back and resulting in superior mechanical characteristics including high elasticity, rapid energy recovery, and resistance to climatic changes. Illustrations and descriptions in East Asian collections demonstrate the systematic use of materials like bamboo, horn, and sinew alongside complex layered construction techniques.

In China, the Qing-era Manchu bow is particularly notable for its large size, long siyahs, and the use of string bridges that keep the string elevated above the bow's limbs, thereby increasing stored energy and enabling the projection of heavy arrows over long distances. These bows were used for formal hunting and military purposes and were often adorned with shagreen (ray or shark skin) and symbols that were painted, inlaid, representing wealth, longevity, good fortune, and the social status of their owners (Selby, 2003).

In Korea, the composite bow is smaller but highly reflexed, requiring exceptional craftsmanship for stability while delivering remarkable power when used with a long draw length, reflecting the technological refinement of the Choson period (McEwen, 1973). Meanwhile, Japan developed the yumi, a long asymmetrical bow with a grip located about two-thirds from the lower limb. Constructed from laminated bamboo and wood with mulberry-wood edges bound and coated with urushi lacquer, the yumi was used together with uniquely Japanese arrows (yanone/yanagi) and accessories, underscoring the close relationship between archery and ritual culture, particularly the kyudo tradition (Onuma, 1993).

Overall, the evolution of composite bows in China, Korea, and Japan demonstrates advanced technological achievement, diverse design philosophies, and deep cultural identity. Their use in both military and ritual contexts further establishes East Asia as a major centre in the history of composite bow development, highlighting its technical superiority as well as its cultural and social significance.

The Bow as a Survival Tool in Oceania and Tribal Asia

The region of Oceania and the tribal communities of Asia including Melanesia, Papua New Guinea, and Borneo that display archery traditions rooted in practicality and survival. Bows in these areas are typically simple and made from readily available materials such as lightweight wood, bamboo, and rattan, well adapted to dense tropical forest environments (Krieger, 1926; Kroeber, 1928; Skinner, 2000). Although these bows do not employ complex layered construction like those of East Asia, structural and decorative variations nonetheless exist.

Collections from Melanesia highlight long reed arrows featuring distinctive carvings that function as cultural identifiers and visual communication systems. In Papua New Guinea, bows play a central role in hunting, tribal warfare, and personal protection. Their designs emphasise flexibility and stability, while arrows are often made from hardwood, bone, or bamboo; some tribal groups also employ poisons to increase hunting efficacy (Skinner, 2000).

In Oceania, arrow classification based on shape, length, and function including ceremonial and defensive arrows is also evident. In Southeast Asia, particularly Borneo, the use of bows and occasionally simple tribal crossbows is documented for small-game hunting,

where arrow shafts and bamboo cut patterns display aesthetic elements retained even in these basic weapon systems (Man, 1932; Draeger, 1972).

Overall, bows in Oceania and tribal Asia reflect survival technologies deeply rooted in the intimate relationship between humans and the forest. They demonstrate how traditional societies optimise local materials for daily use, tribal warfare, and ritual practices illustrating a fusion of practical function and cultural value (Gibson, 1986; Witte, 1967; Tayanin & Lindell, 1991).

Multipurpose Bows in African Hunting and Ritual Traditions

Africa presents an exceptionally diverse landscape of traditional bows, shaped by environments ranging from open savannahs and dense tropical forests to semi-arid regions and deserts. These ecological variations have influenced bow design according to local environmental needs. Traditional bows in the region are generally medium to small in size, yet they retain high efficiency for both hunting and self-defence. Materials used typically come from local resources such as hardwood, plant fibres twisted into bowstrings, and animal sinew for added strength (Frobenius, 1932; Leakey, 1926; Tukura, 1994). Bowstring attachment techniques in Africa also demonstrate cultural diversity and innovation, including knotted strings, eyeleted strings, and indirect strings, each offering flexibility and stability during shooting (Grayson, 1961).

African bow collections exhibit considerable variation in form and function. For example, bows from the Congo and West Africa were widely used for small-game hunting, whereas Somali bows characteristically employ knotted string techniques, usually feature tapered limb tips, and are decorated with giraffe tail hair and double-layered sinew strings (Grayson, 1961; Frobenius, 1932). Arrows are commonly made from hardwood, bamboo, or bone, with arrowheads ranging from wavy ogee blades to fine four-sided points. Some arrowheads were coated with poison beneath sinew bindings to enhance hunting effectiveness (Agthe, 1985; Frobenius, 1932). Such variations reveal the technical diversity, creativity, and deep zoological knowledge possessed by hunting communities in relation to local fauna.

Beyond their practical function, bows and arrows also play significant cultural and ritual roles. In several African societies, bows are used in rites of passage as symbols of courage and as social instruments that determine an individual's standing within the community. The design and decoration of quivers are crafted from leather, wood, or woven materials its showcase meticulous craftsmanship in producing arrow containers and reflect high traditional aesthetic values (Balfour, 1910; Harrison, 1988).

The primary strength of African bows lies in their adaptation to the environments and daily lives of local communities. Peoples of the savannah, forest, and semi-arid regions each developed bow techniques and designs suited to the types of animals hunted and their respective habitats. For example, the Mbuti of the Ituri forest use bows to hunt antelope, monkeys, and other small animals, while the Maasai of Kenya who traditionally declined hunting have had to adapt to bow use due to ecological changes and loss of land (Turnbull, 1965; Spring, 1993). Overall, African traditional bows stand out not only for their practical utility but also as manifestations of technology, art, and culture. Their flexible and adaptive designs illustrate the close relationship between survival needs, traditional technological innovation, and social values passed down through generations (Tukura, 1994).

Ecology-Based Indigenous Bows in the Americas

The Americas exhibit a rich diversity of traditional bows, directly influenced by distinct geographical environments. In the Plains tribal regions, short sinew-backed bows produced significant draw weight and projectile power despite their compact size. This design was ideal for mounted warfare and high mobility, where Plains warriors employed these bows effectively in both combat and hunting. Collections of Plains bows reveal thick sinew layers alongside

varied limb curvatures and decorative styles, marking cultural identity and the technical expertise of bowyers (Hamilton, 1982). In tropical regions such as the Amazon and Andes, long forest bows were created to navigate dense woodland and to hunt at medium ranges. The arrows used were made of bamboo or lightweight wood, some of which were coated with plant-based poisons to hunt dangerous game.

Arrow varieties from the Montaña tribes and Amazonian communities were often decorated with coloured feathers and fine carvings that also served as tribal identifiers and social markers (Métraux, 1949). Along the Northwest Coast, Subarctic, and California regions, communities produced bows from hardwoods, some reinforced with sinew and employed materials such as yew, osage orange, willow, elderberry, and cottonwood root. To compensate for the fragility of certain wood types, bowyers heated and bent the staves into a deflexed form to reduce limb strain and enhance flexibility (Allely & Hamm, 2002; Murdoch, 1892). Bow shapes were adapted to coastal, forested, and mountainous environments, while limb width, thickness, and cross-sectional forms were influenced by the specific wood species used.

Beyond hunting, bows and arrows played vital roles in ritual contexts, warfare, and social status expression. For instance, Inuit and Athapaskan groups used large arrows for big-game hunting, featuring socketed iron points and quivers decorated with marten skin, bird feathers, and black-and-white glass beads (Hosley, 1981; Bright, 1978). Similarly, the Yokuts of California used distinctive quivers and arrows to signify tribal identity and the skill of individual hunters (Wallace, 1978). Overall, traditional bows of the Americas stand out not only for their practical functions but also as expressions of culture, technology, and social identity. The diversity of forms, materials, and construction techniques reflects the adaptation of communities to unique geographical environments while integrating aesthetic, symbolic, and functional elements simultaneously (Hamilton, 1982; Allely & Hamm, 2002).

The Evolution of the Longbow and the Tradition of Sporting Archery in Europe

Europe records some of the most dramatic developments in the history of military archery, particularly through the evolution of the English longbow and the European crossbow. The longbow was typically made from yew wood, which combines two functional layers, elastic sapwood on the back and the stiffer heartwood at the core that allowing it to withstand the high tensile stress generated during drawing (Heath 1971). English military longbows employed “cloth-yard” arrows fitted with socketed iron points and fletched with grey goose feathers, enabling archers to release between 10 and 12 arrows per minute, a remarkably high rate of fire for its time (Kaiser 1980; Rees 1993). The effectiveness of this system was demonstrated in the battles of Crécy (1346), Poitiers (1356), and Agincourt (1415), where English longbows decisively defeated much larger French cavalry forces (Kaiser 1980).

Meanwhile, the crossbow dominated European weaponry for nearly five centuries. Its development peaked in the fifteenth century with the introduction of the steel crossbow, an innovation that produced immense draw weight through a short metal bow, typically drawn using a winch or hand crank (Payne-Gallwey 1903). This design significantly reduced the need for great physical strength and intensive training, making the weapon accessible to ordinary soldiers and ultimately altering the military landscape of Europe.

Beyond England, the continent also exhibited diverse archery traditions. In Eastern Europe, Russian and Polish cavalry used steppe-style composite bows similar to Ottoman designs (Abratowski 2001; McEwen 2001b). Finno-Ugrian groups such as the Saami produced two-wood bows crafted from glued strips of different timber species as an adaptation to subarctic climates (Insulander 1998). Modern-era bow craftsmanship continued through makers such as Philip Highfield, a nineteenth-century producer of lancewood bows (Soar 1994b), and Aldred, renowned for crafting yew bows that required up to five years of drying and finishing (Lake 1972).

As firearms gradually dominated the battlefield, the function of the bow shifted toward recreation, competition, and sporting hunting, giving rise to an aristocratic archery culture in modern Europe. This development culminated in the establishment of the Fédération

Internationale de Tir à l'Arc (FITA) in 1931 by several European nations and the United States as the world governing body for archery as a sport (Rhode 1981). Collectively, these transformations illustrate the bow's transition from a military instrument to a symbol of skill, craftsmanship, and European cultural identity.

TABLE 1 Comparative Analysis Across Five Continents

Continent	Main Materials	Manufacturing Technology	Bow Morphology/Shape	Shooting Technique	Social and Cultural Function
East Asia	Horn (tusk), sinew (tendon), bamboo, hard wood	Laminated composite (layered composite); layers of horn, wood, sinew; strong reflex; long siyah	Recurve composite (recurved core), long draw (high draw length), high performance	Thumb draw	Hunting, warfare, status symbol, aristocratic
Oceania dan Asia Tribal	Bamboo, rattan, light wood	Simple manufacturing without backing (no reinforcing layers); adapted to tropical ecology	Simple/long straight bows (long forest bows)	Primary, secondary & tertiary draw (variation of traditional draw lengths)	Hunting, tribal conflicts, ecological survival
Afrika	Simple wood, rattan; poisoned arrow shafts	Simple bow (focus on using plant/animal poisons)	Small, simple bows; straight profile	Mediterranean draw (three-finger draw)	Hunting, rituals, social identity; poison as cultural element
Amerika	Hard wood, sinew-backed bows (tendon layers), Amazonian bamboo	Sinew-backed bows (Plains bows); long forest bows (Amazon)	Plains short bow, Amazon long bow; long arrow shafts	Mediterranean draw + indigenous variations	Warfare, hunting, status symbol, heroic symbol
Eropah	Yew wood (heartwood + sapwood), hard wood, crossbow	Self bow → longbow → steel crossbow; winch/lever mechanism	Longbow (6 feet); crossbow	Mediterranean draw; mechanism triggers crossbow	Long-distance warfare, aristocratic identity; later used for sports & recreation

CONCLUSION

This study emphasizes that traditional bows are not merely tools or weapons, but the result of technological innovation and a manifestation of cultural adaptation unique to each continent. The diversity of shapes, materials, crafting techniques, and functions of bows reflects the interaction between humans and their environment, as well as how societies utilize natural resources for practical, social, and ritual needs. The various functions of the bow that from warfare, hunting, status symbols, religious rituals, to sports and demonstrate its flexibility and

multifaceted role in society, serving as a medium that unites technology, cultural identity, creativity, and social values.

Although modern weapons have replaced the bow's original functions, its cultural, aesthetic, and traditional knowledge values remain preserved and appreciated. The bow stands as a symbol of respect for history, cultural identity, and the human-environment relationship. Understanding traditional bows provides insights into technological history and offers a deeper perspective on creativity, problem-solving, and the influence of culture on the production and use of technology. Therefore, traditional bows continue to be relevant as a source of learning, inspiration, and the preservation of human heritage diversity worldwide.

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