Ceramics Digitization Procedures Guideline

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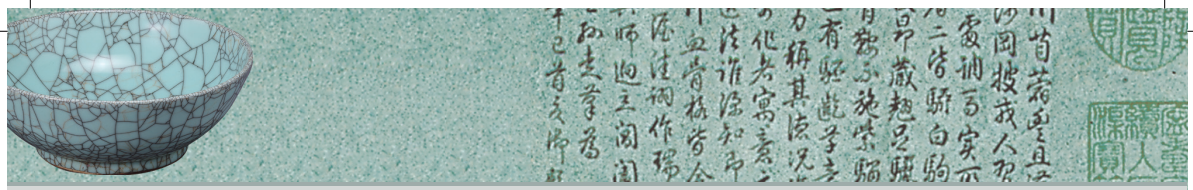
Taiwan e-Learning and Digital Archives Program
Taiwan Digital Archives Expansion Project



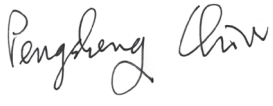
Preface

In January 2002, the National Science Council of the Executive Yuan of the Republic of China launched the National Digital Archives Program under the leadership of Dr. Ovid J.L. Tzeng, then vice-president of Academia Sinica. Over the past five years, the digital achievements attained by the project have been quite remarkable. The majority of these digital achievements may be viewed by the public (for non-commercial, lawful purposes) free of charge on the main portal site of the National Digital Archives Program (http://digitalarchives.tw). Since the beginning of 2008, the project leaders have embarked upon the second stage of development. The name of the project was changed to Taiwan e-Learning and Digital Archives Program (http://www.teldap.tw), and the executive director of this project is the current vice-president of Academia Sinica, Dr. Ts'ui-jung Liu. The Taiwan e-Learning and Digital Archives Program consists of eight core projects, one of which is the Taiwan Digital Archives Expansion Project (http://content.teldap.tw). Under the direction of Dean Fu-shih Lin, the College of Liberal Arts of the National Chung Hsing University, the Taiwan Digital Archives Expansion Project is closely collaborating with the experts and staff of the main TELDAP project and the other core projects. Our aim is to display Taiwan's cultural and natural diversity in digital form.

Since the completion of the first stage of the project, we have worked hard to record the digitization procedures of all of the organizations and institutions involved in digitizing their treasures. We have successively published over twenty digitization procedures guidelines related to the digitization of flora and fauna, archival documents, pictures, cultural

relics, and other materials. The purpose of these digitization procedures guidelines is to forge specific guidelines for the digitization of different kinds of archival material, determine priorities in digitization work, establish meta-data, computer programs needed for digitization, and the long-term preservation of digital material. In order to strengthen international exchange in digital archival work, we have now translated three digitization procedures guidelines (on the digitization of ancient Chinese string-bound book, ceramics, painting and calligraphy) into English. By doing so, we hope to share our digitization experiences and spur cooperation in digitization work in future years.

We will continue to work together with the experts and staff of each digitization project to refine the digitization procedures guidelines for different types of digital archival material. We welcome any suggestions or comments on the digital archives by users in Taiwan or abroad.



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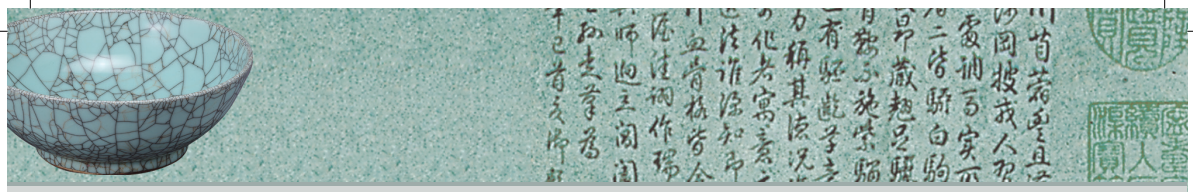

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One. Introduction

–The greatest enterprise of the mind has always been and always will be the attempt linkage of the science and humanities.

<<Consilience>>1998. P.8

Edward O. Wilson (1929-)

China's Jingdezhen is renowned for its quality china. From the original manuscript of a purchase order made by England to China's Jingdezhen for blue-and-white porcelain during the late Ming Dynasty, we can see that specific requirements were made for artwork on the porcelain, hoping that the artwork would be mainly female characters and best if they came with a story. Due to these requirements, Jingdezhen specially produced a batch of blue-and-white porcelain plates and vases based on the love story of Chang Chun-Jui and Tsui Ying-Ying in "*The Story of the Western Chamber*"; this batch of porcelain unexpectedly became the earliest media for spreading "*The Story of the Western Chamber*" to Europe, and induced its English, German and French translations.[1] The historical value and social meaning of an artifact is often larger than the object itself; an ordinary piece of ceramic clay can become a piece of art that conveys cultural features and records transitions in time after going through high temperatures and the painter's originality.

Cultural transmission events such as the one above may be rare in the 17th century, however today in the 21st century we are able to show the world our rich cultural heritage and local features through digital archives, thanks to the popularity of the internet. Main domestic units

[1] "A Literature Study on *The Story of the Western Chamber*" by Chiang Hsing-Yu, Shanghai Classics Publishing House, 1996, page 58.

currently engaged in ceramics digitization work include the National Palace Museum and National Museum of History. Their digitization achievements not only achieve the purpose of preserving national artifacts, but also provide the general public with an abundance of information. Today, people can connect to the internet anytime and anywhere, they can explore the mysterious blue Ru wares at the National Palace Museum, and also relish the rich artwork on Changsha wares in the National Museum of History.

Apart from the ancient ceramics collected in museums, kiln sites from all over Taiwan are continuously creating ceramics with local features. Ancient ceramics needs to be preserved via digital archives, but ceramics with local features demands digitization more eager to enable the world to know the subtleties of this traditional technique, as well as the rich creativity of Taiwanese people. This book was named "*Ceramics Digitization Procedures Guideline*", its main purpose is to integrate prior digitization work experiences of different units and generalize a guideline for digitization work, allowing a set of standards to be provided to ceramic holding units when they join the ranks of digital archives, and helping them to truly understand the meaning of digital archives.

When most people think of "digital archives", their idea of the term is limited to digital images of objects. Without doubt, a part of this book will relate to how to create image files suitable for digital archives, especially with the fact that material of ceramic itself easily reflects light and is harder to photograph than other objects. This is why digitization work emphasizes on how to take a picture that perfectly shows the ceramic's shape, at the same time clearly expresses the texture of artwork. If digitization work ends at the creation of digital image files, then it

brings little meaning to artifact preservation and knowledge transmission. The establishment of metadata for artifacts and integration via the development of a database system is also required for archives to be properly preserved and utilized, truly implementing the meaning of digital archives.

Two. Digitization Flowchart

This book is mainly divided into four parts based on the digitization procedures: The first part is on preliminary operations of digitization work, including checking and organizing the museum's collection, determining the production method for artifact digital images, and establishing image specifications and naming methods; the second part describes the process of ceramics imaging; the third part discusses metadata establishment and related tasks; the fourth part analyzes equipment of digitization work. Please see Figure 1 for the overall digitization flowchart.

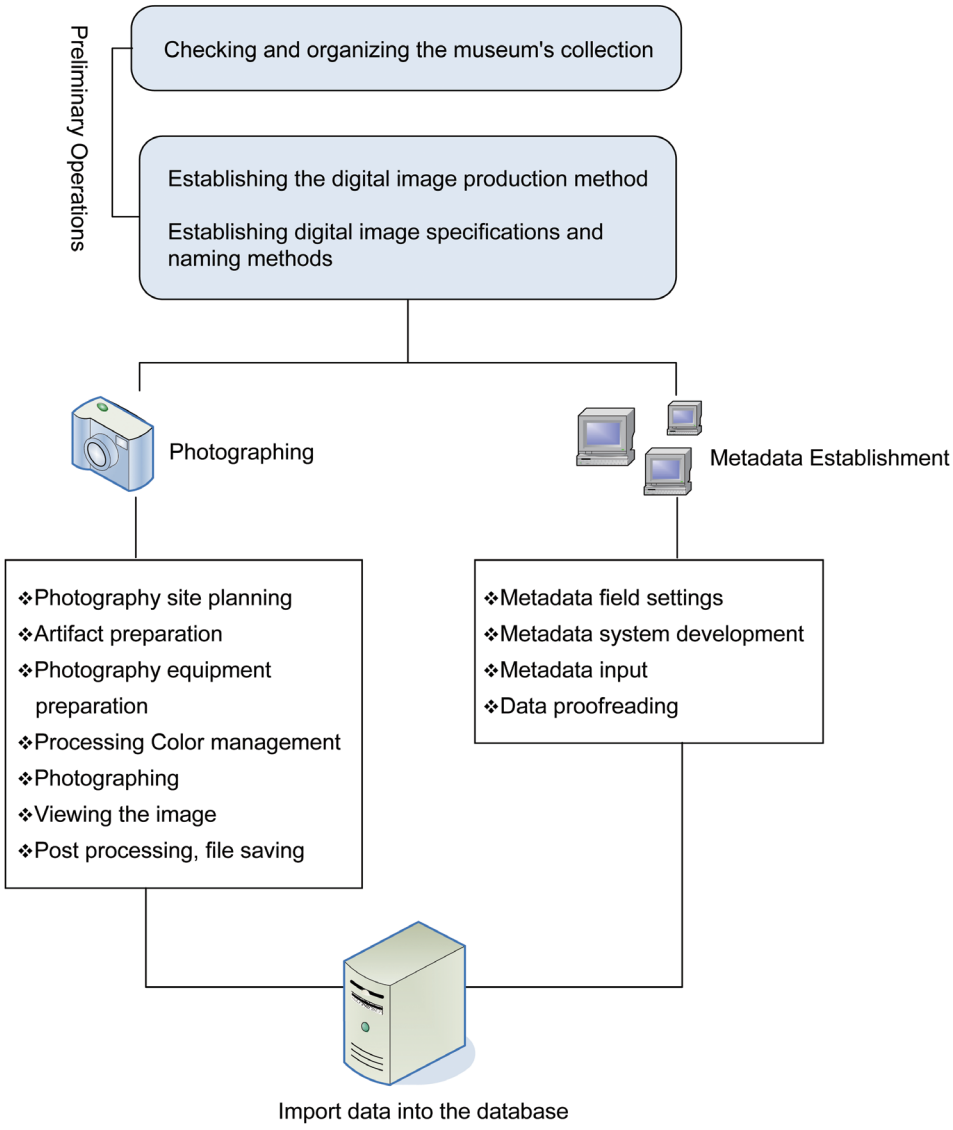


Figure 1. Ceramics Digitization Flowchart

Three. Preliminary Operations

I. Checking and Organizing the Museum's Collection

* Purpose: To check and organize the museum's collection, understand the collection's status, and use the list for recording the progress of follow-up digitization work.
* Related tasks: Making a complete inventory of artifacts, and updating the list at all times to avoid leaving out any new collections.

The artifacts list should include two parts:

(1) Basic Information: Serial number, registration number, title, provenance, type, dating, quantity, unit, size condition and digitization priority. In which the standard for digitization priority gives consideration to[2] :

a) The artifact's importance

i) The artifact's ranking (national treasure, important artifact, artifact, etc.);

ii) The artifact's preciousness (originality, rareness, style, and other irreplaceable characteristics);

iii) The uniqueness (special considerations of who, what, when, why and where);

iv) Urgency of digitization (fragile, hard to preserve, etc.);

v) Other considerations.

b) Value of the digitization product

c) Circulation of the digitization product

This part of the list can be expressed using numbers 1~3; 1 means highest priority, 2 means second priority, and 3 means last. This way the holding unit can arrange a digitization schedule based on priority.

[2] "A Preliminary Study on Museum Collection Digitization Metadata – Using the National Museum of History as an Example" by Wu Kuo-Chun, International Conference on Museum Digitization, 2003, page 257.

(2) Image Digitization Related Information: Check if images have already been made for the artifact and record follow-up image capturing, for example, the artifact has special patterns or detailed information that requires additional shoot, and information on the photographer.

II. Image Digitization Work Planning

(1) Determining the Production Method for Artifact Digital Images

The main method for digitization is to photograph artifacts into 2D images. During early periods, image digitization mainly employed the use of medium to view cameras for film photographing, and then the picture taken was scanned into a digital image file. Based on considerations for reducing cost and saving time, while maintaining image quality, image digitization today uses digital camera backs. Camera backs not only maintain image quality, but also allow images to be directly displayed on the computer monitor immediately after taking them, helping working staff to manage images. So that images that don't meet requirements can be retaken immediately, avoiding repeated borrowing of the same artifact and reducing the chance of damaging artifacts when moving them. Therefore, former director of the National Palace Museum Information Center, Mr. Shun-Tzu Tsai, once said that he hopes an artifact won't need to be re-photographed at least within 15 years after it is digitized. This shows that extra importance should be attached to the image production method during digitization. At present, both the National Palace Museum and National Museum of History use camera backs for artifact digitization.

(2) Establishing Digital Image File Specifications

The main file formats used in image digitization are RAW, TIFF and JPEG. In which RAW files are the original image file produced by digital cameras; RAW files are uncompressed files that are able to show rich colors and multiple layers. Although TIFF files are compressed files, its

low compression rates allow images to maintain high quality. TIFF files are relatively large files compared with RAW files, but more software support its use. JPEG is a high compression rate format that causes images to lose quality, but its files are relatively small and it's currently the most popular image file format used on the internet. Please see the table below for file format characteristics and file size.

Table 1. Image files format characteristics and file size

File Format	Characteristics		
RAW	1.Files haven't been through any form of compression and retain the colors and details of images. 2.File size is about two thirds of TIFF files and takes relatively less storage space. 3.Can only be opened by special software.		
TIFF(.tif)	1.Larger file size than RAW files, but is very popular, can be used on numerous platforms, and has the ability to operate cross platforms, such as Microsoft Windows, DOS, UNIX and MAC. 2.Low compression rate, but images don't lose quality.		
JPEG(.jpg)	A high compression rate format that causes images to lose quality, but has relatively small file size and is suitable for online browsing.		
File size of different file formats (Using CCD 6 mega pixels as an example)			
File Name	RAW	TIFF	JPEG
File Size	Roughly 13MB	Roughly 18MB	Roughly 3MB (High Quality)

Besides file format, file specifications also include color mode and image resolution. Units must decide on file specifications based on usage purpose after image digitization. Generally, ceramics digital image files are used for the following purposes:

a) Preservation

b) Research purposes

c) Printing and publishing

d) Online browsing

Based on the ceramics digitization purposes above, we have listed the following reference specifications for related files:

Table 2. Reference specifications for digitization files

	Preservation	Printing and Publishing	Online Browsing
File Format	TIFF	TIFF	JPEG
RGB	24 bit full color	24 bit full color	24 bit full color
Image Resolution	300-600dpi (Based on the size of the original object)	General printings can use 300dpi; use 350 dpi for publishing (Based on printing size)	72dpi

(3) Establishing Digital File Naming Method

For the convenience of managing and searching digital data, working staff must give digital image files a unique name to identify it once it is produced. At present, there is no unified standard for naming digital files, but from the viewpoint of file management, it is recommended to consider the following factors when naming files:

a) The file name can be traced back to the original object and the unit that provided it.

b) Original image files will be converted into different file formats based on its purpose. Therefore, the file name should tell you which file format of which object it belongs to.

Furthermore, in order to let the file name be readable on different platforms, it is recommended that characters of the file name be in accordance with the following standards:

a) Use lower case letters and numbers for the file name.

b) Don't use special characters, such as %, /, ?, #, *, and -.

Please refer to the digitization naming principles of the National Central Library digital archives project (http://readopac.ncl.edu.tw/ndap/ndap-doc-03.htm) for other recommendations on file naming.

Besides general naming principles for digital files, holding units also need to establish rules for expressing the ceramics' photograph situation (whole or partial) and when the ceramic set comprises of multiple pieces (e.g. the ceramic set comprises of a tea pot and tea cups). Below we will use ceramic set that comprises of one tea pot and three cups as an example to describe the file's naming method. In the table below, part A is the complete image file of the ceramic set, which is why its number is 00; part B is the first piece of the ceramic set, making its number is 01. Furthermore, if detailed patterns are separately photographed, change the names of such files from na to nd; the serial number (the last two digits) of the first detailed pattern photograph is 01, the second is 02, and so on.

Table 3. Digitization file naming example

	Illustration	File Name	Description
A		cr000001na0001	1.cr is the abbreviation for ceramic. 2.000001 is the artifact's collection number. 3.n (normal) means that the artifact is in a normal state. 4.a (all) or d (depart) means the image is a part or the whole artifact. 5.The two digits in gray are the piece's number. 6.The last two digits 01, 02… are the image's number.
B		All: cr000001na0101 Depart 1: cr000001nd0101 Depart 2: cr000001nd0102	
C		All: cr000001na0201 Depart 1: cr000001nd0201 Depart 2: cr000001nd0202	

Reference: National Museum of History File Naming Rules

Four. Object Digitization Procedure

I. Site Planning and Photography Equipment Preparation

* Purpose: Site planning before artifact photographing, and choosing the best photography location for equipment arrangement.
* Related Tasks: The site must be prepared with a photography platform, lights, camera, computer, working platform and at least two working staff.

(1) Considerations for selecting photography location include:

a) The size of the site must at least be able to accommodate all of the photography equipment mentioned above.

b) It is best if the photography location had a totally dark environment and the only light was from the lighting equipment; this way the image's color can avoid being distorted by external lights (if a professional darkroom cannot be found, install blackout fabric in the photography location to block external light).

c) Ceramics is made from inorganic substances and not easily influenced by temperature, relative humidity and light. Therefore, no special restrictions exist on the temperature and humidity of the photography environment.[3]

d) The recommendations above are based on photography environment. The photography location should also give consideration to the artifact's security, meaning that the distance artifacts are move should be as short as possible and the line of movement should be thoroughly thought out.

(2) Photography Platform

When setting up the photography platform, the artifact's size is not the only thing that should be kept in mind, selection of background

[3] The most suitable environment for protecting artifacts is room temperature between 20-24% and relative humidity between 50–65%.

paper also plays an important role to image quality. Background paper is generally gray, white or black, in which white and gray are neutral colors and are suitable for objects of any color. However, please keep in mind that the object's color shouldn't be too close to the background paper's color; for example, if the object is a light color, then use black or gray background paper; if the object is a dark color, then use white background paper.

(3) Lighting Equipment (Please see chapter six of this guideline for details on equipment selection)

(4) Camera Backs (Please see chapter six of this guideline for details on equipment selection)

(5) Equipment (Please see chapter six of this guideline for details on equipment selection)

(6) Others: Tripod, computer work platform, ceramics cleaning tools, artifact photograph list

II. Artifact Preparation

* Purpose: Borrow the ceramic object to be photographed, move it to the photography area, and prepare it for photographing
* Related Tasks: Fill in an artifact borrowing list in advance, and place the ceramic object on the photography platform in accordance with rules on holding the ceramic object.

(1) Holding the Ceramic object

Before holding the ceramic object, check to see if its structure is secure, over estimate its fragility as much as possible, and don't touch where it has special patterns. The correct way to hold ceramic object is to avoid holding it from its weaker parts, such as its two ears, handle, parts that are sticking out, or where it is connected together, use both hands to support the most stable part of its body, pick it up from its base, and move it to the photographing position. Gently hug large ceramic vases

with your palms and in between your elbows, gently lean artifacts with higher center of gravity against your body, and then pick it up. After moving the ceramic object to its photographing position, make sure its weight is evenly supported and is in a secure state before slowly letting go your hands.[4]

Generally, artifacts should only be held when wearing gloves, but the smooth surface of ceramic object is slippery, so make sure the gloves are skidproof. When the ceramic surface is to smooth and must be held without wearing gloves, make sure both hands are clean and dry. No matter what its size, try to only hold only one piece at a time, artifacts with caps should also be held separately to avoid accidents. If multiple pieces need to be held at once, use a stable and skidproof tray; if the artifact is to be moved to another room or up/down stairs, use a basket or box that has a cushion, and place soft pads to avoid pieces from knocking against one another, but make sure that not too many pieces are in the same basket.[5]

In addition, before moving the artifact, make sure the line of movement is clear and smooth, and that there is enough room the place the artifact. Working staff should wear formal work clothes (to avoid buttons or decorations on clothes damaging the artifact) during the whole process from holding artifacts to when photography work is completed, and should remove any accessories, such as watch, bracelet and ID.

(2) Cleaning the Ceramic object

After placing ceramic object in front of the photography platform, use air bubbles, a vacuum cleaner or soft brush for cleaning off dust and dirt to ensure image quality.

[4] Reference: "Key Points of the 'Artifact Handling Safety Demonstration'" by Kou You-Lin, 2002, " National Digital Archives Program Newsletter" , Issue 2 (http://www2.ndap.org.tw/newsletter06/news/read_news.php?nid=972)

[5] Notices on Borrowing Artifact for Photographing, National Museum of History

(3) Positioning the Ceramic object

The position of ceramic object on the photography platform should be at a certain distance from the background to give its environment a spacious and three dimensional feeling. If the ceramic object is placed too close to the background, it will compress the image's foreground and background, losing the sense that the image is a solid object.

III. Photography Equipment Preparation

* Purpose: To make sure lighting, camera and computer equipment are prepared and ready (e.g. cold lights and CRT monitors need to be on for 30 minutes to ensure stability of light source and monitor color temperature).
* Related Tasks: Making lighting and lens adjustments in accordance with the size, shape, patterns and color of the ceramic object.

(1) Lighting: Consider lighting arrangements when photographing the ceramic.

The surface of ceramics contains glaze, causing reflection and light-spots when light is shone on the ceramics during digitization. Although delusterant can be applied parts of the ceramic object when it is photographed and then cleaned afterwards[6], reflections in fact show the characteristics of the material, which is why it isn't recommended to apply any substance to the ceramic object and the problem should be handled via lighting arrangements. Below are some recommendations for handling light during ceramic object photographing:[7]

a) Dealing with light-spots:

i) There shouldn't be too many light-spots, so try controlling the number of light-spots or lines of light to one per surface of the

[6] Same as 4.

[7] http://www.f123.com.cn/sj/zsc/zs_10.html

object.

ii) Don't let the light-spot be on the ceramic artwork.

iii) When photographing ceramic object with colored patterns, adjust the light's angle to move the light-spot to a white and clean part.

b) How to remove excessive reflections on the ceramics:

i) The use of a polarizer can weaken or remove reflections. Put the polarizer over the lens and slowly rotate it until you see the reflection weaken or disappear in the viewfinder.

ii) Surround the object with semi-transparent white paper or white cloth, leaving a hole in the front for the lens to enter through; it works like a static object photography case (as shown in Figure 2).

iii) Add a layer of tracing paper in front of the light bulb to soften the light. Or, use an umbrella reflector or white paper used as a reflector and photograph the ceramic object using light reflected of these reflectors.

Figure 2. Still-Life Photography Case

Description: The static object photography case is designed to reduce reflections from the object being photographed, using semi-transparent light shields to soften light rays.

(2) Camera and Computer Connection, Camera Adjustment

a) Make sure the camera is connected to the computer system.

b) Adjust the camera lens to make it level, use an instrument to aid measurement if necessary.

c) Composition: Make the artifact and related labels evenly displayed in the picture.

IV. Processing Color Management

* Purpose: To ensure the trueness of the artifact's image, and cause image peripherals (monitor, printing) to display the same or close colors of the same image.
* Related Tasks: Create color profiles for the monitor, digital camera and printer.

(1) Monitor Color Calibration: Use Adobe Gamma for color calibration, or use special equipment, such as a spectrophotometer (Figure 3), together with color management software to produce a color profile.

(2) Digital Camera Color Calibration: Place the ColorChecker Chart in a photography environment with a stable light source, use the digital camera to photograph the color chart, start the computer's color

Figure 3. Using a spectrophotometer for monitor color calibration

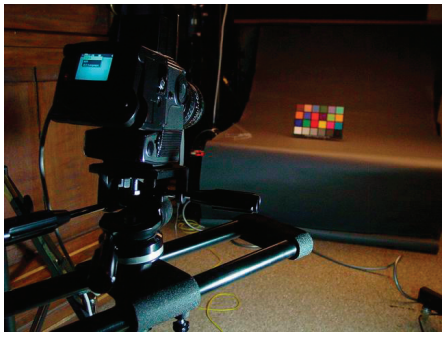


Figure 4. Conducting digital camera color calibration under a stable light source

calibration software for computation and produce the color profile (Figure 4). A different color profile needs to be produced whenever the light source changes.

Besides the production of color profiles, the following hardware usage situations also require special attention to avoid affecting the quality of color management: 1. Noise of the digital camera back CCD; 2. Aging of the CRT monitor; 3. Changing cold light florescent tubes.[8]

V. Photographing: Verify that the exposure and focus settings are correct before photographing

Some artifacts have high research value or exhibition demand because of their unique shape or patterns. Therefore, separately photograph four aspects of ceramic object, the opening, bottom, and unique pictures and patterns on the ceramic object. Arrange the photographing order based on surface, shape and size, putting ceramic object with similar characters close in line can significantly reduce photographing time.[9]

VI. Viewing the Image

* Purpose: To verify whether or not the image quality meets requirements.
* Related Tasks: Working staff with image verification ability

Verification Items Include:

(1) Are there any foreign bodies, dust on the artifact or in a clear part of the image?
(2) Is the image exposure accurate?
(3) Is the grayscale balanced?
(4) Is the composition complete?
(5) Are there any light leaks?

[8] National Museum of History, 2003 Digital Archives Final Work Manual, page 92.
[9] Same as 4.

(6) Is the light-spot on the ceramic object covering any main patterns?

VII. Post Processing

* Purpose: To edit the image, calibrate its colors, and convert the image file.
* Other requirements: Keep a copy of the original image file that hasn't been processed. (The RAW file produced by the digital camera back is generally the file preserved. RAW files do not only preserve image data, but also save the original photography settings.)

Post processing items include:

(1) Embedding ICC Profile

(2) Utilize image-editing software to sharpen the image and adjust the color-depth and curves.

(3) Image File Conversion: Save the edited image file according to the unit's requirements in TIFF format and another copy in JPEG format.

VIII. File Storage

* Purpose: To ensure the proper storage of digital files.
* Related Tasks: Store digital files in discs, hard disks, RAID, or magnetic tape machines in the form of remote backup.

The advantages of storing files in discs include low cost, easy storage and access, and long service life under proper care. However, in order to prevent accidents from destroying files, backup data on a second disc or in other hardware. Regular tests should be arranged to verify if digital files can be opened.

Five. Metadata and Database Establishment

I. Introduction to Metadata

The work of digital archives doesn't stop at the creation of artifact image files for permanent preservation, but also includes creating text data that describes artifacts in databases for users to search and use. The text data mentioned above is what we call "Metadata", meaning "data about data". Metadata not only records elements, attributes, records and data structures of the unit's digital archives, but also includes descriptive data, such as background, quality or data characteristics. In brief, the function of metadata is to help the provider, owner and administrator of digital archives to store, control, manage, spread and exchange digital resources; furthermore, to the users of digital archives, metadata can aid the search, identification, acquisition and use of digital resources. Therefore, the establishment of metadata should not only think from the perspective of administrators, but should also consider the requirements of users. For example, the 1995 Consortium for the Computer Interchange of Museum Information (CIMI)[10] generalized 11 access points that users might use when searching through information systems: Category, Date, Event, Material, Method, Person, Place, Object, Resource, Style and Theme[11].

Basically, the more complete metadata of archives is, the more helpful it is to research, education and application in related fields. At present, metadata used by domestic units for digital archives were all referenced

[10] CIMI was initiated by the Museum Computer Network (MCN), Research Libraries Group (RLG), Canadian Heritage Information Network (CHIN) and Getty Information Institute (GII). It was founded in 1990 after combining other library, museum and information units. Its purpose is to popularize museum information to the general public, implement open system standards, and manage and transmit digital museum information.

[11] "Electronic Museums' Information organization Search" by Chen Chao-Chen, 1999, Library Society of China Journal, Issue 63, pages 95-104.

from international standards, and then revised according to the attributes and requirements of the holding unit's collection. Currently, there are many metadata formats by museum communities from around the world, in which the "Categories for the Description of Works of Art (CDWA)" is the most frequently used among domestic museums.[12]

II. Establishment of Ceramics Metadata Fields

The CDWA[13] standard is a metadata standard designed for researchers of art history and staff that manage works of art; it is mainly used by museums to describe works of art. Besides descriptive data of an artwork's appearance and the artwork's relation to time, space, people, history and culture, the way a work of art is described is also very important. Many elements of the CDWA standard reflect on the characteristics of artworks, such as styles, periods, inscriptions and marks. In addition, the artwork's conservation history and exhibition history are also elements included in the CDWA standard. Table 4 shows the 27 elements of the CDWA standard and divides them into four aspects: 1. Basic Information; 2. Production Techniques and Materials Related Data; 3. Conservation and Exhibition Related Data; 4. Management Related Data.

[12] Please refer to the website of Academia Sinica's Metadata Architecture and Application Team for related metadata by international museum communities and metadata standards adopted by domestic digital archives projects. (http://www.sinica.edu.tw/~metadata/standard/standard-frame.html)

[13] The maintenance unit of the CDWA standard is J. Paul Getty Trust's Art Information Task Force (AITF).

Table 4. Main elements of the CDWA standard

	Element	Definition
1. Basic Information		
1	OBJECT/WORK	Describes the artwork's type and quantity.
2	CLASSIFICATION	Classifying artworks with similar characteristics under a formal classification structure.
3	ORIENTATION/ ARRANGEMENT	Describes the way an artwork is displayed or the artwork's position from observation.
4	TITLES or NAMES	The title or name of an artwork, architectural work or group work, and also includes the title's type and time used.
5	STATE	For artworks that could be made in certain amounts (such as printings), this element describes the relationship of artworks in different states.
6	EDITION	For works that were issued numerous times, this element describes its position among other edition. This element can be used to describe a specific work among multiple works issued at the same time, or its position in a series of the same work issued at different times.
7	PHYSICAL DESCRIPTION	Uses general terminology to describe the artwork's appearance. Appearance descriptions include recognizable designs used to decorate the artwork, decorations or the artwork's texture.
8	MEASUREMENTS	Provides information on the artwork's size, shape, scale and volume.
9	INSCRIPTIONS/ MARKS	Description of parts inlayed, stuck, stamped, written, imprinted or adhered to the artwork, contents include markings, letters, notes, articles or labels.
10	CREATION	The creation, design, execution or production of components of artistic or architectural works, including groups that are responsible for the creation of works or its details, dates of activities, and location of creation.
11	STYLES/PERIODS/ GROUPS/ MOVEMENTS	Descriptions of characteristics revealed in the artwork, including its style, period, group, painting school or movement.
12	SUBJECT MATTER	Describes whether the theme (usually means its contents) of an artwork is descriptive, imagery, or conveys subjective meanings via abstract or image components.
13	CONTEXT	Related political, social, economic, religious events or movements during the creation or existence of artworks or architectures.
14	RELATED WORKS	Describes other artworks related to the current artwork or the relationship between different artworks.
15	RELATED VISUAL DOCUMENTATION	Information for identifying or describing artworks provided via images.
16	RELATED TEXTUAL REFERENCES	Any quotes on artworks or architectures in documents, unpublished manuscripts, publications, and oral expressions by scholars or specialists.

	Element	Definition
17	CRITICAL RESPONSES	Any critical responses from artists, architects, art historians, art critics, art dealers, sales persons, buyers, officials and the general public to a specific work of art.
18	DESCRIPTIVE NOTE	Descriptions of the artwork in text, including related discussions. Important information in this note requires reference of other elements.
2. Production Techniques and Materials Related Data		
19	MATERIALS and TECHINIQUES	Any materials or substances and techniques or processes used for the artwork's creation, its content can be a description of the material or forming method.
20	FACTURE	A detailed discussion of the artwork's production method, includes an evaluation of the technique or facture, utilization of its creation method, or application of special techniques.
3. Conservation and Exhibition Related Data		
21	CONDITION/ EXAMINATION HISTORY	A complete evaluation of the physical state and characteristics of artworks from a specific period. Evaluation methods include placing the artwork under ultra violet rays for examination, but don't include artificial changes to the artwork's state, such as repair or maintenance.
22	CONSERVATION/ TREATMENT HISTORY	Describes any repairs, preservation, or fastening procedures or actions to the artwork.
23	OWNERSHIP/ COLLECTING HISTORY	Owners and history of an artwork since its creation. This includes the way it changed ownership, any open sales, the agent that contributed to change of ownership, or any merchant that handled the artwork or listed the artwork into his/her catalog. Any loss, theft, damage, or disappearing of an artwork is recorded under this element.
24	EXHIBITION/LOAN HISTORY	Records of the artwork's public exhibitions, including its arrangement in the museum, special exhibitions it was exhibited in, exhibitions that borrowed it, and even informal exhibitions.
4. Management Related Data		
25	COPYRIGHT/ RESTRICTIONS	Identifies individuals or groups with the right to use, exhibit or duplicate the artwork, and indicates restrictions on the artwork's duplication, exhibition or use.
26	CATALOGING HISTORY	Records of the creation and revision of artwork descriptions, including who and when and adding related notes. It also describes corrections made by the author or any other individual.
27	CURRENT LOCATION	The location and geographical position the artwork is currently held.

SOURCE: CATEGORIES FOR THE DESCRIPTION OF WORKS OF ART
(http://www.getty.edu/research/conducting_research/standards/cdwa/index.html)

Besides the CDWA standard, holding units can also choose the Dublin Core (DC) (as shown in Table 5) as a reference standard for establishing ceramics metadata. The main difference between the two standards is in elements provided by the CDWA standard reflect better on the characteristics of artworks, making it more suitable for use by museums. The DC standard can be easily used by individuals who haven't received profession training because it only has 15 fields to fill in. Please see Table 6 for a comparison of the CDWA and DC standards.

Table 5. The 15 elements of the DC standard

	Element	Description
1	Title	Key words of the artwork's theme or main concepts, and a vocabulary of important people, places, events or other background data related to the object.
2	Creator	The artwork's creator.
3	Description	A brief description of the object or its contents.
4	Publisher	The individual or organization responsible for publishing the artwork, such as a museum.
5	Contributor	The original owner of the object.
6	Date	The period or time the artwork was created.
7	Resource Type	The type of artwork or the abstract scope it belongs to, such as text, sound, image, real object, event, original object, or proxy object.
8	Format	Software and hardware possibly required for the access, display or use of this artwork.
9	Resource Identifier	Registration number or catalog number.
10	Relation	Related publication information.
11	Coverage	The period and geographical area covered by the artwork.
12	Rights Management	Copyright declaration and usage regulations.
13	Subject and Keywords	One or multiple names given to the artwork.
14	Source	The artwork's source.
15	Language	The language used by the artwork.

Table 6. Comparison of the CDWA and DC standards

		CDWA	Dublin Core
Demand	Application Object	Artworks	Documents, specimen, maps, historical relics, paintings, video tapes, etc.
	Users	Designed for art historians and staff that manage works of art and mainly used by museums.	Suitable for any individual
Elements	Element Structure Characteristics	Reflects better on characteristics of artwork	Includes 15 of the most frequently used fields, simple and easy to use, and can even be completed by non-professionals
	Main Elements	27 Main elements; every element has sub-elements underneath it.	15 Elements

DC is a frequently used metadata standard and its most significant characteristic is its high commonness. In order for units that established their metadata based on the CDWA standard to be able to exchange data with other academic fields, the method used is to build a table to correspond each field used by the holding unit to one of the 15 fields of the DC standard.

Even though elements designed in the CDWA standard are able to satisfy archive management requirements of museums, differences in Chinese and Western developments and in the characteristics of their collections have caused differences in categories and definitions of elements when using metadata. For example, the National Museum of History revised the definitions of elements when it was developing its ceramics metadata. Kiln equipment has a significant influence on the research of ceramics, knowledge elements in this category include: shaping method, application of glaze, firing method, kiln structure, fuel, temperature and atmosphere. In order to accurately express the contents

of ceramic production knowledge, the National Museum of History revised the element "materials and techniques" into "Techniques and Equipment".[14] The development of Chinese ceramics attaches special importance to the description of background knowledge, such as kiln system and kiln site, but Western ceramic collections have no need for descriptions of such knowledge.[15]

In another example, the element "decoration" in CDWA cannot fully express the content of decorations discussed in Chinese ceramics, such as the decoration's position, type and skill, which is why the National Museum of History revised the element into "method of patterning" to fully describe its contents.[16]

From the above we know that in order to satisfy the requirements of archives, holding units must develop suitable metadata standards based on the contents of artifacts.

III. System Development and Metadata Recording Rules

(1) System Development

After metadata elements for artifacts have been established, the holding unit may begin communicating with system designer to develop a system that suits the unit's management requirements and users' search and usage requirements.

(2) Text Database Organization

Data establishment staff can use Office Excel or Office Access for organizing artifact data. These two applications are easy to use, provide

[14] "National Museum of History Digitization Metadata Development Process and Contents" by Wu Kuo-Chun, *Digital Archives Book Series, Digitization Procedures – Artifacts Thematic Group*, National Digital Archives Program – Content Development Division, 2003, page 54.

[15] Same as the above, page 48.

[16] Same as 14.

fast input and are extremely popular (almost every PC has Excel), they can be directly saved in a computer format, and they can be converted into other formats or imported into other databases.[17] However, when importing text data into a different database, the form of data tables need to be adjusted for it to match the database. Furthermore, pay attention to whether or not the same code is used by the file and the database.

(3) Establishment of Metadata Recording Rules

Rules here include system operation and content recording rules.

System operation rules:

a) In order to create a file in the recording interface, the recording staff's identity must be confirmed by the system to login.

b) The file's creator, date, and information of the person who filed in the form must be recorded during data recording.

c) When verifying data modifications, the proofreading staff's identity must be confirmed by the system, and the last modification date must be recorded.

Content recording rules:

In order to avoid disunity of data, a standard must be established for data entering because artifact data is normally entered by numerous researchers at the same time. In addition, an authority file can be created to establish a unified vocabulary. The National Palace Museum is currently establishing an authority file for decorations on ceramics to achieve unification of contents.

(4) Proofreading Recorded Data

In order to ensure the correctness of inputted data, all data should be proofread twice to minimize human mistakes.

[17] "National Palace Museum Artifact Digitization Techniques", *Digital Archives Technology Collection*, National Digital Archives Program – Program Office, 2004, Volume 8, page 2.1.7.3.

Six. Equipment and Cost Analysis

I. Considerations of Equipment Selection

In this chapter we will explain the selection of digitization related equipment. Main equipment includes digital camera back, lighting system and computer system.

(1) Digital Camera Back Selection

Digital camera backs can be used on 120 medium format cameras or 4×5 view cameras. Digital camera backs contain CCD and control/storage units, removing the traditional camera back and replacing it with a digital camera back turns it from a film camera into a digital camera.

* Considerations of Camera Resolution Selection

The most basic condition for selecting a camera is to find one that suits the purpose. In the part on image specification establishment we already mentioned that images produced from ceramics digitization have different purposes, such as artifact preservation and publishing. Therefore, the minimum requirement of a camera is that its image resolution at least meets the high quality image output specification. Generally, the medium format output size is 8×6 inches, the output resolution required is 300-350ppi. Using 350ppi for calculation: (8×350) × (6×350) = 5,880,000, meaning that 6 mega pixels CCD is the minimum requirement of a digital camera. However, if images with higher quality or larger images are required, then select cameras with more pixels. Digital camera backs currently in the market all have at least 20 to 30 mega pixels, which means that they satisfy general ceramics photographing requirements. Other factors beside number of pixels that affect image quality include camera lens quality, image CCD type and size, individual CCD type and size, and software used to process image

data.[18]

(2) Lighting Equipment Selection

Although traditional lighting equipment on the market, such as light bulbs that use tungsten filaments[19] and quartz lamps[20], can effectively control lighting, they produce too much heat, which will damage artifacts, and their brightness and color temperature become unstable after being used for certain amount of time. Cold lights are not only able to maintain the standard color temperature between 5000-6000K (stable light source), they emit softer light and cause less damage to artifacts. However, cold lights are relatively expensive and have limited brightness, and if the camera's diaphragm is enlarged at this time, it will result in insufficient depth of field. Besides cold light, holding units can also consider using flashlights, but should use a lampshade for ultraviolet rays if they choose to do so.

(3) Computer System

* Considerations of Computer Selection: Capability to process large amounts of image data.

Computers in the market that are Apple Mac G4, PC Pentium4 or higher can satisfy requirements of digital photographing (at least 512 MB RAM). Other required equipment include: CD burner (for data backup) and card reader (to access data from different brands of memory cards). In addition,

[18] *Mastering Digital Printing* by Harald Johnson, Taipei, Flag Publishing Co., 2005, pages 3-22.

[19] Light bulbs used for photographing are like light bulbs used at home and provide continuous light, but they are much brighter and come in two color temperatures 3200k and 3400k. Light bulbs are hot, continuous and direct light sources, like home light bulbs, they gradually become weak and as the color temperature decreases, the light become more and more red. Therefore, in order to maintain color temperature, use new light bulbs under 115V or 120V.

[20] Quartz light bulbs are also called quartz halogen light bulbs, they can be a point source of light or a line source of light, and they are a common artificial light source in the photography studio. It is smaller in size, is a heat light source (slightly lower temperature), and the halogen inside extends the lifespan of its tungsten filament. It is a linear light source, is suitable for long objects, its color temperature is maintained at 3200K, and the halogen extends both its lifespan and the time its color temperature is maintained.

FireWire (IEEE 1394) is a frequently used interface of digital equipment; list it as standard equipment if the budget allows it.

* Considerations of Monitor Selection: High level CRT monitors are more capable of displaying high quality colors than LCD monitors, but if working staff need to work in front of monitors for long hours, then LCD monitors are recommended.

(4) Color Management System

Use Photoshop for color management. In addition, some digital camera backs come with a color management system when purchased. Other color management systems are also on the market for users to choose from.

II. Cost Analysis

Costs required for the digitization of ceramics include: Material expenses, labor expenses, and other expenses.

Material Expenses: Cost of consumables used for digitization.

Labor Expenses: Salaries of staff.

Other Expenses: Mainly the cost of hardware and software.

Due to limited data, this guideline calculates the digitization cost of a single image based on only labor expenses and equipment cost.

* Calculation Method:

(1) Setting equipment amortization expenses based on service life

(Labor expenses + Equipment amortization expenses) / Digital output quantity (pages) = Cost per page

Equipment amortization expense = (Hardware expenses + Software expenses) / service life

(2) Setting equipment amortization expenses based on digital output

[Labor expenses / Digital output quantity (pages)] + (Hardware expenses

+ Software expenses) / Digital output quantity (pages) = Cost per page

* Calculation Example (1):

Setting equipment amortization expenses based on service life

(1) Hardware expenses + Software expenses

(2) Manpower: Salary NT$30,000 per month

	High-level	Middle-level
Equipment	Price (NT$)	Price (NT$)
Tripod	16,000	16,000
Cold Light Set	50,000	50,000
Computer (MAC G4)	45,000	45,000
Computer (PC)	30,000	30,000
Digital Camera Back (22 mega pixels)	1,100,000	750,000
120 Medium Format Camera	200,000	150,000
Camera Lens	150,000	100,000
Software (Photoshop)	20,000	20,000
Software (Professional Color Management System)	200,000	–
Total	1,811,000	1,161,000
Description: The prices listed here are for middle to high level equipment on the market. In which, items with relatively higher price difference are: the digital camera back, the camera itself and the color management system.		

(3) Image output per month: 960 pages

(Using 10 minutes as the required time for one image, 48 images can be produced per day (8 hours), and 960 images can be produced per month (20 days).)

(4) Service life: Calculated using 4 years (this should be based on the accounting settings of each unit)

Labor expenses: NT$30,000 × 2 people = NT$60,000

High-level	Middle-level
1,811,000/4×12＝37729	1,161,000/4×12＝24188
(60,000 + 37,729) / 960≒101	(60,000 + 24,188) / 960≒88
Cost per page: NT$101	Cost per page: NT$88

* Calculation Example (2):

Setting equipment amortization expenses based on digital output

If a certain digitization work requires the production of 30,000 images, then it will require 30,000/960 = 31 months.

Labor expenses = 60,000 × 31 = 1,860,000

High-level	Middle-level
(1,860,000/30,000) + 1,811,000/30,000 = 62 + 60≒122	(1,860,000/30,000) + 1,161,000/30,000 = 62 + 39≒101
Cost per page: NT$122	Cost per page: NT$101

Seven. Production Outsourcing

In consideration of the funds, equipment, manpower and time required for digitization, units can decide to outsource all or a part of its digitization work. Ideal advantages of outsourcing include: not needing to purchase expensive equipment or worry about equipment maintenance and replacement, and reduced manpower requirements.

Ceramics digital imaging is divided into "film scanning" and "digital photography". To avoid the risk of damaging artifacts by repeatedly borrowing them, check if film already exists for the artifact when making the artifact inventory, and scan film that are in good condition; only photograph artifacts that have film in bad condition or haven't been photographed before. Using the National Museum of History as an example, its policy was to keep its whole collection and any new collections on traditional film, when it began implementing its digital archives project, it considered the high cost, manpower, location and equipment required for digital photography and decided to hire professional photographers to digital photograph only the artifacts with film in bad condition, outsourcing the scanning of film in good condition into digital files.

The National Palace Museum also uses the same method, outsourcing film scanning and conducting digital photography itself. Early digital images of the National Palace Museum were the product of outsourced film scanning in 2002; film in good condition was selected for scanning. The same year, its Department of Antiquities began preparation of its first digital photography system and carried out full-scale digital photography. The National Palace Museum Department of Antiquities chooses not to outsource digital photography for three reasons: (1) Save

funds; (2) Accumulate knowledge and experience; (3) Artifact safety and digitization speed. At that time, a reasonable pricing method could not be found when outsourcing digital photography; prices were calculated based on file size. Considering that digitization is a long-term task, digital files were cheaper when they were self-made, and it eliminates the need to invite bids each year. Another advantage of self-made digital files is the accumulation of knowledge and experience, which aids the continuous improvement of digital image quality. In addition, the National Palace Museum's artifact photography location was its storehouse, allowing researchers and photographers to photograph artifacts near their original workplace without needing to worry about managing the contracted firm. With more flexible time, images were produced at a faster speed with more controllable quality.[21]

Digital imaging is not the only task units frequently outsource because of technical problems, others tasks include database establishment, hardware and system maintenance, and the establishment of a watermarking system and quality examination system. When units intend to outsource a certain task, it needs to understand and plan which parts are suitable for outsourcing, the establishment of specifications, the selection of a suitable firm, and how to negotiate and communicate with the selected firm, as well as notices on accepting the final product. Below are matters that require attention when outsourcing a task:

[21] "National Palace Museum Digital Photography System Preparation and Color Management Practices – Artifacts, Paintings and Calligraphy" by Cheung Chi-Gwong and Chen Yung-Jen, Color Management Practices Workshop (Northern Taiwan) Activity Manual, National Digital Archives Program Content Development Division, December 2004.

I. Before Inviting Bids

(1) Outsourcing evaluation: Before deciding to outsource a task, first consider whether or not the project is suitable for being outsourced, or if partial outsourcing should be adopted, because it concerns manpower, funds and operation of every internal unit. For example, the National Museum of History has a policy to hire professional photographers to keep its entire collection on film, when it comes to digitization, it believes that compared with the manpower and time cost required for digital photography, outsourcing film scanning is the more economical way. Besides considering internal manpower and resources, implicit costs from outsourcing should also be considered, such as communication with the firm, when a mistake is made in the process of communication, and staff circulation or when corrections are required.

(2) Establishing a suitable requirements specification: Once it is decided to adopt outsourcing, the unit should fully understand the purpose of outsourcing and internal requirements of the project, including budget, required number of files, file format, file naming, quality standard, examination process, whether or not the firm needs to be stationed at the unit or can take object out for processing, confidentiality agreements, etc. Besides understanding internal requirements, referring to the outsourcing requirements specifications of relevant projects and investigating common technology standards are both helpful to the completion of a thorough requirements specification, and it will avoid only specific firms being able to participate because conditions are too harsh.

(3) Understanding bidding regulations and processes: There are certain processes and regulations for government open bids that need to be understood to avoid problems with follow-up bid invitations. Some organizations have specialized units to handle bid invitations, which is the situation where the bid inviting unit is not the unit in need, in such a situation, even though the unit with requirements doesn't need to fully

understand bid invitation procedures, understanding details still helps the bid inviting process.

(4) Selecting a suitable firm: Considerations for firm selection include: cost, the firm's technology, scale, financial condition, operation mode and past records. The self-description and presentation of firms may include their subjective views. Therefore, refer to the cooperation experiences of other units with the firm. An outsourcing selection team can be established under the project, each team member scores the bidding firms, the winning firm is decided after thorough discussion, and then administrative procedures like contract signing are handled. Bidding firms can be asked to complete some outsourced tasks on a trial basis, for example, the National Museum of History asked firms to trial scan films as reference for firm selection. In another example, when the Fu Ssu-nien Library was outsourcing its string-bound book scanning, it announced a standard procedures, specially made a string-bound book, and invited firms to trial scan the book using machines in the Library; whether or not firms followed their standard procedures was used for rating the firms.

II. After Firm Selection

(1) Maintaining frequent contact: After outsourced tasks begin, regular contact should be maintained with the contracted firm; this way, units know the current work progress and can make adjustments whenever problems are found. Professional knowledge on handling artifacts, such as characteristics of ceramic material should be retained when they are photographed, techniques to avoid damaging artifacts when they are moved or photographed, and how to present data to meet the requirements of users from special fields, should be communicated with the contracted firm or training should be provided; likewise, units can ask firms to explain its work process to project staff to benefit cooperation and interaction. Furthermore, both parties should designate a fixed staff

as representatives for communication, contact and acceptance to benefit efficient communication between both parties.

(2) Regular checks and modifications: The acceptance process should be based on the contract, if any faults are found, immediately ask the firm to make corrections. Using digital image files from film scanning as an example, check if the number of files is correct, are there any repeated files, are the file names and file formats correct, are there any segmented files or slant images, and are file size, resolution, compression rate and color mode all in accordance with the contract's standard. Acceptance can be done manually or computer aided using the collection list and photography list.

Eight. Digital Content Protection

One of the purposes of digital archives is to show Taiwanese people the precious collections of Taiwan without damaging the original objects; this is done by digitizing real objects, achieving research, promotion and education purposes. Therefore, spreading and sharing digitization achievements as much as possible with an open attitude is the only way to create the highest value of digital contents. However, to prevent unworthy persons from improperly spreading, using, falsifying or taking forcible possession of digital contents, the creators and providers of digital contents normally hope to protect their digital rights. Therefore, we will introduce common methods for protecting digital contents below; they are the business circle's Digital Right Management (DRM), digital watermarks, and the "CC License" used by Union Catalogs of Digital Archives.

I. Digital Rights Management (DRM)

DRM uses file encryption to set access rights for digital contents; it traces the use of digital contents to ensure file security and to protect rights of the creator and provider. DRM applications may come in multiple forms, such as restricting file access, saving and duplication, limiting the number of forwarding and burning times, only allowing the file to be played within a certain time period, requiring specific codes to open the file, prohibiting content modification, and sometimes only allowing files to be accessed by specific software or hardware.

In commercial use, DRM is more commonly seen in legally downloaded audio/video files and e-books, famous examples include

Amazon's e-books and Apple Computer's iTunes Music Store. Using iTunes Music Store as an example, all songs downloaded from the music store are protected by special technology, and since Apple Computer hasn't widely opened its license to other hardware manufacturers, up to the end of 2006, users could only use extremely limited hardware, such as Apple's iPod or some Motorola cell phone types, to listen to music downloaded from the music store. The purpose of DRM is to protect the rights of digital contents providers, but its various restrictions to the use of digital contents, such as requiring specific software or hardware to open files or limiting the number of times a file can be duplicated, often turn users away and also is disadvantageous to the circulation and utilization of digital contents, which has raised several disputes.

II. Digital Watermarking

Digital watermarking is the technology of implanting intellectual property rights information into digital documents; this information includes the original author and the copyright owner's name, address and trademark. Based on the protected file's format, digital watermarks could be text, images, video, or audio frequency symbols; they are just like the signature of an artist on a painting, announcing the identity of its creator. Digital watermarks can be obvious or hidden, but only the party that implanted the watermark is able to undo it. Both kinds of watermarks have their own pros and cons, visible watermarks damage the image's quality and if it results in the image become unreadable, the original image will have lost its purpose, but visible watermarks are more capable of stopping malicious intentions. Hidden watermarks cannot be seen and must be identified using special methods, allow the image to maintain its

quality.

Digital watermarking is a digital content protection technology widely used in the National Digital Archives Program, but like any other encryption technique, watermarks have the risk of being undone by others. Therefore, pay special attention to encryption quality when producing digital watermarks. In the National Palace Museum's case, its digital content protection method is to add hidden information to digital images using double-layered encryption, making it more secure than traditional single-layered encryption.[22]

III. CC License

Creators that publicly announce digital content on the internet usually have the purpose of sharing with others. Therefore, CC License provides a simple method that has legal effect to allow creators to announce the permitted scope of use for digital contents while reserving partial rights. This way the copyright owner can reserve the rights he/she desires, and also show good intentions to the general public and encourage free access or derivative work. The Union Catalogs of Digital Archives (http://digitalarchives.tw) is currently using CC License.

CC License provides many different kinds of licensing for the copyright owner to choose from. Using the Taiwan version CC license that abides by Taiwan's legal system as an example, if the license "Creative Commons Attribution – Noncommercial Share Alike 2.5 Taiwan" is chosen, it means that if a person wishes to use a protected digital content, such as use a picture protected by CC license in his/her

[22] National Palace Museum, "National Digital Archives Program Technology Collection", http://www.ndap.org.tw/2_techreport/index.php?pid=228

own work, the person has to specify the name of the copyright owner and share it alike; the digital content can be freely used for noncommercial purposes, licensing from the original copyright owner is only required when it is used for commercial purposes. Besides "Attribution", "Noncommercial" and "Share Alike", other rights that can be reserved include "Prohibit Modified Versions", meaning that the user may not use the protected creation to create derivative work, such as translation, transcription and adaptation.

CC license was a project that began implementation in 2001 led by professor Lawrence Lessig of Stanford University School of Law. The iCommons project was initiated in 2003, cooperative units from all around the world translated CC licenses into their language and adjusted them in accordance with local laws. Up to the end of November 2006, 36 countries and areas had already completed localization, including Taiwan. Academia Sinica Institute of Information Science is the CC cooperative unit in Taiwan. In order to complete licensing for your own creations, visit the Taiwan area project website (creativecommons.org.tw), select "choose license" from the homepage, follow the webpage's instructions to select the license your wish to use, and add the code produced by the system to your own website for copyright announcement.

CC licenses and DRM hold a different view on copyright protection. The purpose of DRM is to protect the rights of copyright owners, adopting strict restrictions for the access and spreading of files. CC licenses release partial rights to users, assuming that the copyrights owner doesn't care if people browse his/her creation online or spread it freely, only requiring reasonable remuneration when the user uses it for commercial purposes. CC licenses encourage others to browse and use

one's creation, and have the implication of encouraging cultural exchange and creation.

Nine. Benefits and Prospects

For digitization work to be implemented more maturely and efficiently, a few recommendations have been proposed below for holding units to refer to, hoping that units will be able to plan a work mode that satisfies their requirements best when implementing digitization work:

I. Digital Imaging Equipment Selection

Although ceramics digitization mainly uses digital single lens reflex cameras or digital camera backs, whether or not the image quality meets requirements also depends on surrounding equipment, such as the lighting system, computer system and post processing system. At present, there is no single set of standards for the combination of different equipment that is suitable for all units. Therefore, it is recommended that units select suitable digitization tools based on the considerations for purchasing each type of equipment described in this guideline. As to choosing between high level and low level equipment, not only should the unit's budget be considered, but also the artifact's condition. For example, if a unit's collection comprises of ancient artifacts that are hard to preserve, then preserving a high quality image of the artifact to avoid the need of moving it multiple times should be the main consideration when selection equipment.

II. Continuous Training for Photographers

Digital image quality is not only determined by whether or not equipment and photographers have followed procedures and notices, but also highly dependent on the photographer's professional competence

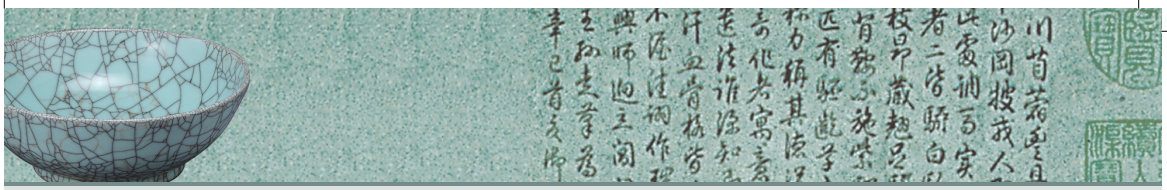
and experience. Therefore, arrange for photographers to participate in training courses and work meetings.

III. Cost Estimation of Digitization Work

When holding units are estimating digitization cost, not only should they consider the price of hardware equipment, but should also consider amortization and other implicit costs (such as location cost and utilities).

Ten. Conclusion

Every step of the digitization procedure, from file format establishment, file naming standards, image digitization to metadata establishment, is closely linked with other steps. When the digital archives program was first implemented, there were no precise processes or relevant experiences for units to refer to, and the only way to find an optimal mode and path of digitization was through trial and error. Although these attempts and efforts might be to make the procedures smoother going, but digitizing artifacts under the safest condition possible has always been the most fundamental consideration. This guideline was successfully completed, thanks to past experiences, and it will help holding units new to this field to successfully carry out ceramics digitization. We hope that after establishing such a standard, other units will not hesitate to provide us with their responses and recommendations to bring it closer to perfection.



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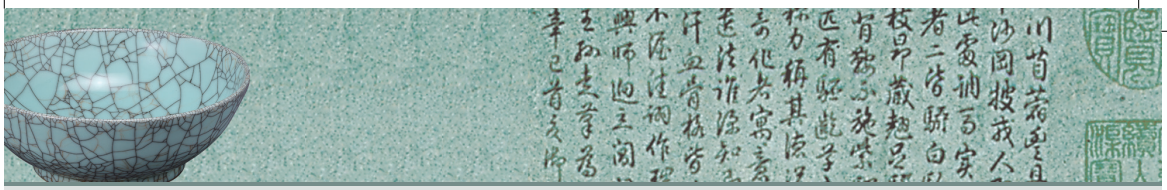

【Appendix 2】List of Artifact Imaging Equipment of the National Palace Museum and National Museum of History

	National Palace Museum	National Museum of History
	1. Computer Equipment	
	Mac Digital Photography Workstation 1. PowerPC G4 2. CPU: PowerPC G4 3. RAM: 1GB	Mac Digital Photography Workstation 1. PowerBook G4 2. CPU: PowerPC G4 3. RAM: 512MB
	2. Camera Body	
	120 Medium format camera Contax 645	120 Medium format camera Hasselblad 555 ELD
Price	Roughly NT$100,000 each	Roughly NT$150,000 each
	3. Camera Lens	
	Ziess 80mm, 120mm and 35mm	Hasselblad CFE 80mm and CFI 120mm
Price	Roughly NT$100,000	Roughly NT$150,000
	4. Digital Camera Back	
Type	Phase One H5	Kodak DCS pro back plus
CCD Resolution	6 Mega pixels	16 Mega pixels
Image Capture Method	One shot	One shot
Suitable for	Hasselblad H1 and all camera series, MAMIYA 645 AFD, CONTAX 645 AF, and all types of 4x5 cameras	HASSELBLAD 555ELD, MAMIYA RZ67 Pro II
Price	Roughly NT$400,000	Roughly NT$700,000
	5. Lighting System	
	BALCAR NEXUS Flash unit, BALCAR Flash head	Use BALCAR flashlight together with BALCAR NEXUS Flash unit, light intensity will maintain within 50 degrees of the constant color temperature, and use BALCAR cold light lamp, color temperature 5,500 degrees

Ceramics Digitization Procedures Guideline

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