SCIENTIFIC CULTURE
www.sci-cult.com

SCIENTIFIC CULTURE, Vol. 12, No. 2.1, (2026), pp. 5229-5238
Open Access. Online & Print

DOI: 10.5281/zenodo.19114226

THE ORGANOLOGY OF HULUSI IN KUNMING, CHINA

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Received: 06/02/2026
Accepted: 05/03/2026

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ABSTRACT

This study investigates the organology of the Hulusi, a traditional Chinese free-reed musical instrument, within the cultural and historical context of Kunming, Yunnan Province. The study integrates document analysis, fieldwork, interviews with master craftsmen and performers, and direct observation. The primary objective is to examine the Hulusi's historical development, structural components, acoustical mechanisms, and contemporary innovations. Findings reveal that the Hulusi originated among the Dai ethnic group, where the gourd resonator symbolized harmony and auspiciousness. Prior to the twentieth century, construction practices were non-standardized, resulting in regional variation. A significant transformation occurred during the 1950s–1980s in Kunming, where systematic refinements such as metal free reeds, standardized pipe dimensions, and adjustable drone systems established the foundation for modern Hulusi production and pedagogy. Organologically, the Hulusi is classified under the Hornbostel–Sachs system as a free-reed aerophone. Its acoustic properties derive from the interaction between the gourd wind chambers; vibrating metal reeds, cylindrical bore structure, and drone resonance system. Contemporary developments, including chromatic key mechanisms, bass and baritone models, and synthetic materials, demonstrate the instrument's adaptability to modern ensemble contexts while preserving its traditional timbral identity. The study concludes that the Hulusi represents not only an organological system but also a dynamic cultural artifact reflecting regional identity, technological innovation, and educational transformation in contemporary China.

KEYWORDS: Hulusi, Organology, Yunnan Ethnic Music, Chinese Traditional Musical Instruments.

1. INTRODUCTION

Yunnan Province, located in south-western China, represents one of the most culturally and ethnically diverse regions in East Asia. As home to more than twenty officially recognized ethnic minority groups, including the Dai, Yi, Bai, Hani, and Achang, Yunnan has long served as a crossroads of cultural exchange between China and Southeast Asia (Yunnan Provincial People's Government, 2022). Its geographical position along historical trade routes, including the Southern Silk Road, facilitated sustained intercultural contact, resulting in a rich musical landscape shaped by both indigenous traditions and transregional influences (He & Zhang, 2020). Within this multicultural environment, traditional wind instruments have played a central role in ritual, social, and artistic life.

Among these instruments, the Hulusi (葫芦丝) occupies a distinctive position. Originating primarily among the Dai ethnic community in south-western Yunnan, the Hulusi was traditionally constructed from natural gourds and bamboo materials readily available in the region and symbolically associated with harmony and auspiciousness (Lei, 2025). Historically, the instrument was used in courtship, storytelling, and festival contexts, where it's soft and lyrical timbre complemented vocal and dance traditions. Despite its long history, the Hulusi remained a localized folk instrument until the mid-twentieth century, when systematic documentation and reform of minority musical traditions brought it into broader national recognition (Li, 2017).

A significant transformation occurred between the 1950s and 1980s, particularly in Kunming, the capital of Yunnan Province. During this period, instrument makers and ethnomusicologists standardized structural features, introduced metal free reeds, refined tuning systems, and incorporated adjustable drone mechanisms. These innovations enhanced the instrument's acoustic stability and expressive capacity, enabling its integration into formal music education and professional performance contexts. Since the 1990s, further developments including chromatic key systems, expanded-range models, and synthetic materials have positioned the Hulusi within contemporary ensemble and cross-genre settings (Zhao, 2021). Although previous studies have addressed the historical development and pedagogical dissemination of the Hulusi (Liu, 2022), there remains a relative lack of comprehensive organological analysis focusing specifically on its structural system, acoustical mechanisms, and contemporary transformation within the Kunming context. Most existing scholarship emphasizes cultural symbolism or performance practice, while detailed examination of material construction, reed technology, bore acoustics, and drone integration remains fragmented.

From an organological perspective, the Hulusi is classified within the Hornbostel–Sachs system as a free-reed aerophone, distinguished by its gourd wind chamber and integrated melody–drone pipe configuration. The interaction between the resonating gourd cavity, vibrating metal reeds, cylindrical bore, and drone pipes creates a timbral quality that differentiates it from other Chinese wind instruments such as the Xiao, Suona, and Sheng (Yao, 2023). Understanding these structural and acoustical mechanisms is essential for situating the Hulusi within broader comparative organology and for tracing its technological evolution. Therefore, this study aims to investigate the organology of the Hulusi in Kunming, China, by examining its, classification, structural components, acoustical principles, and modern innovations. By integrating documentary research with fieldwork and expert interviews, the study contributes to a more systematic understanding of the Hulusi as both a musical instrument and a dynamic cultural artifact. The findings offer implications for ethnomusicology, organological theory, and the preservation of traditional musical heritage in contemporary China.

2. RESEARCH METHODS

This study adopted a qualitative research methodology, integrating organological analysis, historical inquiry, and ethnographic fieldwork. The research focused on the structural system, acoustical mechanisms, and contemporary development of the Hulusi in Kunming, Yunnan Province, China. Fieldwork was conducted between October 2024 and September 2026. Data were collected through documentary analysis, semi-structured interviews, direct observation, and audio-visual documentation. The investigation was structured into four major phases, each representing a critical stage in the research process.

2.1. Step 1: Data Collection

A. Secondary Data: The researcher consulted academic monographs, peer-reviewed journal articles, ethnomusicological studies, local chronicles, governmental cultural reports, and archival materials related to Yunnan's musical traditions and the historical development of the Hulusi. Particular attention was given to sources discussing Chinese

wind instrument classification, the Hornbostel–Sachs system, reed acoustics, and regional craftsmanship traditions. These materials provided a theoretical and historical foundation for understanding the Hulusi's evolution from a localized Dai folk instrument to a nationally recognized musical instrument.

B. Primary Data: Field research was conducted in Kunming, the capital of Yunnan Province, which functions as a major center for Hulusi performance, education, and manufacturing. Primary data were gathered through semi-structured interviews with key informants, including master craftsmen and professional performers with more than twenty years of experience. The principal informant, Mr. Yang Zhiyuan, a Bai craftsman specializing in Hulusi and Bawu production, provided in-depth insight into construction techniques, reed formation, tuning systems, and material selection.

On-site observations were conducted in workshops, rehearsal spaces, and performance venues, enabling the researcher to examine instrument-making processes, fingering systems, airflow control techniques, and performance practices.

2.2. Step 2: Recording Data

All interviews and field observations were systematically documented through audio recording, video recording, photographic documentation, and detailed field notes. Instrument measurements including pipe length, bore diameter, reed dimensions, and gourd cavity characteristics were carefully recorded to support organological analysis. Interview transcripts were prepared verbatim to preserve contextual meaning and technical terminology related to instrument construction and acoustics. Special attention was given to discussions concerning reed–resonator interaction, drone integration, tuning standardization, and modern innovations such as chromatic key systems and synthetic materials.

2.3. Step 3: Preparation and Analysis of Data

Historical data were analyzed using historical musicology approaches to trace the transformation of the Hulusi from Dai ethnic origins to twentieth-century standardization in Kunming. Organological analysis was conducted based on the Hornbostel–Sachs classification framework, focusing on structural components including the gourd resonator, melody pipe, drone pipes, metal reeds, mouthpiece, and stoppers. Acoustical interpretation examined airflow dynamics, reed vibration principles, bore resonance, and drone harmonic reinforcement. Comparative analysis with other Chinese and Southeast Asian free-reed instruments was also conducted to contextualize the Hulusi's distinctive structural system. Triangulation among documentary sources, interviews, and field observations was applied to ensure analytical reliability and methodological rigor.

2.4. Step 4: Synthesis, Discussion, and Presentation

The findings were synthesized through descriptive and interpretive analysis aligned with the study's objectives. The Hulusi was examined not only as a physical instrument but also as an evolving organological system shaped by regional identity, craftsmanship innovation, and educational institutionalization. The results were contextualized within broader discussions of ethnomusicology, free-reed aerophone studies, and contemporary Chinese musical modernization. Finally, the research outcomes were compiled into a scholarly manuscript, presenting an integrated understanding of the Hulusi as both a traditional cultural artifact and a technologically adaptive musical instrument in modern China.

3. LITERATURE REVIEW

Yunnan Province occupies a distinctive position in China's cultural geography. Located in the south-western region bordering Myanmar, Laos, and Vietnam, Yunnan has historically functioned as a cultural crossroads linking China with Southeast and South Asia (Yunnan Provincial People's Government, 2022). The province is characterized by mountainous plateau terrain, major river systems, and exceptional biodiversity, earning the designation "Kingdom of Animals and Plants." More significantly for ethnomusicological inquiry, Yunnan is home to more than twenty officially recognized ethnic minority groups, including the Dai, Yi, Bai, Hani, Achang, and Wa communities (Yunnan Local Chronicle Committee, 2022). This ethnic plurality has produced a dense network of musical traditions shaped by multilingualism, ritual practices, and interregional exchange. Linguistic diversity including Sino-Tibetan and Tai language families has influenced vocal styles, tonal systems, and instrumental forms. Scholars have noted that Yunnan 's musical landscape reflects both localized identity formation and broader transnational cultural flows, particularly along the historical Southern Silk Road (Ouyang 2015). Within this context, wind instruments occupy a central role in ritual, festival, and communal life, forming a foundational category

of Chinese traditional instrumental music.

Kunming, the capital of Yunnan, has served as a political and cultural hub since the era of the Dian Kingdom (475–221 BCE). Incorporated into the Han imperial system in 109 BCE, the region became a site of sustained cultural exchange between Central Plains dynasties and south-western ethnic communities (Li, 2016). During the Tang Dynasty, the Nanzhao Kingdom positioned Kunming as a major regional power, while subsequent Yuan, Ming, and Qing administrations consolidated its urban and administrative functions (Li, 2023). In the modern period, Kunming's opening as a commercial port and its strategic role during World War II further expanded its cultural and infrastructural development. Post-1949 industrialization and modernization transformed the city into a key educational and artistic center in southwest China (Luo, 2022). This historical trajectory positioned Kunming as a focal site for the institutionalization and standardization of regional musical traditions, including the Hulusi.

Chinese traditional wind instruments constitute one of the four principal categories of national instruments and are widely used in solo, ensemble, operatic, and ritual contexts (Qin, 2022). Their classification is primarily based on sound-production mechanisms rather than material or external appearance. From an acoustical perspective, three main systems can be identified: air-jet (edge-blown) aerophones, reed-activated instruments, and free-reed aerophones. Air-jet instruments, such as the Xiao and Di, produce sound through airflow striking an edge and generating vibration within the air column. Reed-based instruments, including the Suona, rely on reed vibration within a conical bore. Free-reed instruments, such as the Sheng and Hulusi, generate sound through the oscillation of a metal reed activated by airflow. This classification corresponds to principles of airflow dynamics and resonance (Song, 2021). Among these systems, free-reed instruments exhibit a particularly intricate interaction between reed vibration and resonating cavity structure, forming the theoretical basis for the present organological study of the Hulusi.

Scholarly studies of Chinese wind instruments highlight a dynamic balance between historical continuity and technological adaptation. Instruments such as the Xun, Suona, and Sheng illustrate the long evolution of Chinese aerophones, reflecting both indigenous innovation and intercultural exchange (Zhang Li, 2017; Lin & Liang, 2003; Li Ran, 2019). Across different dynasties and regions, three organological characteristics consistently emerge: the use of natural materials such as bamboo, clay, and gourd; the central role of airflow and reed–air column interaction in sound production; and the continuous modification of structural design in response to changing musical and social contexts (Chang& Xiong, 2018).

The Hulusi originated among the Dai ethnic community in southwestern Yunnan and is believed to derive from early gourd-reed instruments (Pang, 2020). Traditionally made from natural gourds and bamboo, early versions lacked standardized tuning and were primarily used in intimate social and ritual contexts, where the gourd symbolized harmony and auspiciousness. Until the mid-twentieth century, the instrument remained regionally confined. However, between the 1950s and 1980s, systematic reform and standardization through the introduction of metal free reeds, refined bore structures, and drone integration transformed the Hulusi into a nationally recognized instrument. Since the 1990s, innovations such as chromatic key systems, extended-range models, and synthetic materials have further expanded its musical capacity and educational use, facilitating its integration into contemporary ensembles and global performance contexts (Long, 2022).

While existing literature has documented the historical origins, cultural symbolism, and pedagogical dissemination of the Hulusi, comprehensive organological analysis remains limited. Most studies emphasize performance practice or cultural identity, with comparatively less attention to structural systems, reed mechanics, acoustical interaction, and the technological evolution of construction practices within Kunmingg (Zhang, 2016). Therefore, a focused organological study integrating historical documentation, structural examination, and acoustical analysis remains necessary to clarify the Hulusi's position within Chinese wind instrument classification and contemporary musical transformation.

4. RESEARCH RESULTS

4.1. Historical and Cultural Development of the Hulusi in Kunming

The findings indicate that the Hulusi originated among the Dai ethnic community in southwestern Yunnan, where natural gourds and bamboo were abundant and symbolically significant. Historically, the gourd represented harmony, protection, and auspiciousness, reinforcing its selection as the instrument's primary resonating body. Prior to the twentieth century, the Hulusi functioned primarily within intimate social contexts, including courtship,

storytelling, pastoral leisure, and local festivals. Instrument construction during this period lacked standardization, resulting in regional variation in tuning, tonal quality, and structural design.

A major transformation occurred between the 1950s and 1980s, particularly in Kunming. During this period, ethnomusicologists and instrument makers systematically refined the Hulusi's structure. Metal free reeds replaced earlier simple reed forms, pipe dimensions were standardized, and drone systems were integrated with improved stability. These modifications enhanced intonation accuracy and broadened expressive capabilities. As a result, Kunming emerged as a central hub for Hulusi performance, pedagogy, and manufacturing, marking the instrument's transition from a localized ethnic artifact to a nationally disseminated musical instrument.

Since the 1990s, further developments including chromatic key mechanisms, extended-range models (bass and baritone Hulusi), and synthetic materials such as ABS resin have expanded the instrument's adaptability in educational and ensemble contexts. These innovations demonstrate the Hulusi's capacity to balance tradition with technological modernization.

4.2. Organological Classification and Position

From an organological perspective, the Hulusi is classified within the Hornbostel–Sachs system as a free-reed aerophone. Sound production occurs when airflow activates thin metal reeds located at the upper section of the melody and drone pipes. Unlike edge-blown aerophones such as the Xiao or double-reed instruments such as the Suona, the Hulusi's sound emerges from the interaction between reed vibration and the resonating cavity of the gourd wind chamber. Comparative analysis reveals similarities with other Southeast Asian gourd-based free-reed instruments; however, the Hulusi's modern structural refinement particularly standardized pipe length, reed stabilization, and drone integration reflects a distinct trajectory within Chinese organological development.

4.3. Structural Components of the Hulusi

A detailed organological investigation reveals that the Hulusi is not merely a simple folk aerophone but a carefully integrated acoustic system in which each structural element performs a specific mechanical and resonant function. The instrument's design reflects a synthesis of traditional craftsmanship and acoustical logic, where material selection, dimensional proportion, and reed configuration collectively determine tonal character and performance capability.

Unlike many single-pipe wind instruments, the Hulusi incorporates a wind chamber, melody pipe, and one or more drone pipes within a unified structure. The interaction among these components produces a distinctive timbre characterized by warmth, softness, and sustained resonance. Therefore, understanding the Hulusi requires analysis not only of its visible construction but also of the interdependence between structural form and acoustic behavior. Detailed structural examination demonstrates that the Hulusi is a composite acoustic system consisting of multiple interdependent elements:

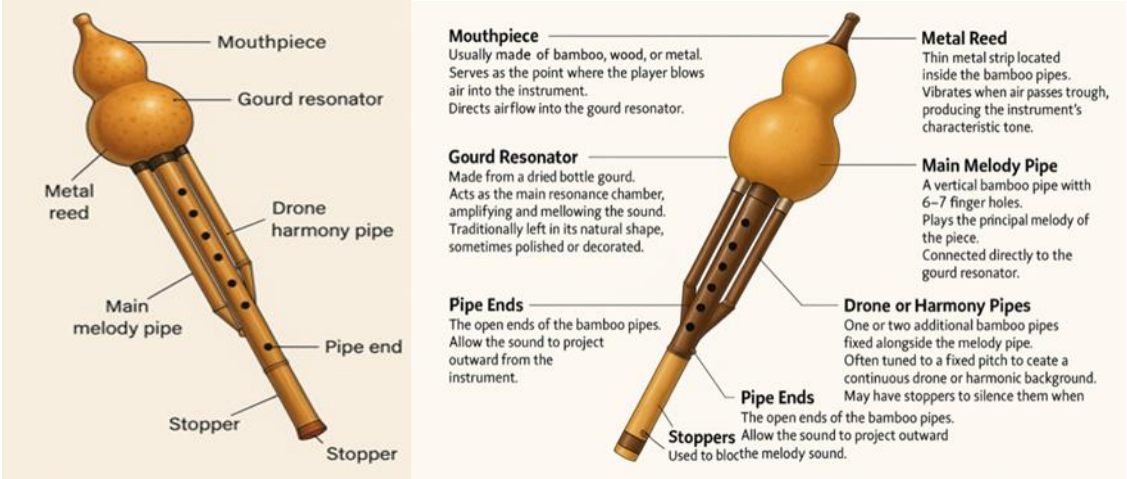

Figure 1: The component and Organology of Hulusi Musical Instrument. Source: Wu Hengbin, from fieldwork in 2025.

4.3.1. Mouthpiece

The mouthpiece, commonly crafted from bamboo, hardwood, or metal, serves as the initial interface

between performer and instrument. Beyond functioning as a simple air inlet, it regulates airflow velocity and pressure before the air enters the gourd wind chamber. The internal diameter and smoothness of the mouthpiece channel influence air resistance and breathe efficiency. A well-balanced mouthpiece facilitates stable airflow, minimizing turbulence and ensuring precise activation of the metal reed. In performance practice, subtle variations in embouchure and breath control at this entry point significantly affect articulation and dynamic shading.

4.3.2. Gourd Resonator

The gourd resonator, made from a dried bottle gourd, constitutes the acoustic core of the Hulusi. Functioning as a wind chamber, it equalizes air pressure before distributing airflow into the melody and drone pipes. Its spherical or oval cavity acts as a natural resonator, reinforcing lower harmonic frequencies and producing the instrument's characteristic mellow and velvety timbre. Artisans select gourds according to symmetry, shell thickness, density, and durability. Variations in internal volume directly influence tonal depth and resonance sustain. Structurally, the gourd also stabilizes airflow by reducing sudden pressure fluctuations, which contributes to smooth tone onset and reduced noise during articulation. Beyond acoustics, the gourd retains symbolic meaning in Dai cultural tradition, reinforcing its dual function as both acoustic chamber and cultural signifier.

4.3.3. Gourd Resonator

The metal reed is the principal sound-generating component of the Hulusi. Typically made from copper or alloy strips, it is precisely fitted within the upper section of the bamboo pipe. When air passes through the reed aperture, pressure differentials cause the thin metal tongue to oscillate rapidly, generating periodic vibrations that excite the internal air column. The reed's thickness, curvature, length, and slot alignment determine pitch accuracy, tonal brightness, response speed, and dynamic flexibility. Minor adjustments in reed positioning can significantly alter intonation stability. Modern craftsmanship in Kunming emphasizes micro-adjustment techniques and improved reed plate stabilization, enabling expanded expressive range and chromatic adaptability. Thus, reed formation represents the most technically demanding stage of Hulusi construction.

4.3.4. Main Melody Pipe

The main melody pipe is a vertically oriented bamboo tube directly connected to the gourd resonator. It typically contains six or seven finger holes arranged to facilitate diatonic and modal scale production. The pipe's cylindrical bore supports stable harmonic resonance, while finger-hole placement determines scale accuracy and tonal balance. Pitch production arises from the interaction between reed vibration and air-column length modification through finger-hole control. Bore diameter, pipe length, and wall thickness collectively influence tonal color and projection. In contemporary models, synthetic materials such as ABS resin may be used to enhance durability and tuning consistency without substantially altering acoustic character.

4.3.5. Drone or Harmony Pipes

One or two drone pipes are affixed alongside the melody pipe to provide sustained harmonic reinforcement. Traditionally tuned to a fixed pitch often the tonic or dominant the drones create a continuous sonic background that strengthens modal identity and enhances the instrument's meditative quality. Acoustically, drone pipes increase overall resonance density by adding sympathetic vibration to the sound spectrum. Modern Hulusi designs incorporate stoppers or adjustable valves, allowing performers to activate or silence the drones according to repertoire requirements. This structural innovation significantly expands performance versatility, enabling both traditional folk expression and contemporary ensemble participation.

4.3.6. Drone or Harmony Pipes

The open ends of the bamboo pipes serve as the primary sound projection outlets. The diameter, edge finishing, and structural smoothness of these openings affect resonance dispersion and tonal clarity. Slight variations in pipe-end shaping can influence brightness and projection strength. Though structurally simple, the pipe ends contribute directly to the instrument's acoustic radiation pattern and overall balance.

4.3.7. Stoppers

Stoppers typically crafted from wood, cork, or synthetic materials, are inserted into the drone pipes to control harmonic output. By blocking airflow, they allow the instrument to function temporarily as a single-melody aerophone. This mechanical feature enhances adaptability across different musical genres and performance contexts. Structurally modest yet functionally significant, the stoppers represent an example of practical organological modification responding to modern repertoire demands.

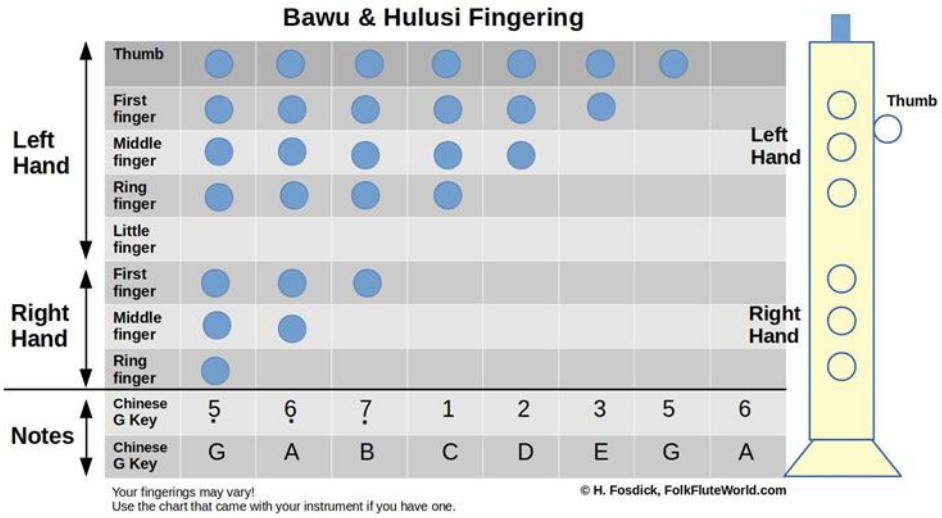

Figure 2: Hulusi's fingering
Source: H. Fosdick, FolkFluteWorld.com in 2025.

4.4. Acoustical Mechanisms

The acoustic behavior of the Hulusi is governed by a complex interaction among airflow pressure, metal reed oscillation, bore resonance, and drone reinforcement. Unlike edge-blown aerophones, in which the vibrating air column itself is the primary sound generator, the Hulusi depends on a free-reed system in which mechanical vibration of the reed precedes and activates resonance within the air column. The tonal identity of the instrument therefore emerges from a coordinated balance between aerodynamic control and structural design.

4.4.1. Reed–Resonator Interaction

When air is introduced through the mouthpiece, it first enters the gourd wind chamber, which functions as a pressure-stabilizing reservoir. This chamber moderates airflow velocity and reduces turbulence before the air reaches the metal reed. The stabilized air pressure allows the reed tongue to oscillate at a consistent frequency determined by its physical dimensions length, thickness, curvature, and elasticity. As the reed vibrates, it intermittently interrupts the airflow, generating periodic pressure fluctuations that excite the internal air column within the melody pipe. The gourd resonator enhances lower-frequency components and smooth's the attack transient, producing the Hulusi's characteristic soft onset and reduced edge noise. This reed–resonator interaction explains the instrument's velvety timbre, sustained tonal quality, and lyrical expressiveness.

4.4.2. Bore Acoustics

The main melody pipe typically features a cylindrical bore, which supports a relatively stable harmonic spectrum compared to conical-bore instruments. The effective acoustic length of the pipe is altered through finger-hole manipulation, enabling modal and diatonic pitch production. Because the Hulusi lacks a pronounced conical taper, its harmonic distribution favors warmth and tonal roundness rather than sharp projection. The bore diameter, wall thickness, and finger-hole placement collectively influence intonation accuracy and timbral consistency. Precise alignment between reed frequency and air-column resonance is essential; any imbalance may result in pitch instability or tonal harshness. In modern standardized models, dimensional calibration has significantly improved tuning reliability and ensemble compatibility.

4.4.3. Drone Resonance

The drone pipes contribute an additional layer of harmonic reinforcement by producing a continuous fixed pitch, typically aligned with the tonic or dominant of the modal system. Acoustically, the drones increase resonance density and enrich the overtone spectrum through sympathetic vibration. This sustained background tone deepens modal perception and creates a meditative sonic atmosphere characteristic of southwestern Chinese musical aesthetics. From an organological standpoint, drone integration distinguishes the Hulusi from single-pipe reed instruments and aligns it with broader Asian traditions of sustained harmonic accompaniment.

4.5. Contemporary Organological Innovation

The findings indicate that the Hulusi has undergone substantial organological transformation

in response to changing musical, educational, and performance contexts. Contemporary modifications reflect a deliberate effort to expand the instrument's tonal range, structural durability, and functional versatility while preserving its characteristic timbre. Technological adaptations include the integration of chromatic key mechanisms that enable performance beyond traditional Dai modal structures, facilitating compatibility with orchestral arrangements and cross-genre repertoire. In addition, the development of large-scale models, such as bass and baritone Hulusi, has extended the instrument's lower register and strengthened ensemble balance. These structural adjustments require proportional recalibration of gourd chamber size, reed dimensions, and airflow dynamics to maintain tonal stability.

Material innovation also plays a significant role in modern Hulusi production. The use of synthetic materials, including ABS resin and composite structures, enhances durability, moisture resistance, and manufacturing consistency. Although natural bamboo and gourds remain preferred in professional contexts for their organic resonance qualities, synthetic variants support standardized tuning and broader accessibility in educational settings. Collectively, these developments demonstrate that the Hulusi has evolved from a regionally handcrafted folk instrument into a technologically adaptive organological system capable of functioning within contemporary musical, institutional, and global performance frameworks.

The findings confirm that the Hulusi represents a historically rooted yet technologically evolving free-reed aerophone. Its development in Kunming reflects a process of organological refinement characterized by reed stabilization, bore calibration, drone integration, and material innovation. The instrument's acoustic identity emerges from the coordinated interaction of airflow control, reed oscillation, resonant cavity design, and harmonic reinforcement. The transformation of the Hulusi from a localized ethnic instrument into a standardized national and globally disseminated musical form demonstrates the intersection of traditional craftsmanship, acoustical science, and cultural modernization. As such, the Hulusi embodies both continuity and innovation within contemporary Chinese musical heritage.

5. DISCUSSION

The findings of this study are broadly consistent with the theoretical and empirical literature reviewed, particularly in relation to three interrelated domains: (1) organological theory and wind-instrument classification, (2) ethnomusicological perspectives on music as cultural practice, and (3) UNESCO's safeguarding framework emphasizing transmission, community participation, and adaptive continuity (UNESCO, 2003). At the same time, the present research contributes context-specific evidence from Kunming and advances an integrated interpretive model that situates the Hulusi as both an acoustic system and a living cultural heritage practice.

From an organological standpoint, the study confirms that the Hulusi in Kunming conforms to the broader classification of Chinese free-reed aerophones whose sound production relies on the interaction between vibrating metal reeds and a resonating air column. This is consistent with established wind-instrument frameworks that position the Hulusi alongside Sheng, Lusheng, and Bawu within the reed-based aerophone category (Yang, 2020).

The present findings reinforce this classification through detailed field-based documentation of the instrument's core acoustic components: the gourd wind chamber (pressure stabilizer and resonator), bamboo melody and drone pipes (air column regulators), and metal free reeds (primary vibrating source). The acoustic analysis further demonstrates that tonal character emerges not from any single element, but from the calibrated interaction among reed elasticity, airflow control, bore dimension, and drone resonance (Fu & Qin, 2010).

Beyond confirming existing classifications, this study extends organological literature by highlighting the systemic integration of craftsmanship knowledge, material science, and acoustic calibration in contemporary Hulusi production. In Kunming, artisans do not treat the instrument merely as a static object; rather, they conceptualize it as a dynamic acoustic system requiring proportional balance among gourd volume, reed stiffness, pipe length, and airtight assembly. This finding aligns with broader organological perspectives that define musical instruments as complex design systems embedded within technological and symbolic networks (Wang, 2020).

Importantly, the research also demonstrates how standardization processes particularly during the 1950s–1980s reframed the Hulusi from a regionally variable folk instrument into a structurally stabilized national instrument. This supports (Gen & Li,2002) historical account of evolving fingering systems and tuning normalization while adding empirical evidence from workshop-based observations

regarding reed micro-adjustment and bore refinement practices.

The findings further resonate with ethnomusicological approaches that conceptualize music not merely as sound, but as socially embedded cultural practice. The Hulusi's continued association with Dai and other Yunnan minority communities reinforces its role as a marker of regional identity and cultural memory. While structural modifications and chromatic expansions have broadened its technical capacity, the instrument's timbral aesthetics soft attack, warm resonance, sustained drones continue to reflect the lyrical and pastoral musical values of south-western China(Li,2019).

Field data reveal that contemporary performers and craftsmen consciously preserve symbolic elements, particularly the gourd resonator, which carries connotations of harmony and auspiciousness within Dai cultural frameworks. Thus, the Hulusi exemplifies what ethnomusicologists describe as adaptive continuity: a process in which tradition evolves technologically without severing its cultural semiotics. Furthermore, the expansion of Hulusi education in schools and public cultural institutions demonstrates the instrument's transition from localized ethnic practice to national cultural representation (Wan, 2018). This transformation aligns with broader patterns of state-supported cultural integration in post-1949 China, where minority musical forms are recontextualized within institutionalized music education and national performance circuits.

6. CONCLUSION

This study has examined the Hulusi in Kunming through an integrated organological, acoustical, and cultural framework. The findings demonstrate that the Hulusi is not merely a traditional ethnic wind instrument, but a structurally sophisticated free-reed aerophone whose tonal identity emerges from the calibrated interaction of airflow regulation, metal reed oscillation, bore resonance, and drone reinforcement. The instrument's acoustic character marked by warmth, softness, and sustained resonance is inseparable from its carefully balanced structural system.

Historically, the Hulusi originated within Dai cultural contexts in south-western Yunnan, where natural materials such as gourds and bamboo carried both practical and symbolic significance. Prior to the twentieth century, its construction remained regionally variable and embedded within localized social functions. However, systematic refinement in Kunming during the mid-twentieth century particularly the introduction of metal reeds, standardized tuning, and stabilized structural proportions transformed the instrument from a localized folk practice into a nationally disseminated and pedagogically institutionalized musical form.

Organologically, the Hulusi is firmly situated within the Hornbostel–Sachs category of free-reed aerophones. Yet the present research extends existing classifications by demonstrating that contemporary Hulusi craftsmanship operates as a dynamic acoustic design system. Artisans in Kunming engage in precise material selection, reed micro-adjustment, bore calibration, and airtight assembly to maintain tonal stability and expressive flexibility. These findings highlight the interdependence between craftsmanship knowledge, acoustic engineering, and musical aesthetics.

Furthermore, the study confirms that the Hulusi exemplifies adaptive continuity. While modern innovations such as chromatic key systems, extended-range models, and synthetic materials have expanded its technical and institutional functions, the instrument continues to retain its cultural symbolism and timbral identity rooted in Yunnan minority traditions. Its development reflects not the erosion of tradition, but its recalibration within contemporary musical, educational, and global performance contexts.

In conclusion, the Hulusi represents a compelling case of how a traditional free-reed aerophone can evolve through structural refinement, technological innovation, and institutional dissemination without losing its cultural core. The instrument embodies the intersection of organological science, regional identity, and heritage sustainability in contemporary China. As such, it contributes not only to Chinese wind-instrument studies, but also to broader discussions in ethnomusicology, instrument technology, and intangible cultural heritage preservation.

Acknowledgments: This research project was financially supported by Mahasarakham University. The author gratefully acknowledges this institutional support, which made the fieldwork and data analysis possible. The author would like to express sincere appreciation to the key informants in Kunming, particularly Mr. Yang Zhiyuan, for generously sharing their knowledge, craftsmanship experience, and valuable insights into the construction and performance practice of the Hulusi. Their cooperation and openness were essential to the successful completion of this study.

Special thanks are also extended to colleagues and academic advisors for their constructive comments and scholarly guidance throughout the research process. Appreciation is further given to the local communities and cultural practitioners in Yunnan Province whose living traditions continue to sustain and enrich the cultural heritage examined in this study.

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