

文化部文化資產局出國報告提要

出國報告名稱：

2012 歐洲地中海文化資產數位科技研討會(The Euromed 2012)

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關鍵詞：

文化資產、三維地理資訊系統、價值優先、整合型數位技術、世界遺產

內容摘要：

「2012 歐洲地中海文化資產數位科技研討會(The Euromed 2012)」為歐洲地中海地區自 2006 年起持續每兩年舉辦之重要學術會議，本年度為第四次舉辦。此次於 10/29－11/3 間共六日時間舉辦，共有 300 餘位各國人士參加。共計五日發表論文，一日舉行世界遺產現場參訪。

本次參與會議共發表兩篇論文，第一篇“An Integrated Management System for Historical Buildings: The Case Study of Dihua Historical Street Districts in Taiwan”介紹國內以三維地理資訊系統的整合型數位技術，提供文化資產的管理、防災以及民眾參與的平台，獲得與會者諸多正面回應，特別是三維 GIS 的技術與整合介面與世界發展趨勢結合，也有頗多國外學者探詢相關技術問題。第二篇“A CH based Integrative Management Framework on the Value Priority Aspect”提出基於價值優先的國際觀念，與在地政策整合的操作平台，並藉行動技術，設計及時的古蹟管理資訊系統，本篇論文關注的國際化與在地化的整合觀點與操作方式，對政策與管理的協助功能，引起廣泛的討論，多位專家認為是一個可以深入發展的方向。

配合參與大會，同步展出我國申遺各項工作（以金門為重點），六幅 A0 海報配合各項文宣，吸引與會者的關注，並得到諸多正面鼓勵。

行政院及所屬各機關出國報告

(出國類別：其他(出席國際會議))

「2012 歐洲地中海文化資產數位科技研討會
(The Euromed 2012)」

服務機關：中國科技大學建築系

職 稱：副教授

姓 名：閻亞寧

派赴國家：利慕索,賽普路斯

出國期間：10/27—11/4

報告日期：11/15

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壹、背景



EUROMED 是國際上較早推動探討古蹟保存與數位科技整合的國際性研討會，自 2006 年起，每 2 年於賽普路斯舉辦。本（2012）年為第四次舉行，由於該會議議題的前瞻與深度均深受肯定。該會議受到聯合國教科文組織（UNESCO）、世界遺產中心（WHC）、歐盟（European Commission）、CIPA、ISPRS 等機構的支持與協辦，會議論文亦皆由世界著名的 springer 出版社正式出書廣為刊行。本年度共收到 85 個國家 372 篇論文的申請，足見該會議在學術與國際上的影響力。

本年度適逢賽國擔任歐盟執行委員會主席（Presidency of the Council of the EU）因此會議已正式列入歐盟與 UNESCO 重要行事曆，邀請多位世界級專家與會，是本年度世界文資數位保存的重要學術活動。

本次除了發表論文兩篇外，並配合大會同步展示國內與金門申請世界遺產工作，計有六幅 A0 海報，輔以豐富的影片與文宣資料，在會議中引起許多正面回應。

貳、研討會議程

本次大會自 2012 年 10 月 29 日至 11 月 3 日共計六日舉行，共有來自 48 個國家 300 餘位專業人士參與。逐日議程表如下：(詳附錄一)

日期	內容
10 月 28 日	大會報到及展覽佈置
10 月 29 日	<ul style="list-style-type: none"> ● 上午舉行開幕式及特邀貴賓演講。 ● 下午同時在不同分會場舉辦 Full Papers 發表與工作坊(一)。 ● 工作坊(一)主題為 “Enabling small, medium and local cultural organizations to participate in the European digital space”
10 月 30 日	<ul style="list-style-type: none"> ● 上午 8 時至 9 時請特邀貴賓進行演講。 ● 下午同時在不同分會場舉辦 Full Papers、Short Papers 發表與工作坊(二)。 ● 晚上同時在不同分會場舉辦 Full Papers、Projects Papers 發表。 ● 工作坊(二)主題為 “3D Libraries”
10 月 31 日	參訪賽國世界遺產點。
11 月 01 日 (歐盟計畫日)	<ul style="list-style-type: none"> ● 上午 8 時至 9 時請特邀貴賓進行演講後，接著邀請全體出席 “European Commission Presentations Support and Research in CH”。 ● 下午舉行 “Council of the European Union and ESF/COST EU Success Projects in CH” 與 “ESF/COST and European Commission DG R&I EU Success Projects in CH”。 ● 晚上舉行 “European Commission DG R&I EU Success Projects in CH”
11 月 02 日	<ul style="list-style-type: none"> ● 上午 8 時至 9 時請特邀貴賓進行演講。 ● 上午除了進行 Full Papers 發表外，並於分會場進行 “Meeting of ECTP Fach: Focus Area Cultural Heritage General Assembly”。 ● 下午進行 Projects Papers 發表。 ● 晚上進行 Full Papers 發表。 ● 全天同步於分會場舉行工作坊(三)，主題為 “GIS systems and Archaeological Spatial Data Infrastructures in Europe and Mediterranean area”
11 月 03 日	<ul style="list-style-type: none"> ● 全天進行 Short Papers、Projects Papers 發表。 ● 晚上進行閉幕式。

叁、論文發表

本次參加研討會經審查通過共提出並發表兩篇論文。

- 一、第一篇為 “A CH based Integrative Management Framework on the Value Priority Aspect” ，作者為建築系閻亞寧副教授，論文摘要如下：

Historic monuments preservation is not only an international trend in the 21st century, but one of the major policies of every country. In the past, it was once categorized under the disciplines of literature, history, artistry, and engineering techniques. Following the advances of digital technology, applications of the technology have been widely adopted by many different fields. However, the use of this technology is rarely included in the historic monuments preservation and integration study. The purpose of this project is to show how the advanced technology can be fully utilized in establishing a more effective way to preserve historic monument for future reuse. This paper is to report a preliminary outcome for a project titled “A CH based integrative management framework on the value priority aspect,” which mainly aims to establish an information exchange platform together with a mobile mechanism for the management of historic monuments and reuse from the perspective of the governmental point of view.

- 二、第二篇為 “An Integrated Management System for Historical Buildings: The Case Study of Dihua Historical Street Districts in Taiwan” ，作者依序為本校室內設計系楊文斌兼任講師、建築系閻亞寧副教授及室內設計系鄭鴻銘講師，論文摘要如下：

Dihua Street, a celebrated historic district in Taiwan, was chosen as the subject of the current study. Through three-dimensional (3D) modeling, namely point clouds and reverse engineering, featured in 3D laser scanners, the researcher restored the appearance of cultural heritage and enhanced

authenticity in historical preservation. Besides, on the basis of the Taiwan Cultural Heritage Conservation Law, the researcher planned the framework of a digital database and developed a safety monitoring system with a management platform for 3D digital data. As a result, the law serves as a base for applying digital preservation of historical sites in Taiwan as well as integrated management of historical rehabilitation.



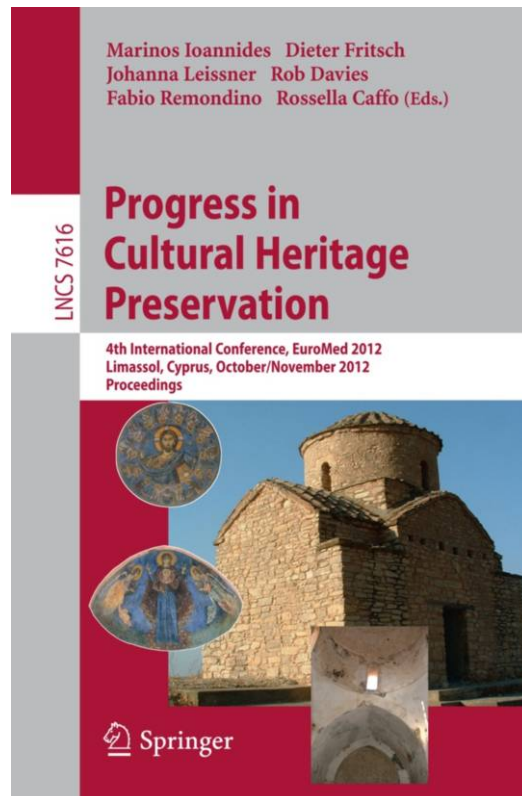
10/30 論文發表



11/1 論文發表-1



11/1 論文發表-2



Euromed 2012 出版品封面

肆、活動紀要

本次大會全名為「歐洲地中海文化資產數位科技研討會 (The Euromed 2012)」，本年度共收到 85 個國家 372 篇論文，經評閱後，擇優發表，並由世界有名的 Springer 公司出版論文集，為國際文資數位保存領域上深具影響的學術活動。大會自 10 月 29 日起連續舉辦六日，而正式註冊出席者共有 48 個國家 300 餘位專業人士。大會期間除論文發表外，亦同時舉辦各種專業如地理資訊系統、數位量測等主題之工作坊，共動用一間主會場和六間分會場，規模相當盛大。

飛行近 20 小時後，於 10 月 28 日中午抵達賽國 (Cyprus) 第二大城利馬索 (Limassol)，在入住飯店 (The Mediterranean Beach Hotel) 稍事休息後，即前往大會地點亞馬薩斯旅館 (The Amathus Beach Hotel) 報到，並於大會展示區張貼此次帶來的六張介紹金門申請世界遺產的 A0 海報。此外，大會於報到處設有交流展示櫃台，供各國研發成果於公開園地宣傳交換。

是日晚上 9 時，賽普路斯科技大學副校長 Andreas Anayiotos 博士於舊城古建築再利用的餐廳裡設宴招待大會學術委員會成員晚餐，我國二位代表也在受邀之列，另外大會則於 10 月 30 日晚上舉辦 Social Dinner，展現賽國傳統文化風貌。

10 月 29 日起活動正式展開，本年度適逢賽國為歐盟輪值主席，大會因此正式列入歐盟重要行事曆，其中開幕式由賽國總統府秘書長和文化科技部長代表賽國政府表示歡迎，隨即進行特邀貴賓演講，包括 RFID 發明人 John Greaves 先生、Google 首席技術顧問 Michael T. Jones 先生及 UNESCO 世界遺產中心主任 Kishore Rao 先生等人，就國際研究方向進行分析說明。下午則展開分組論文發表。我國此次共有三篇論文入選，但僅到會發表兩篇，分別於 10 月 30 日和 11 月 1 日進行發表。



▲大會地點亞馬薩斯旅館 (The Amathus Beach Hotel)



10/28 大會報到



研討會現場



大會主席 Marinos Ioannides 博士演講



貴賓 Daniel Thalmann 博士演講



Social Dinner 並體驗當地文化和飲食



利慕索舊港區工業廠房文化空間保存再利用

10 月 31 日大會安排一天的世界遺產實地參訪，如 Phasouri 考古遺址與世界遺產地 Papos 舊城與考古遺址等。

Phasouri 遺址為紀元前 5 世紀起由希臘人建立，後因地震損毀，再由羅馬人復建，遺址包括公共浴場、神廟、劇場等，現場部分採露天展示，展示中心內並有模型、多媒體等方式提供充分的解說服務，為觀光客參觀的重要據點。



Phasouri 遺址的重要公共浴場及馬賽克地坪以鋼、木構等做半坡護式保護



Phasouri 遺址內建木棧道方便遊客近距離觀賞馬賽克地坪



Phasouri 遺址的公共浴場



Phasouri 遺址內的賞馬賽克地坪

賽普路斯共有三處世界遺產，Papos 舊城即為其中之一，其為腓尼基人在世紀前所興建的城市，曾是賽普路斯的首府，目前則是賽國第三大城和海濱度假勝地。Papos 遺址基地幅員廣潤，包括希臘羅馬時期的城牆、劇場、行政區、生活區等，保存了大量完整的馬賽克地鋪，為世界上極為珍貴的文化遺產。遺址外圍建築環境皆受到一定管制，不超過三層的地中海式建築，各種餐廳、紀念品店在外圍規劃的井然有序，充分發揮以文化為主體，達到藉觀光帶動地方經濟的目的。



Papos 遺址



Papos 遺址周邊設有完善的解說導覽資訊



Papos 遺址內保存大量完整的馬賽克地坪



世界遺產 Papos 入口



Papos 遺址外圍不超過三層的地中海式建築



各種餐廳、紀念品店在 Papos 遺址外圍規劃的井然有序

大會特別將 11 月 1 日訂為「歐盟日」，因歐盟整體預算受世界經濟不景氣影響大幅緊縮，連帶未來幾年的歐洲文化資產預算在 Horizon 2020 年計畫中是否被刪減，成為本次大會的另項議題。是日除邀請歐盟文化事務執行委員會官員報告各項整合計畫的推動成果外，並由大會提交建議文請執委會轉歐洲議會，強烈表達爭取重視文化資產研究的意願，在大會中獲得各國學者共同支持。

此次參加大會的另一項重要工作為介紹國內和金門推動世界遺產的各項觀點和成果，也特別感謝 Marinós 博士的安排。我方除了以六張 A0 海報介紹成果外，還備有金門縣文化局、金門縣政府交通旅遊局、金門國家公園、文化部文化資產局和交通部觀光局的各項文宣品和申遺文件，以多樣性的動態和靜態文宣與各國專家交流。除了得到多方面的詢問外，更有許多專家表示願親赴金門參訪。



介紹金門申請世界遺產六張 A0 海報展示區



李錫隆局長介紹我國及金門申世成果

伍、討論與建議

一、討論

文化遺產保存是一項跨種族、跨國界的工作，國際上近年主要的方面除各項保存理論研究與實質的行動外，如何藉數位化的技術，強化管理與知識傳播已成為普遍關注的重點包括：

1. 資料格式的標準化（蒐集、資料庫、呈現）
2. 資料擷取的精確化與簡便化
3. 資料管理的普及化（政府、民間組織、相關人等）
4. 資料呈現的生動化（三維技術、GIS、互動、虛擬實境等）
5. 國際合作與教育訓練

其中，以資料格式標準最受到關注。歐盟執行多年的歐洲數位圖書館計畫（Europeana）花了極大的力量在整合建立各種資料的標準。蓋蒂基金會與世界遺產基金（WMF）2013 年將公開的 Arch 計畫，也著眼於此，其中環境背景與有形和無形遺產的整合，已成為普遍的共識。我國既往對於文資保存的資料管理，並沒有太深的著墨，即便近年強調管理的重要性，但在資料標準、有形和無形的整合上，仍有許多可努力的空間，另方面擴展到資料的整體呈現，則在觀念與技術上，和國際有著較大的落差。

文化主管機關誠應體認本項工作的重要性，已開闊前瞻的視野，建立完整的觀念、體系與中長程計畫，使我國文資保存可以進一步的和國際接軌，並在本土上落實。

二、建議

1. EUROMED 是國際上較早推動探討古蹟保存與數位科技整合的國際型研討會，迄今仍主導全球數位支援文化資產保存的各項觀念、標準、技術、國際合作等工作，極具影響力，對我國研究成果頗為重視。而藉由此活動 EUROMED 表示願建立平台與我國進行跨國相關合作，建議可掌握此項管道妥為運用。

2. 本次大會除發表論文外，並積極與各國學者專家洽談，並再次與文化遺產國際檔案委員會 CIPA 2013 法國大會主席會談，除力邀我國代表赴法國參加會議發表論文外，也表示願支持我國辦理 CIPA 2015 大會，建議我國應努力爭取此項重大國際盛會，參與學習，並帶動國內相關領域的成長。
3. 參訪世界遺產點：Phasouri 考古遺址與世界遺產地 Papos 舊城與考古遺址等，進一步瞭解世界遺產地古蹟保存與在地經濟發展及都市景觀整合的良好案例，值得我國效法。
4. 保存與數位結合是國際趨勢，由 EUROMED 受到正式推動，而且都是跨國的 NGO、NPO 如聯合國教科文組織 (UNESCO)、世界遺產中心 (WHC)、歐盟 (European Commission)、CIPA、ISPRS、美國蓋蒂基金會等，我國誠應積極鼓勵多元參與，藉文資保存的平台和國際接軌，帶動實質合作創造更廣泛的效益。

附錄一：大會議程表

[illegible]

A CH based Integrative Management Framework on the Value Priority Aspect

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Abstract. Historic monuments preservation is not only an international trend in the 21st century, but one of the major policies of every country. In the past, it was once categorized under the disciplines of literature, history, artistry, and engineering techniques. Following the advances of digital technology, applications of the technology have been widely adopted by many different fields. However, the use of this technology is rarely included in the historic monuments preservation and integration study. The purpose of this project is to show how the advanced technology can be fully utilized in establishing a more effective way to preserve historic monument for future reuse. This paper is to report a preliminary outcome for a project titled “A CH based integrative management framework on the value priority aspect,” which mainly aims to establish an information exchange platform together with a mobile mechanism for the management of historic monuments and reuse from the perspective of the governmental point of view.

Keywords: historic monument, digital technology, integrative management

1 Background

The application of digital technology for cultural heritage documentation is becoming a global trend in the 21st century; in the meantime, it is taken as one of the major policies that every country avidly supports. In the past, research on digital technique aided preservation framework was rare. Towards a new era of world heritage, numerous issues are put into consideration, such as management, risk prevention, interpretation and public participation etc. Of all these important issues, those related to the applications of digital techniques will certainly play a key role in the trend.

Several important techniques are under development currently, including 3D digital imaging, reverse engineering, GIS etc. However, no system for overall management or data integration is yet available. Indeed, a system to efficiently manage and interpret data for the preservation of cultural heritages is urgently called for.

In addition, taken from a macro perspective, governmental supports with its influence always play a key role in the information management; it is always necessary for a government to be concerned and aware of the issues related to legitimacy and legality of the information provided to the public. With this, examining how an authority functions in the management platform can be contributive to the study. In view of the diversity of heritage, it is hoped that the value assessment for further understanding will be great help in the developing of management system.

1.1 Goals

This paper discusses standards of digitizing process to govern and manage cultural property in Taiwan. There are two main goals:

1. To propose a management framework based on the cultural value priority aspect and providing an integrated management service.
2. To propose a DBMS (Database Management System) and operation procedure according to the global trend and domestic condition for the application of management in Taiwan.

1.2 Methods

Two main methods were used in this study. First, the document method (by reviewing relative research papers) is adopted for analyzing and finding the characteristics of cultural heritages (form, construction, function, etc). The other one is model-simulation method. The method can be used to establish an integrative platform where mobile management system can be applied to.

2 The Cultural Value and Management

It has been nearly 50 years since the inception of The Venice Charter in 1964 declaring the importance of conservation. Over this period of the time, significant concepts and practices in various aspects have been promoted through literatures and studies.

2.1 Value

Under the efforts of UNESCO, the 1972 Convention Concerning the Protection of the World Cultural and Natural Heritage developed a new era for the world heritage. An idea of OUV (Outstanding Universal Value) has been pointed out as the most important issue in the evaluation and preservation process of world heritage.

Authenticity and integrity are two key issues for the evaluation of OUV, management and monitoring can help those values sustainable. All the detail has been shown in the OG. (The operational guide for the implementation of world heritage convention)

2.2 Management and Education

In 2008, the 16th general assembly of ICOMOS adopted The Quebec Declaration on the preservation of the spirit of place. This declaration points out the importance of re-thinking, identifying the threats, safeguarding and transmitting the spirit of cultural heritage sites.

The assembly also declared the Charter for the Interpretation and Presentation of Cultural Heritage Sites. The charter concludes the significance of “value” and proposes 7 principles as means of enhancing public appreciation and understanding of cultural heritage sites. Digital techniques were mentioned as important tools for the implementation of this charter.

2.3 Recent Progress

With the globalization trend, a wide range of proposals and ideas provided by international communities have been offered and made known publicly, which have shown great influences on the study of conservation. These proposals and ideas include those issues such as climate change, cultural diversity and risk management etc.

In 2011, the 17th general assembly of ICOMOS adopted The Paris Declaration on heritage as a driving force for the development of different areas. Urban developments, tourism, economic and social issues within the stakeholders are asked to set up a cooperation framework. ICOMOS, hence, has greatly strengthened its cooperation and partnerships with national and international institutions carrying out work on heritage and development.

3 The Role of Digital Technology

The advanced developing of computer and Internet technology has changed the way of knowledge dissemination through digital archives. The development of digital technology not only speeds up data collection, it also helps data management, dissemination and application. Preservation of cultural

properties passes on human knowledge. Digital technology allows effective preservation of cultural properties and analysis and has become a trend all over the world.

3.1 Main Objectives of digital technology

Preservation of cultural properties includes knowledge of multiple fields such as architecture, sociology, history, surveying, structure, geography, art, etc. It is important to work with experts and academics in various fields for research and investigation. Integrated digital technology has become an inevitable trend to be effectively applied to cultural properties conservation.

3.2 Research Trends

Recently, there have been many organizations such as ISPRS and CIPA involved in the applications of digital technology for studies in heritages. Through the research and international program such as EUROPEANA together with conferences such as EUROMED, the trend of this field was clearly defined by its goals, Data Acquisition, Information Management, Digitization of the application, and Presentation etc.

3.3 Digital Technique and Management

ICOMOS comprises 26 International Scientific Committees. The ISEC - International Committee Economics of conservation, CIPA - International Committee on Heritage Documentation, ICIP - International Committee on Interpretation and Presentation and ICORP - International Committee on Risk Preparedness have high connection concerning the digital technique and management issues. The framework can be shown as Fig. 1.

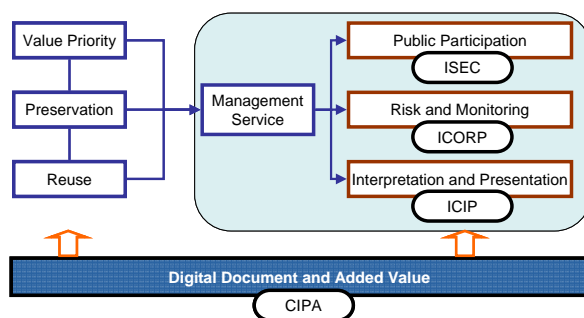


Fig. 1. The framework of integrative digital knowledge for CH

The use of digital technique is not only seen as the basis of applying various techniques for preservation but also considered a crucial support for this discipline. An integrative study on the application of digital technique for the needs of management is becoming one of the most important tasks.

3.4 Management Framework

Combined with both policy and public orientated demands, with the perspective of knowledge management, this study provides a research management framework is shown in Fig. 2 (Yen, 2011)

1. The database established should meet the demands of the public and the government for its application and dissemination.
2. The diversity of cultural heritage properties and the normalization of data should be taken into account on the level of management, interpretation and presentation and other needs.
3. Considering life cycle of administrative procedures for cultural heritage preservation, data for the integrative management system of monuments should be divided into three phases, registration, restoration and management.

4. The integrative management system should take into account the future possibility of expansion and added value.

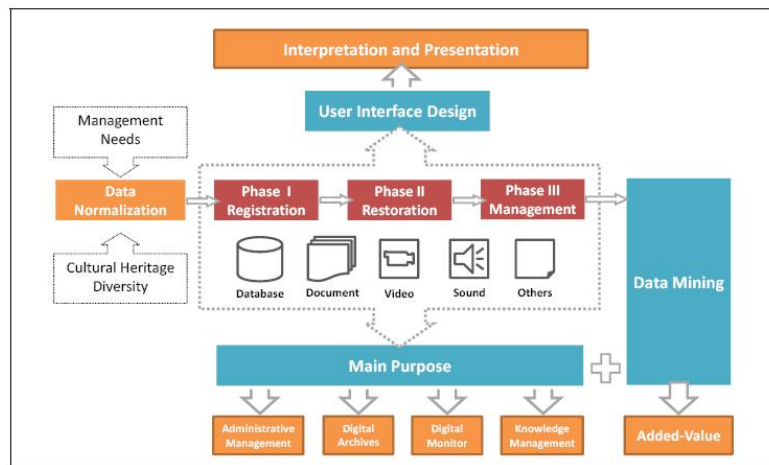


Fig. 2. An integrative management framework of data dictionary for Cultural Heritage (Yen, Weng et al. 2011)

4 A Tentative Management framework for Taiwan

4.1 Current situation in Taiwan

Taiwan has enacted its Cultural Heritage Preservation Act (CHP. ACT.) since 1982. In accordance with the influence of international movement, the act has been amended and promulgated for 7 times. In 2005, a new act with articles was taken effect; an information system and data tables were set together with this new act; and a new era of digital management for cultural heritage began.

However, current system mainly focused on the first phase of conservation, almost all the tables dealt with basic information and registration process of monuments while lacking information of restoration and management.

4.2 Requirement Analysis

4.2.1 Global Linking Platform

Value priority in conservation is a common awareness of diverse disciplines. Many documents in varied aspects drafted for the international countries to help us understand this concept. Furthermore, the ICOMOS has set up 26 international science committees together with action plans, which provide working tools for the implementation of the conservation. These resources can be integrated with an administrative and legal system of political entity to build a global linking platform. This platform can provide useful and efficient content for the DBMS of the management system. Fig. 3 takes the legal system of Taiwan to show the operational easiness and functional of this platform. In other words, for different countries, we can replace the second column of Fig.3 with their acts for operation.

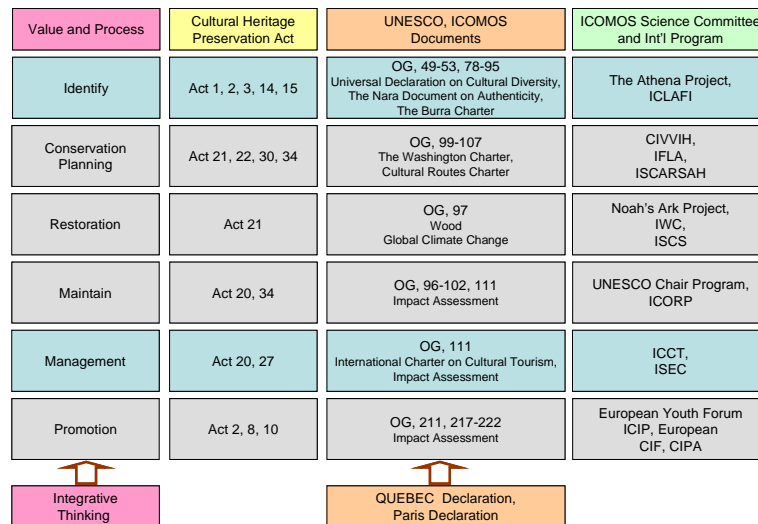


Fig. 3. A Global Linking Platform with the Domestic system in Taiwan

4.2.2 Operational Process

According to the CHP Act 2005, the basic information for the management can be shown as three issues. A process (intangible and tangible) of 3 different phases of information management can be established for preparing those contents of the DBMS.

1. Act and accompanying rules provide a clear procedure which needed to identify the process of preservation. It can be taken as basic information for the database.
2. The required information in 3 different phases is necessary to help the management with their importance.
3. With database management system (DBMS), an efficient convenient platform for the management of cultural properties can be provided.

4.2.3 Mobile Management System and Simulation

This research takes the Ji-Ing temple, a monument in Taipei city for simulation. The basic tangible, intangible and the restoration information of this temple would be acquired then put in the established database. Acquired by the mobile device, the management information of the 3rd phase could transmit to the database for further usage.

This example classified the whole process into 3 phases which are based on the management needs and normalization of the information. The main purpose would like to simplify these complicated data and make them easier to meet the management needs.

5 Results

This research provides several strength benefits which could be obtained from this framework.

1. The cultural value priority concept could be treated in an integrative aspect and applied under this management framework, (Fig. 2).
2. A Global Linking Platform (Fig. 3) provides domestic authorities a clear process to set up their own management system which could easily tailor to meet the management needs.
3. The normalization of various data is a basic key issue in the first phase. As for on site, a mobile management system could be established as the main working tool for the implementation of this framework.

Cultural diversity is a main consideration for this management system. The normalization of metadata in the first step and the extended added value are 2 key issues of this system. Besides, an

integrative mobile mechanism provides the site managers an easy and convenient tool for the implementation, which can acquire and transmit on site information in real time.

6 Conclusion

Each country and their monuments hold vast and various data. To link the global concept and local legal system is the basic principle of management. It's essential to collect and sort out data efficiently according to needs then come up with an appropriate interpretation and presentation. With regard to the diversity of cultural heritage together with requirement of management, this research provides a platform and simulation process which shows that holding the content of monument is the key issue for the framework.

Furthermore, government plays a key role in information management; it is always necessary for a government to be concerned and aware of the issues related to legitimacy and legality of the information provided to the public.

Acknowledgements. This research is supported by two projects.

1. Development and Integrated Application of Digital Preservation Technology for Cultural Heritage NSC 99-2632-H-163-001-MY2.
2. Research of Target Requirement and Operational Organization Assignment of Cultural Heritage Disaster NSC 100-2625-M-163 -001

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An Integrated Management System for Historical Buildings: The Case Study of Dihua Historical Street Districts in Taiwan

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Abstract. Dihua Street, a celebrated historic district in Taiwan, was chosen as the subject of the current study. Through three-dimensional (3D) modeling, namely point clouds and reverse engineering, featured in 3D laser scanners, the researcher restored the appearance of cultural heritage and enhanced authenticity in historical preservation. Besides, on the basis of the Taiwan Cultural Heritage Conservation Law, the researcher planned the framework of a digital database and developed a safety monitoring system with a management platform for 3D digital data. As a result, the law serves as a base for applying digital preservation of historical sites in Taiwan as well as integrated management of historical rehabilitation.

Keywords: historical building, historical street districts, 3D laser scanning, digital techniques, integrated management

1 Introduction

In the 21st century, digital preservation technologies are expected to be used efficiently and effectively in order to preserve cultural heritage [1]. Since the Cultural Heritage Conservation Law (the Law) was enacted in 1982 in Taiwan, the authorities have accumulated experiences of historical preservation for 30 years. They have also incorporated much important international practice, such as repurposing, disaster prevention and public participation. Since the 921 Earthquake in 1999, “modern technologies” have been adopted in the Law as an assisting tool. However there is a lack of effective research, development and application in digital technologies, especially in digital integration technology. For the purpose of enhancing the quality and variety of digital rehabilitation of historical sites for expediting the integration of digital data across platforms, this research committed the development and integration of digital preservation technology. Also, the researchers are in the hope that digital preservation technology can be more widely applied in cultural heritage preservation.



Fig. 1. The integrating equipment of 3D laser scanners

The results of digitization are applicable to investigation and research, restoration and design, management, disaster prevention monitoring, geographic information system (GIS) and education, etc. The background of “Taipei XiaHaiChengHuang Temple” and “Taipei Dihua Street” [2] is described below:

XiaHaiChengHuang Temple (fig. 2): The temple is located on #61, section 1 of Dihua Street in Taipei. It was built in the Qing Dynasty (1859) and served as an important building for community gathering. It remains a major venue for various cultural, religious activities or celebrations. It is listed 3rd graded historical monument and one of the three temples of Dadaocheng historical district along with Tszsheng Temple and Fajugung Temple.

Dihua Street Block of Taipei (fig. 2): Dihua Street was first constructed in 1850s and has always been a commercial center for groceries, Chinese medicine, tea leaves, and cloth. The street is 800 meters in length with 77 buildings. The buildings were mostly in Southern Fukien style (tile-roofed, wooden windows and doors), mixed with western style (parapet, arch window, bottle-shaped balustrade), imitation of baroque style, modernism style. They were not only the hub of Taipei commerce, but also representatives of historical street blocks in Taiwan.



Fig. 2. XiaHaiChengHuang and DiHua Street Block of Taipei

2 Integrated Management of Digitization

3D laser scanning [3,4] technology is a growing trend in the 21st century. With the development of 3D laser scanners, 3D data of historical architecture could be conserved for better heritage preservation. Furthermore, incorporation of 3D GIS techniques with cultural property preservation becomes a cutting-edge concept of total solutions. The digital archiving with the help of 3D laser scanning technology in multiple application and research has become one of the most important tasks in the world.

3D GIS and 3D laser scanning technologies are applied in digital preservation of cultural heritage. To simulate the navigation environment of traditional architecture and to establish the virtual reality of adjacent monuments, the researcher took advantage of point clouds for digitization accuracy, scale and speed of the reverse engineering of 3D modeling. Meanwhile, they were processed by 3D GIS software such as Google Earth and Skyline to analyze and manage the navigation task.

3 Digitizing works

This research, sponsored by the National Science Council, lasted for two years from 2010. In the first year (2010-2011), the integrated management of digitization was introduced to XiaHaiChengHuang Temple and it was then extended to Dihua Street in the second year (2011-2012). Integration of digital preservation technology (fig. 3) was introduced on the basis of the knowledge framework of cultural heritage preservation. Furthermore, its management platform includes retrieval and establishment of 3D data, development and integration of GIS, digital monitoring and service platforms, so that preservation and reuse of historical sites can be efficient.

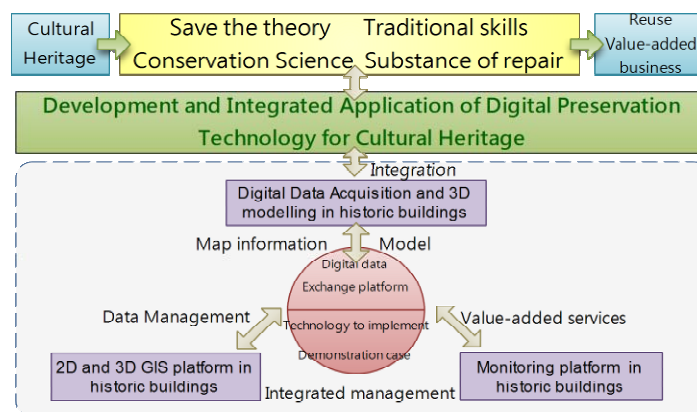


Fig. 3. The framework of integration of digital preservation technology for cultural heritage

3.1 3D laser scanning for XiaHaiChengHuang Temple

The exterior space of XiaHaiChengHuang Temple was scanned mainly by a Riegl-Z420i laser range scanner while the interior by a Faro Laser Scanner Photon80. Scanning stations were set up at every angle in both the exterior and interior space. Moreover, through conjugate points and a total station, data produced by all the scanners were combined to create point clouds.

For scanning of the exterior, a total of six scanning stations were set up to investigate the current condition and qualities of the building. One of the scanners was lifted to 10 meter high by a mobile device, and scanning density was regulated whenever necessary. Each scanner produced 790,000 points per point cloud on average, which were later combined through conjugate points. There were five scanning stations in the interior.

3.2 3D laser scanning on Dihua Street

Dihua Street measures approximately 2,000 meters in length. Along the street were 107 scanning stations in total, where Riegl-Z420i laser range scanners were exploited to scan the District. Conjugate points and features points of the total station were used for registration of scans. About four to eight conjugate points were introduced at each station, and registration precision is presented in the table 1 below. Besides, the stations were scattered in a Z shape, and each of them were set up every 15 to 20 meters in order to completely present the appearance of the District. Point clouds with about 525,0000 points for each were produced at every station. Also, scanners were lifted to 10 meters high by mobile devices so that the mobility of scanners improved and was free from the restriction of local terrain and constructions, and on the other hand data retrieval was bettered and not interrupted by passers-by and vehicles. The scanning results and photographs of operations are illustrated as follows:



Fig. 4. Scanning on Dihua Street and photographs of operations

Table 1. Difference of station registration.

	Average Difference(cm)	The largest difference (cm)	The minor difference (cm)
Different after registration	1.1cm	3cm	0.2cm

3.3 3D reverse engineering for XiaHaiChengHuang Temple

3D modeling was performed using Rapidform XOR3, which transferred the point cloud data into the file format ASC. Some of point clouds were left out based on their quantity and density, and isolated points were removed as well. Therefore, a model was constructed through highly precise point clouds to conform to the actual size. The processes of 3D reverse engineering are shown below (fig. 5).

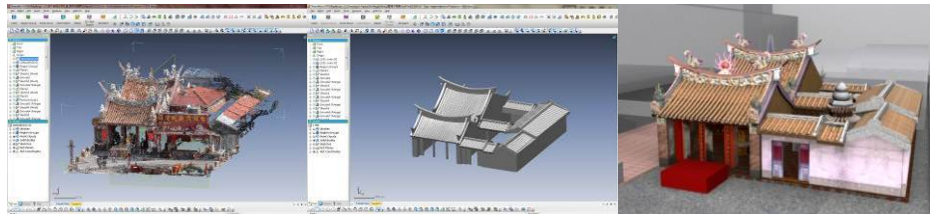


Fig. 5. Process of 3D reverse engineering

4 Integrated platform of monitoring system

The timber structure of XiaHaiChengHuang Temple is that china fir trees are used for framing on the basis of brick walls and granite. The researcher conducted SAP2000 3D finite element analysis and dynamic analysis of the digital data and further established a real-time monitoring platform, as shown in fig. 6.

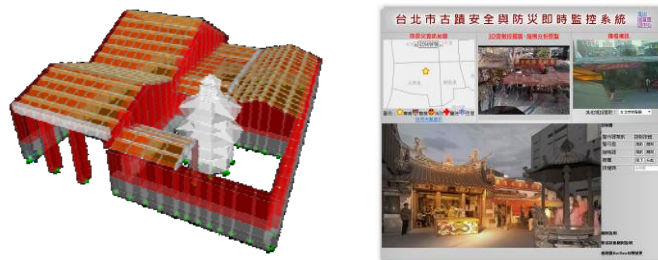


Fig. 6. The interface of real-time monitoring for XiaHaiChengHuang Temple

5 Integrated Platform of GIS

5.1 Metadata

The metadata [5,7] used in the current study was developed to conform to the one concerning preservation and reuse of historical sites. In accordance with the Taiwan Implementation Rules for the Cultural Heritage Conservation Law [6], in Section 2 states that “historical sites and constructions defined in Subsection 1 of Section3 herein refer to the buildings and attached facilities that are constructed long ago and their important parts are still complete. They include ancestral shrines, temples, mansions, city walls, border forts, government offices, stations, academies, steles, churches, memorial archways, graves, dike gates, lighthouses, bridges and industrial facilities, etc.” The researcher only chose “historical sites and constructions” as the materials to develop a research scope and referred to the essential items of relevant regulations to conduct material archiving. The database framework includes basic information sheets, announced information sheets, records of current use of a land, owner sheets, history sheets, construction description sheets, all of which serve as the elementary fields of the database.

5.2 Established 2D and 3D GIS

In this research, Web Portal of Dihua Street was created, where ARCGIS 10 was exploited as a management platform of 2D GIS to provide such functions as searching for and analysis of basic information, as shown in fig. 7. Besides, Skyline was applied as a display platform of 3D GIS.



Fig. 7. Interface of 2D and 3D GIS of Dihua Street

5.3 GIS and disaster monitoring management

In this research, XiaHaiChengHuang was centered on to establish a real-time monitoring system, including real-time video monitoring, a highly precise GPS geometrical positioning and monitoring sensor, a warning light and a buzzer. The data collected by the GPS sensor (fig. 8) were instantly transmitted to Disaster Prevention Center of the China University of technology and processed through innovation-based adaptive estimation (IAE). Real-time monitoring with 1 cm horizontal and 2 cm vertical positional accuracy helped determine structural displacement, and then standard deviation (SD) of the monitoring data that had been collected for a month was figured out. Furthermore, signals and SD percentage were transmitted to 3D GIS management platform for video monitoring and early warning. As a result, risk maps can be drawn up to function as a basis of risk management as the number of monitored historical sites increases.



Fig. 8. GPS positioning and monitoring system

6 Conclusions

This research contributes to the first mile of the digital integrated management of Dihua Street the Historic District. Relevant digital technologies help ensure data accuracy and better management and presentation of data relating to historical architecture. To perfect data management, it is suggested to include multilateral requirements, literature search and consistency with the national metadata standards. Besides, the disaster monitoring system plays an important role in real-time diagnosis of a post-disaster historical site, and it can thus be integrated with the governmental disaster reporting system. Also, it should be updated and analyzed regularly with an eye to fulfilling the government's actual requirements of management and maintenance.

To be short, there will be a tendency towards long-term establishment of integrated management of digitization, and the future research can be undertaken in the following four directions:

- Integration with digital recording technology
Based on the 3D laser scanning technology, future research can be extended to investigate the integration of such digital technologies as close-range photogrammetry, air-lidar and remote sensing; its emphasis can be placed on the influence of data accuracy, complex objects and integration, etc.
- Integration of digital management and monitoring
Based on the heritage structural monitoring technology, future research can be extended to include risk assessment of World Heritage properties and to investigate such integrating mechanisms as factors affecting the property, management and monitoring systems. Its emphasis can be placed on index compilation, assessment systems and appropriate digital management.
- Integration of digital cognition and management
Based on the heritage management technology, future research can be extended to investigate public participation, digital learning and value-added management, of which creative cognitive management of the digital platform lay the foundation. The emphasis can be placed on transformation of cognitive value, digital learning, digital value-added management and level of detail, etc.
- Integration of digital management and display platforms
Based on the GIS technology, future research can be extended to investigate the integration of data management, data display and heterogeneous systems. The emphasis can be placed on knowledge management of metadata format (text and video), heterogeneous database and database network format.

Acknowledgements

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Taiwan Actively promotes and preserves World Heritage

Potential World Heritage Sites in Taiwan

Preparations for being listed as a World Heritage site require a visionary approach to conservation. In order for Taiwan's approach to conservation to keep pace with the international community, in early 2002, the Ministry of Culture (formerly known as the Council for Cultural Affairs) invited local experts, historians, relevant authorities and agencies to recommend a list of potential World Heritage sites in Taiwan. At the end of the same year, experts from Japan and Australia, Yukio Nishimura, Shinto Sugio, and Bruce R. Pettman, were invited to Taiwan to canvass these potential sites. After several meetings and discussions, a working list of 12 potential world heritage sites in Taiwan was drawn up. In 2010 a meeting held by Taiwan's "World Heritage Committee" passed a resolution to add six more potential sites.



Location of potential sites

Why are we actively seeking nominations to the World Heritage List?

- 1.To bring local conservation concepts and practice up to international standards.
- 2.To highlight Taiwan's culturally specific features, while bringing Taiwan closer to the world stage.
- 3.To increase local residents' self-confidence and enhance their sense of pride in their own culture.
- 4.To improve the quality of life for local residents.
- 5.To develop cultural tourism, creative industries and other associated industries, as well as fostering economic development.





行政院文化局文化資產局
Bureau of Cultural Heritage, Ministry of Culture



金門縣文化局
www.kinmen.gov.tw



中國科技大學
Tsinghua University



Center for Cultural Sites
Rehabilitation and Development

26



Kinmen Chronology (Since B.C. to 19th)

World History

Ancient Greece **800-146**
Military Expansion of Alexander the Great **334-323**

Fall of the Western Roman Empire **476**

Hundred Years' War starts **1337**

Establishment of the Hanseatic League **1367**

End of the Hundred Years' War **1453**

Columbus discovers America, Age of Discovery starts **1492**

Leonardo da Vinci finishes painting Mona Lisa **1506**

Michelangelo finishes painting the ceiling of the Sistine Chapel **1512**

Martin Luther launches the Reformation **1517**

Accession of Elizabeth I, Queen of England **1559**

East India Company established **1600**

Dutch East India Company established **1602**

Accession of Louis XIV, King of France **1654**

Age of Enlightenment **1650-1804**

United States declares independence **1776**

James Watt improves the steam engine **1785**

French Revolution **1789-1799**

Napoleon I becomes Emperor of France **1802**

Volume I of Karl Marx's Das Kapital is published **1867**

Wilhelm I of Prussia is proclaimed German Emperor **1871**

B.C

A.D

Kinmen History

6000-3800 Fuguodun Culture in Kinmen

2000-1500 Pubian Culture in Kinmen

ca. 400 Six Clan immigration (Jin Dynasty, 4th century); Mainland culture transplanted to Kinmen, laying foundation for future development

803 Chen Yuan, head of Imperial Office For Horse Breeding and Raising, leads 12 Clans to settle in Kinmen.

978 Kinmen incorporated into Chinese imperial system: residents begin to pay head tax and are issued receipts.

1311 Yuan Dynasty sets up Salt Transportation Department in Fujian to oversee seven saltworks, including Wuzhou Saltworks in Kinmen

1387 (Ming Dynasty): Islands named Kinmen (= "Golden Gate", abbreviation of Chinese phrases: "a metal fortress surrounded by a moat filled with boiling water," and "an imposing gateway to the sea"). Thousand Household Defense Division is established.

1550-1588 Portuguese trade and load shipments on Kinmen; Kinmen appears on Spanish nautical charts

1650-1680 Koxinga takes Kinmen bases for resistance against Qing Dynasty. During this period, Qing government forces residents to move away from coastal areas (1661), and imposes shipping interdiction. Koxinga's forces move bases to Taiwan.

1680 Zheng Keshuang, Koxinga's grandson, surrenders to Qing Dynasty; Qing troops land in Taiwan; Taiwan is incorporated into Qing Empire

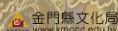
1682 Qing government sets up general military office at Congqingxuan (former home of Ming scholar Xu Xie). Political center moved to Houpu

1735 Beacons, artillery batteries, lookouts and water reservoirs built: Kinmen becomes officially recognized military base.

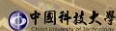
1866 General military office restructured: deputy general appointed as Kinmen chief, under jurisdiction of Fujian Admiral.



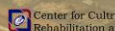
行政院文化局
Bureau of Cultural Heritage, Ministry of Culture



金門縣文化局
Kinmen Cultural Bureau



中國科技大學
Tsinghua University



Center for Cultural Sites
Rehabilitation and Development



Kinmen Chronology (Since 20th)

World History

World War I starts	1914
End of World War I, Weimar Republic established	1918
Athens Charter	1931
World War II starts	1939
World War II ends	1945
Korean War	1950-1953
Vietnam War	1959-1975
Venice Charter	1964
World Heritage Convention	1972
Unification of Germany	1990
Soviet Union is dissolved	1991
Nara Document on Authenticity	1994

20th



21th



Kinmen History

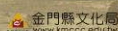
1911	After founding of Republic of China, Kinmen and Xiamen become part of Siming County.
1911-1940	Because of turmoil and economic difficulties, many men emigrate to Southeast Asia and Japan to earn a living. Remittances used to put up foreign style buildings.
1937	Three months after Marco Polo Bridge Incident (1937), Kinmen is occupied by Japanese troops for eight years.
1949	Civil war between Chinese Communists and Nationalists breaks out. Battle of Guningtou starts in Kinmen.
1956	Implementation of military administration: large number of troops stationed in Kinmen.
1958	Outbreak of 823 Artillery Barrage; Communists shell Kinmen on odd-numbered days; propaganda leaflet shells used by both sides; Kinmen becomes extended battlefield in Chinese civil war between Communist Party and Nationalist Party.
1971	Republic of China withdraws from United Nations.
1979	Establishment of diplomatic relations between Communist China and United States; Kinmen shelling stopped.
1982	Taiwan's Cultural Heritage Preservation Act promulgated.
1987	Lifting of martial law in Taiwan, Republic of China.
1992	Lifting of military administration, Kinmen opened up for domestic tourism.
2001	Mini Three Links (direct postal, transportation, and trade links) between Kinmen and Xiamen take effect.
2002	Council for Cultural Affairs of The Republic of China (now Ministry of Culture) designates Kinmen as potential World Heritage site.
2012	Kinmen prepares for World Heritage nomination.

Revised Operational Guidelines
for the Implementation of the
World Heritage Convention
(article 290)

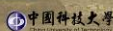
2005



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金門縣文化局
Kinmen County Cultural Bureau



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Center for Cultural Sites
Rehabilitation and Development



Cultural properties in Kinmen

Registered Tangible Cultural Properties

With a history over 1600 years, many Chinese dynasties have left distinctive traces on Kinmen. Construction and facilities sponsored by officialdom and by civil pioneers slowly shaped its landscape and appearance. Even though Kinmen was touched by various wars, it was very fortunate not to be unduly affected by them; the island is dotted with many ancient buildings. Many of the properties in Kinmen have been officially registered under Taiwan's Cultural Heritage Preservation Act. Kinmen's tangible cultural properties currently include 43 sites registered as monuments, 144 sites as historic buildings, and 1 site as a cultural landscape.



Registered Intangible Cultural Properties

With its long history, Southern Min traditions are deeply rooted in Kinmen. Ironically, because it was kept under military administration for so long, the pace of modernization in

Kinmen has been much slower than in Taiwan proper. As a result, many aspects of the Southern Min traditional lifestyle are alive and well. Taiwan's Cultural Heritage Preservation Act takes note of six traditions and ceremonies under the heading of "Folk culture and related artifacts": Mid-Autumn Festival Moon Cake Gambling, Universal Deliverance Lanterns, the reception of the City God on April 12, the Cai Clan ancestor worship ceremonies, Wind Lion Deities (that protect Kinmen against strong wind), and the Houhu Village Sacrifices (every 12 years). We hope that with the help of our national laws, this intangible cultural heritage will be preserved.

Other unregistered valuable cultural properties

Kinmen has many settlements that are composed of traditional Southern Min buildings; these buildings are faced with crises arising from the process of modernization. However, by working together, the county government, the National Parks Administration, and local residents are making a concerted effort to protect these traditional buildings in the settlements from being replaced by modern architecture. We hope that in the future, these traditional settlements can also come under the protection of national laws.



Settlement photos



Kinmen's Outstanding Universal Values

Kinmen's living Southern Min culture has been well preserved over the past 1600 years. While it is still evolving, this culture is tightly integrated with the everyday lives of Kinmen residents. Kinmen's culture manifests itself in various forms ranging from intangible traditions, philosophy, ceremonies, and arts to tangible entities such as buildings, settlements, ancestral shrines, and family temples, all of which intact and completely preserved. Although the island has suffered through countless wars, a longing for peace and stability has become the common people's basic belief. The defense systems established by civilian and government authorities, the cultural and educational facilities, the religious beliefs, talismans, and mascots all serve as manifestations of the people's longing for peace and stability.

Kinmen: living Southern Fujianese Culture satisfies criteria (ii) and (iii) for inclusion on the World Heritage list

Criterion (ii): Over the past 1600 years, Kinmen has suffered from constant threat of wars. Based on the strength of kinship ties and religious faith, Kinmen has evolved a multifaceted culture whose rich mix of Southern Fujianese culture, emigrant contributions and military artifacts provide physical evidence of the strength and authenticity of basic values in the face of war.

In Kinmen there are 170 ancestral shrines, 280 temples, and 130 clan-based settlements. The remains of military and civil defense facilities also serve as a testimony to Kinmen's values.

1. Qionglin Settlement

This settlement, which embodies living Southern Fujianese culture, has been developing for over 1000 years.

2. Zhushan Settlement

Laid out in accordance with Chinese traditional fengshui concepts, an ancestral shrine and a reservoir form the core of this settlement.

3. Shuitou Settlement

A large settlement which is a harmonious blend of Southern Fujianese and diaspora culture.

4. Shanhou Settlement

The overall planning of these villages was supported by overseas remittances.

5. Guningtou Settlement

This settlement bore the brunt of the violence of war.

6. Houpu Township Core Area

Historical, political, economic, cultural and educational center of Kinmen.

7. Zhaishan Tunnel

Military facilities and relics from the cross-strait Cold War confrontation.

Criterion (iii): Kinmen has a rich Southern Fujianese culture, a living breathing organic culture which continues to be nourished through the common people's houses and buildings, farms, fisheries, religious ceremonies and spiritual faith. For the tens of millions of Southern Fujianese people scattered throughout today's rapidly changing global society, Kinmen's unique, excellently preserved cultural artifacts and its particular form of Southern Fujianese culture reflect values of integrity and authenticity.

1. Traditional Southern Fujianese settlements and architecture.

2. Western style buildings.

3. Life, language and seasonal customs.

4. Spiritual faith and religious ceremonies.



行政院文化建設委員會
Bureau of Cultural Heritage, Ministry of Culture

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www.kinmen.gov.tw

中國科技大學
www.nctu.edu.tw

Center for Cultural Sites
Rehabilitation and Development



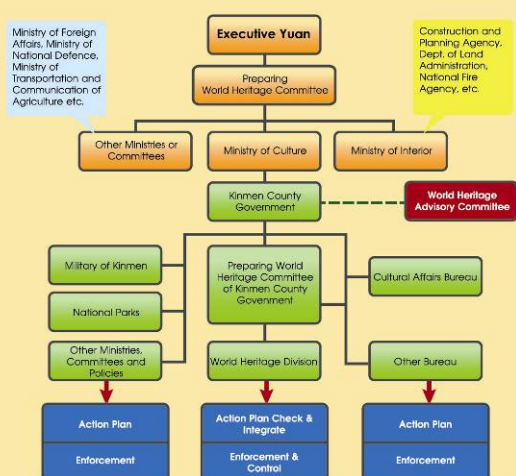


Preparation Work for Submission of Kinmen's Nomination as a World Heritage Site 2002-2012

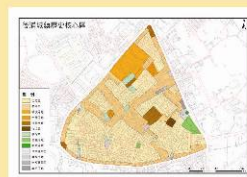
Although the Republic of China is not one of the member states of the United Nations, when the time is ripe, it is necessary for us to be thoroughly prepared. It has long been a global trend for state parties to preserve their heritage in accordance with the standards provided by the World Heritage Centre. The ROC should maintain pace with such trends, for by relying on such thoroughgoing standards, we can reexamine our efforts to maintain historic monuments and their environment in order to recognize failings and apply corrective measures.

By considering the many successful nominations, we have come to recognize that inscription on the World Heritage list is a very time-consuming process which entails continual reexamination and reflection on our culture, a cyclic learning process which leads to gradual change rather than revolution, seeking slow solutions rather than instant opportunities. We are still learning, and we hope that everyone can contribute to our mission.

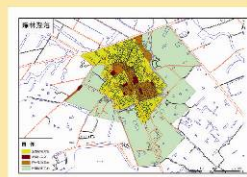
Administrative Hierarchy for the Submission of Kinmen's Nomination



2. Demarcation of the boundaries of the nominated properties



2011 The Core Area in Houpu Township



2012 The Qionglin Settlement

3. Regulations and Management

4. Participation of the public



5. Promotion and Publication

2011 Kinmen Progresses Towards World Heritage Listing published.

2012 Outstanding Universal Value of Kinmen's Battlefield Culture : in preparation.

2012 Tourism and Public Participation in Kinmen's Cultural Heritage : in preparation.

6. International Promotion



Visiting foreign experts

Visiting foreign experts

Exhibition in Macau

Workshop

1. Value Assessment

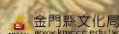
2011-2012 Investigation of cultural heritage in Kinmen.

2011-2012 Drafting of the dossier for submission of the nomination.

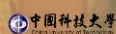
2011-2012 Database constructed for Kinmen's cultural properties.



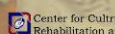
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