Part II
Museums in the Info-Age

The Creation of a Registration and Information Database for Cultural Heritage in Mongolia

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Abstract Under the "National Project for Digitization of Cultural Heritage" started in 2005, a total of 42 organizations are involved in the registration and information state database of cultural heritage, using RCH (Registration of Cultural Heritage) software. So far, 45,645 names and 65,211 movable objects have been registered. For immovable historical and cultural properties, the registration is conducted using RICH (Registration of Immovable Cultural Heritage) software. So far, a total 32,124 historical and cultural immovable properties from 3,100 cultural sites in 15 provinces have been registered. Registration for ICH (Intangible Cultural Heritage) covers 329 soums (sub-provinces) and 9 districts, and 7,206 individuals identified as ICH bearers. In 2014, the "National Project for Digitization of Cultural Heritage-2" was approved, aiming to register and document cultural heritage, to take control of conservation and preservation of cultural heritage, to create a digital database for tangible and intangible cultural heritage, and to improve the system used for registration and information database of cultural heritage.

1 Introduction

By the consent of the People's Great Khural (the unicameral Parliament of Mongolia), the "Law on the Protection of Cultural Properties of the People's Republic of Mongolia" was adopted in 1970. In 1994, after several amendments, the law was adopted as the "Law on the Protection of Historical and Cultural Properties" by the State Great Khural and a new chapter related to the creation of a registration and information state database and its registration procedures was included.

According to the law, the registration and information state database will include research definitions, research reports, photographs, slides, audio and video recordings, and brief reports on restoration. The registration and information database is defined as having the purpose of classifying, conserving, and inheriting the heritage.

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The database is also mandated to assist in the full recovery of cultural heritage elements when they are damaged, destroyed, or forgotten.

In 2001, several amendments were made to the 1994 "Law on the Protection of Historical and Cultural Properties" with articles added on the protection of intangible cultural heritage, and the law was renamed the "Protection Law for Cultural Heritage." According to the "Protection Law for Cultural Heritage," cultural heritage is classified as tangible and intangible. Tangible cultural heritage is classified as historical and cultural properties that are immovable and movable. Historical and cultural immovable heritage can be recognized as individual elements or as complexes.

On May 15th, 2014, the "Protection Law for Cultural Heritage" was amended by the State Great Khural.

2 Registration Form

In 1996, the first document "Registration form for historical and cultural properties of Mongolia" or form №1 was used to register museum objects, artifacts, and immovable properties in the database of historical and cultural properties.

Based on the revision of the "Protection Law for Cultural Heritage" in 2001, the "Registration form for historical and cultural properties of Mongolia" or form №1 was amended as the "Registration form for Cultural Heritage of Mongolia" or form №2 by the 56th decision of Ministry of Education, Culture, and Science of Mongolia, in 2006.

However, the registration form did not allow for sufficient time to record enough information about museum objects and immovable properties. Therefore, in 2007, the Ministry of Education, Culture, and Science decreed in order №348 that the form "Registration of Historical and Cultural immovable properties" №1 be used instead. The order was approved and that form was used.

To assist in their required purpose of creating a database of intangible heritage and its bearers, in 2010, registration forms with specific questionnaires related to the registration of tangible heritage (historical and cultural movable and immovable properties) and of intangible heritage were adopted by 541st decision of the Ministry of Education, Culture and Science of Mongolia.

The "Registration form for historical and cultural movable heritage of Mongolia" gathers information using the following 34 questions, including: owner, possessor, address of location, condition, name of heritage, identification number, classification of heritage, decision, types or categories, relevant period, creator, creative skill, material and method, measurement, set, when collected and discovered, damage, decision for protection, purpose of use, common or uncommon status, origin, definition, brief history, restoration condition, reproduced or not, transfers or movement, relevant research, note of attachment, etc.

The "Registration form for historical and cultural immovable heritage of Mongolia" gathers information using 34 questions, including: province, Ulaanbaatar City, soum

(sub-province), district, owner, possessor, identification number by registration and information database, name of heritage, classification of heritage, administration unit (heritage location), GPS, relevant period, protection condition, decision for protection, complex or not, date of discovery, measurements, protection condition, definition, brief history, relevant research, restoration condition, and note of attachment.

The "Registration form for intangible heritage and its bearers" gathers information according to 28 questions, including: province, Ulaanbaatar Province, soum, district, identification number by registration and information database, expression of intangible cultural heritage (ICH), information related with ICH bearer, information related to ICH elements, distribution of ICH elements and bearers, specific, safeguarding, etc.

After the revision of the registration forms, the guidelines and instructions were elaborated and enforced at every level of the registration and information database.

3 Registration and Information Database

The Center of Cultural Heritage created the registration and information database of cultural heritage. The center was established in 1988 as the Restoration Studio for Museum Objects. In 1996, in accordance with the 7th decision of the Government of Mongolia, the structure of the restoration studio was changed to the Center of Cultural Heritage and a new unit for the registration and information state database of cultural heritage was established.

The structure of the registration and information state database of cultural heritage is seen below (Fig. 1).

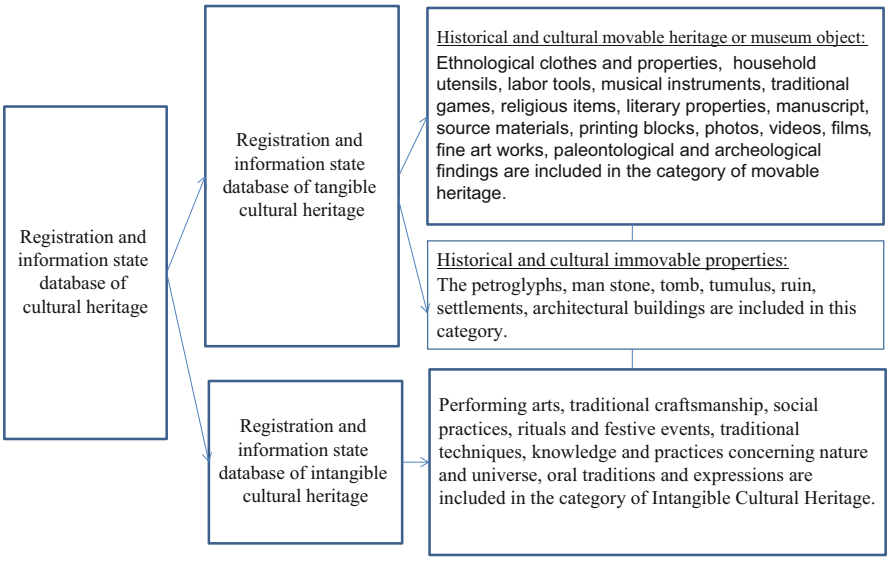

Fig. 1 Structure of the registration and information state database

Cultural heritage registration database systems include:

- Organization registration database;
- Soum, district registration database;
- Province, capital city registration database;
- Unified state registration database.

Registration and information database components are:

- Paper-based registration and information: The object's general registration, classified registration, and research registration are guided by museum regulations. Registrations are completed using the approved forms for tangible and intangible heritage, and they include a heritage photo, research report, etc.
- Digital registration and information: Software "RCH", "Register", "RICH", digital version of the registration form, CD, DVD, hard disk, and audio and video recordings.

From 1996 to 2005, the registration and information state database received registrations from state and province museums in paper form, but this was not considered successful. The questionnaires did not gather enough information, and the state and province museums had poor internet access and a lack of staff members to complete the work.

The project "Automatic Measuring and Image Recording System for Historic and Cultural Heritage" was implemented by the Center through the support of Japanese Cultural Grant Aid in 1999–2000 (Fig. 2). Under the scope of this project, the Center was provided with computers and camera equipment for the documentation of museum objects, as well as some restoration equipment. Since then, photo documentation work has started in 21 provincial museums and the gathered data have been saved in the registration and information database. It was necessary to

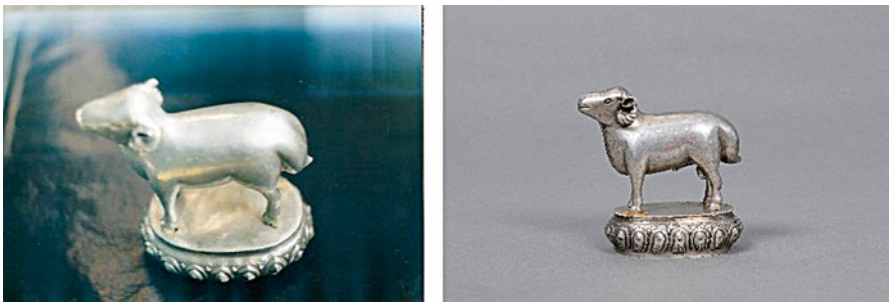

Fig. 2 Photo taken before (*left*) and after (*right*) implementation of the project "Automatic Measuring and Image Recording System for Historic and Cultural Heritage"

provide museums with computer and camera equipment and to introduce new technology into the museums, because their equipment and facilities were previously inadequate for photo documentation of all the objects held in state museums.

Because of this, on December 7th, 2005, the Government of Mongolia in their 244th decision adopted the "National Project for Digitization of Cultural Heritage." The objectives of this project were to enhance the creation of the registration and information database of cultural heritage, to gather all data related to museum objects and historical and cultural properties, to improve the operation of primary registration and information database and systems of databases, and to create a unified state registration and information database.

Aiming to meet the objectives of the project, several measures were taken on human resources and technology. Based on the registration form "Registration form for historical and cultural movable heritage," the software "RCH: Registration of Cultural Heritage" 1.0 was created and installed in 38 museums in 21 provinces. In 2010, the software RCH was revised and RCH version 2.0 was created. These 38 state and provincial museums were provided with the following equipment:

- Computer and UPS (software RCH was installed)
- Printer
- Camera equipment for documentation of museum objects (professional digital camera, two lenses, umbrella, memory card, battery, and charger)
- Network sharing (State and province museums send their registrations to the state database through the internet.)

The new job position of "registration officer" was approved for museums in 2008, and several training workshops were organized for registration officers to provide them with a working knowledge of the RCH software and the process of registering museum objects.

In accordance with national legislation, museums send their registration to the soum, district, and province levels and to Ulaanbaatar City. The provinces and Ulaanbaatar City communicate with the unified state registration and information database, so there is no need for individual soums and districts to send data to the state.

Since using the software RCH, museum research workers and registration officers have sent details on around 800 objects to the state database, depending on the size of their museum's collection, but this work has been delayed.

The state inventories museum objects every 4 years, so information on all objects in state and province museums are gathered in the digital database with the use of the software register.

According to the 2014 revision to the law, the guidelines and instructions for the registration and information database have been amended, and it was decided that information will be saved equivalently in the registration and information databases at each level of soum, district, and province and Ulaanbaatar City.

Today, three software programs are being used for the digital database of tangible and intangible cultural heritage.

4 Database of Historical and Cultural Movable Heritage

"RCH" or "Registration of Cultural Heritage" software was created as two types, based on one prototype. The software "RCH" or "Registration of Cultural Heritage" was installed in museums. Based on the software RCH, the "RCH data processing software" received registration and information from 42 museums and processed the gathered information. Registrations done by the software RCH 2.0 are received in the registration and information state database by the internet network and saved in the database.

As of today, a total of 42 organizations involved in the registration and information state database of cultural heritage and its network are sending their registrations in continuously (Fig. 3).

The software RCH is gathering data according to 55 questions in six parts (Center of Cultural Heritage, Culture and Art Committee. Ministry of Education, Culture and Science 2010: 2).

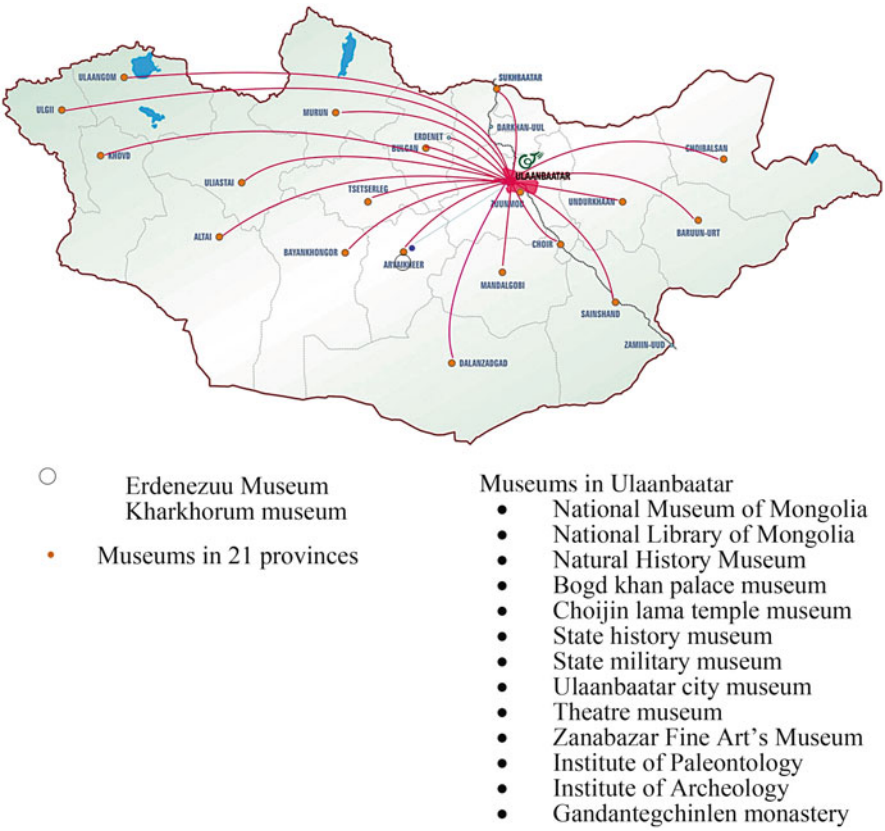

Fig. 3 Network built between Center of Cultural Heritage and state and provincial 42 museums

(1) Art and artistic

1. Painting/every type of art painting, thangka painting, drawing, etc.
2. Sculpture/cast sculpture with all kinds of artistic value, relief and bas-relief, glass and ceramic art (ceramics), papier maché, etc./
3. Carving/crafted workmanship in all kinds of materials, such as wood and stone

(2) Historic

1. Artifacts related to historic persons or individuals/Choibalsan's watch, Yu. Tsedenbal's bag, D. Ravjaa's brush, etc.
2. Documents, audio and video recording/license, certificate, resolution, all kinds of tapes, films, recordings, CDs, etc.
3. Books and stationery/all kinds of texts, imprints, stationery, maps, etc.

(3) Ethnographic

1. Livestock transport/saddles, bridles, halters, strangling, lassoes, saddles, covers, feeding-bottles, collars, etc.
2. Hunting, farming/flint guns, leaden bullets, call-animal, plows, pans, sieves, etc.
3. Family housing, interior furniture/household items, furniture, dishes, buckets

(4) Religious

1. Deities/thangka paintings and forgotten *nagtan*[1] and *gartan*,[2] printed or imprinted paintings, icons
2. Textile art/tapestries, embroidery, and laminated textiles
3. Casts/all kinds of religious large and small castings

(5) Archaeological

1. Stone tools/plates and billets, bread-like blades, etc.
2. Accessories and artifacts/earrings, necklaces, rings, belt ornaments, hair ornaments, animal casted figures, etc.
3. Husbandry artifacts/pottery and ceramic utensils, cups, plates, cereal bleached board stone and mortar/Stone and Bronze Age artifacts, etc.

(6) Natural

1. Mammals
2. Plants
3. Birds

Specifics of the Software RCH

- Detailed information on museum objects is gathered, and it is possible to aggregate, review, process, and print the registrations.
- Registrations can be linked with photographs of museum objects.

- Information transferred by network can be classified as secure and kept in the data center.
- With the help of the software RCH, we created a united network and provided state and provincial museums the following domain address: www.monheritage.mn. With the use of this network and domain address, state and provincial museums are transferring their objects' registrations and information to the registration and information state database of cultural heritage.
- Every correction in an object's registration will be automatically downloaded and saved in the server.

As of today, 45,645 names and 65,211 objects have been registered in the software RCH.

In August 2012, registration software was developed for the state inventorying of museum objects, and it was installed in 42 state and provincial museums and organizations. The registration software is based on the questions from the notebook "General registration for museum objects and artifacts," which allows the database to process data from different categories and periods and to adjust additional questions for each museum. After installing the initial version of the software, it was adjusted and improved 15 times, and each museum received these updates. According to the 140th order of the Ministry of Finance of Mongolia, the regulation "Fixing new value for historical and cultural heritage and museum objects" was approved. The registration software then added a way to save the value of each heritage. In the frame of state inventorying, 97,979 names and 229,976 objects in 42 state and provincial museums were registered in the software "Register" (Fig. 4).

5 Database of Historical and Cultural Immovable Properties

According to joint decision 299/324/111 by the Ministry of Finance, the Ministry of Education, Culture and Science, and the Ministry of Professional Inspection on September 27th of 2006, the inventorying work for "Historical and cultural immovable heritage, such as tombs, tumuli, petroglyphs, inscriptions, stone monuments, temples and monasteries, ruins of ancient cities, and historic stupa and *ovoo*"[3] was approved and is being implemented by the Center. As of 2015, a total 32,124 historical and cultural immovable properties from 3,100 cultural sites in 15 provinces have been registered (Fig. 5), and the information collected is kept in the provincial database and registration and information state database of cultural heritage.

According to the "Protection Law for Cultural Heritage" historical and cultural immovable properties were classified as 11 types regardless of their ownership. Based on the registration form, the software "RICH" or "Registration of Immovable Cultural Heritage" was created. The objective of this software is to create a state database of historical and cultural immovable properties and process the gathered data. The software "RICH" gathers data according to 35 questions in seven parts. These are as follows (Enkhbat et al. 2014: 103–131):

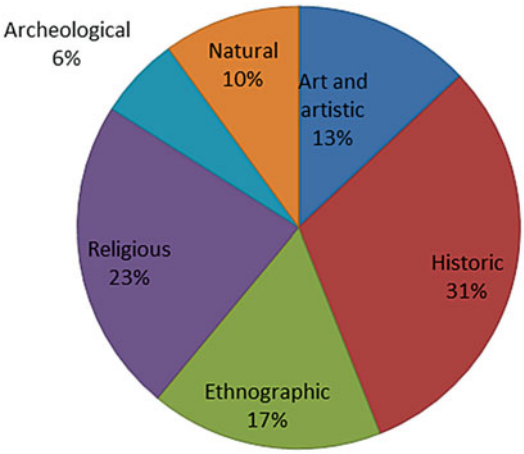

Fig. 4 Classification of the objects registered

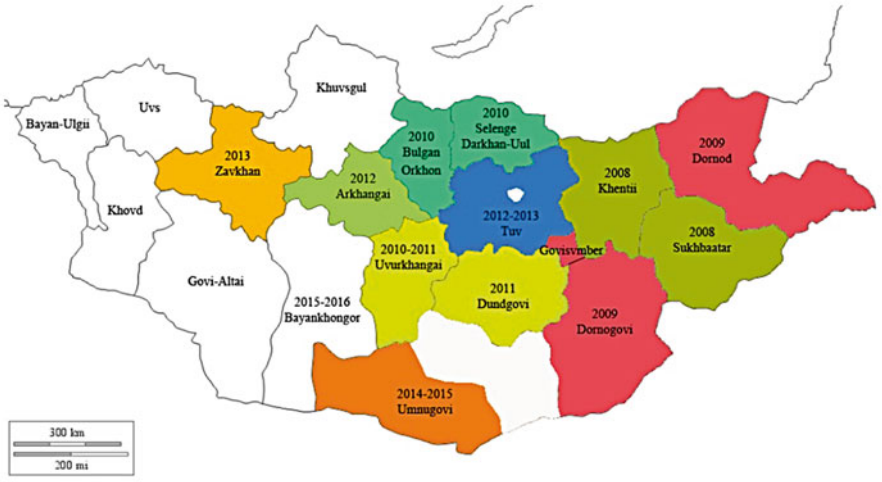

Fig. 5 Registration and inventorying of historical and cultural immovable properties (2008–2018)

Classifications Used in the Software RICH

1. Stone Age sites
2. Petroglyphs and other rock art
3. Tombs, tumulus, sacrificial structure
4. Architectural sites
5. Monuments
6. Places of mineral extraction and manufacturing
7. Natural sites

Questions of the Software RICH

1. Places with findings of ancient flora
2. Places with findings of ancient fauna
3. Petrified wood
4. Fossils
5. Stone Age settlements and crafting places
6. Sites with stone tools
7. Ochre and ink petroglyphs
8. Carved petroglyphs
9. Symbols
10. Inscriptions
11. Deities paintings
12. Tombs and graves
13. Cave tombs
14. Tumuli
15. Sacrificial structures
16. Ovoo
17. Ruins of ancient cities and walls
18. Ruins of temples and monasteries
19. Monasteries and temples
20. Stupa
21. Architectural buildings
22. Fortresses
23. Drainage structures
24. Walls
25. Deer stones
26. Manstone monuments
27. Inscribed monuments
28. Animal-figured stones
29. Sealed monuments
30. Stone monuments
31. Inscribed commemoration monuments
32. Places used for mining
33. Places used for manufacturing of ceramics
34. Places used for agriculture
35. Zel stones or *balbals*[4]

Specifics of the Software RICH

- Every immovable property will be registered in the software RICH and numbered by the state registration and information database.
- It registers and collects the information related to historical and cultural immovable properties, and the collected data is then processed.
- It marks the GPS information of the immovable property on the map and includes a photo.

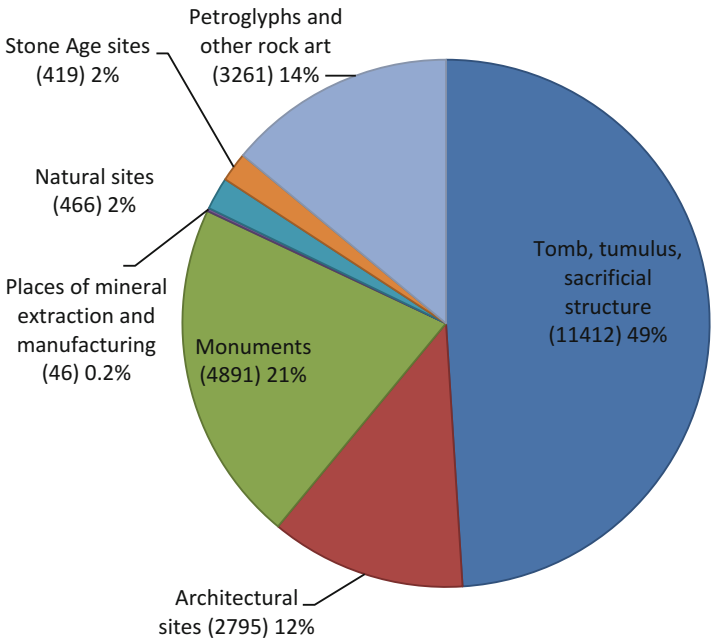

Fig. 6 Classification of the historical and cultural immovable properties registered

- Data from the registration and information state database can be searched and used in statistical analysis relating to the historical and cultural immovable properties in the territory of Mongolia.

As of 2015, 23,290 historical and cultural immovable properties in 2,031 cultural sites have been registered in the software RICH (Fig. 6).

6 Registration and Information Database of Intangible Cultural Heritage

Figure 7 shows the national registration and information system of intangible cultural heritage in Mongolia.

The Protection Division for ICH receives the registration and information of ICH and its bearers in the state database according to the form "Registration of ICH and its bearers" since 2010 (Table 1).

The rules for the registration and information database of ICH were approved and a manual was published. A training session and workshop was organized for local registration officers and cultural staff, aiming to improve the creation of the registration and information database and capacity building.

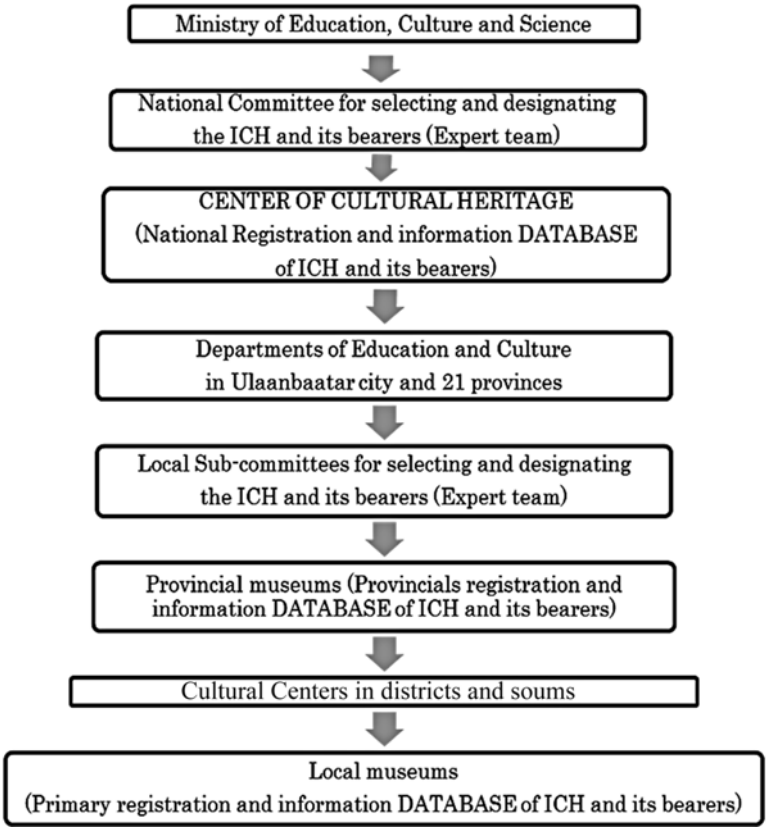

Fig. 7 Establishment of the National Registration and Information System of ICH in Mongolia

Table 1 ICH registration cycle

Cycle I			Cycle II			Cycle III		
Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9
Acceptance of applications from communities, groups and individuals at the local Departments of Education and Culture in provinces and Cultural Centers in soums			Evaluation and Selection by Provincial "Sub-committees for Selecting and Designating ICH and its Bearers"		Elaboration and consolidation by the Center of Cultural Heritage under the Ministry of Education, Culture, and Science		Selection and designation by "National Committee for Selecting and Designating ICH and its Bearers"	Approval by the Ministry of Culture, Sports and Tourism

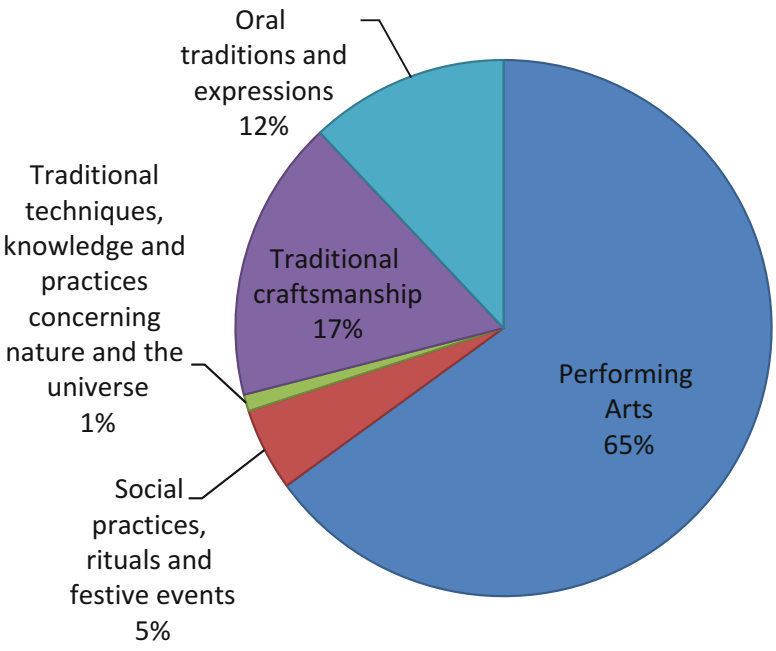

Fig. 8 Registration census of ICH bearers by domain (2013): 7206 ICH bearers by five classifications

Registration work of ICH covered 329 soums and 9 districts and increased the number of individuals identified as ICH bearers to 7,206. The results of the registration census are a valuable asset gathered as a source to further elaborate the short- and long-term objectives, policies, and programs for safeguarding and transmitting ICH (Figs. 8 and 9) (Yundenbat and Tuul 2012: 90).

Since 2013, registration and information of ICH has been saved in the digital database. It is a priority for the information on ICH bearers to be saved in the digital database. As of today, 568 ICH bearers' information is saved in the digital database. In the future, intangible cultural heritage elements will be saved in this database.

7 Problems in the Creation of a Digital Registration and Information Database of Cultural Heritage

Problems related to the creation of database of cultural heritage can be summarized as follows:

Problems Related to the Software RCH and Register

- The budget for registration and documentation of museum objects is inadequate.

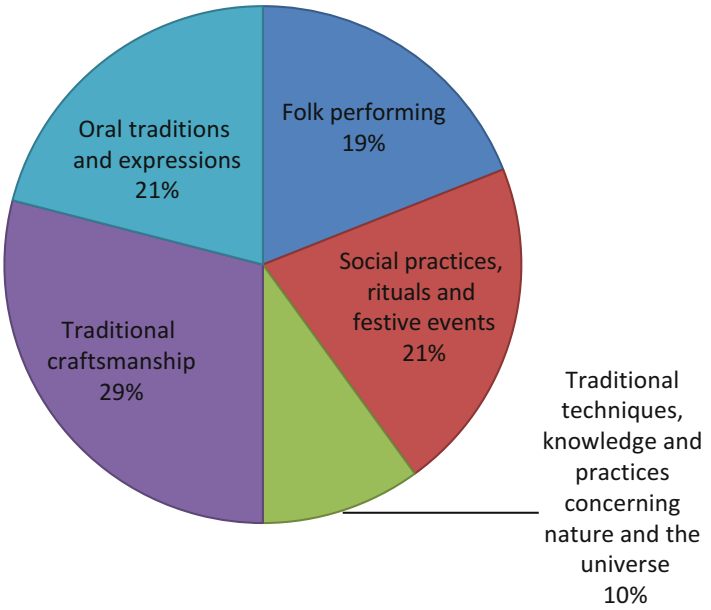

Fig. 9 Registration census of ICH elements by domain (2013): 104 ICH elements by five classifications

- Equipment and human resources for registration of museum objects are inadequate.
- Services of the registration and information database and relevant registration officers have just been established.
- There is a lack of experience in computer and software use, leading to computer viruses.
- There are occasional losses of data, system failures, etc.

Problems Related to the Software RICH

- Delayed information uploading.
- There is a limited data range because data are uploaded only by the Center of Cultural Heritage, which are gathered during the research and inventorying of historical and cultural immovable properties.
- Only some of the early paper-based registration forms in the registration and information database have been uploaded.
- Other research institutes did not participate in using this software.
- It is necessary to encourage other research institutes to participate in using the software and gathering the data.
- All data related to historical and cultural immovable properties in the registration and information state database should be saved in the software RICH.

Problems Related to the Registration of ICH Bearers

- Due to difficulties in documentation equipment, there are some problems in the everyday activities of the division and the creation of a database.
- However, a registration of ICH bearers started in the provinces and Ulaanbaatar City in 2010. Registration is not adequately performed in accordance with the registration form due to inadequate methods, equipment, and finances.

8 New Technologies Used in the Digital Database

8.1 Three-Dimensional Documentation

Three-dimensional documentation for movable and immovable heritage started at the Center in 2008. Since then, several documentation works have been done in collaboration with the National Research Institute for Cultural Properties (NRICP), Tokyo, and Doshisha University and the processed data of 3D documentation have been saved in the registration and information state database of cultural heritage (Fig. 10).

8.2 Improvement of Diagnostic Equipment of the Center of Cultural Heritage

Aiming to make digital documentation for cultural heritage, historical and cultural immovable properties, and intangible heritage and to analyze the material composition of museum objects and archeological artifacts, the Center initiated the project

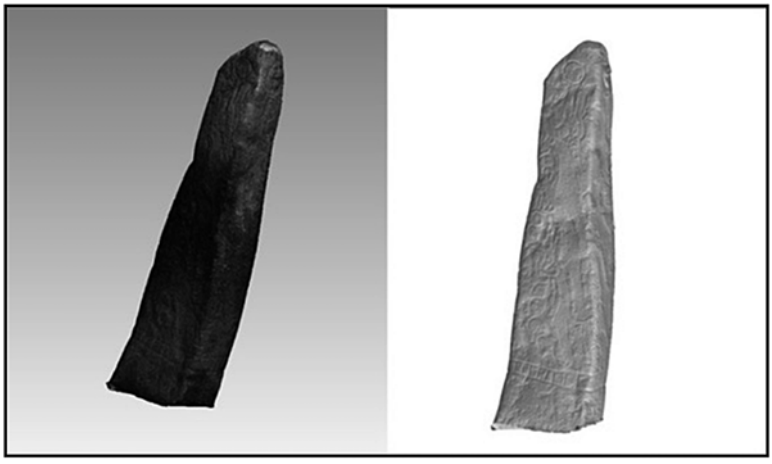

Fig. 10 Deer stones of Dund Jargalantyn am in Omnodelger soum of Khentii Province

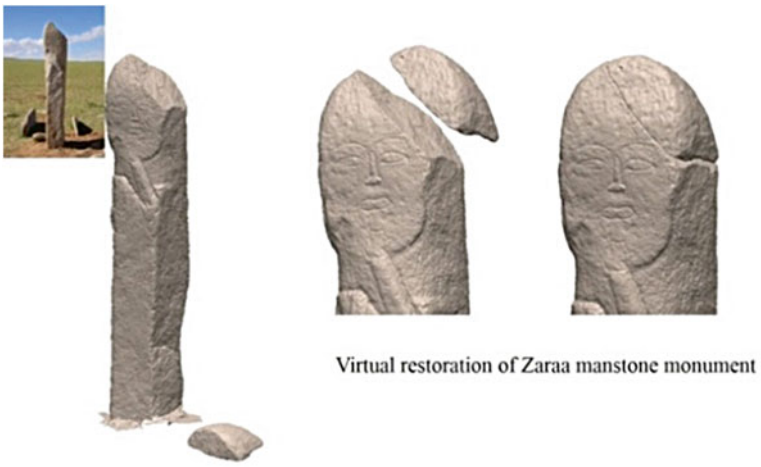

Fig. 11 Visual restoration of Zaraa manstone monument

"Improvement of Diagnostic Equipment of the Center of Cultural Heritage" in 2009 and it was implemented in 2013 through Japanese Cultural Grant Aid. Under the scope of the project, the Center was provided with a portable 3D digitizer (Vivid 9i). Three-dimensional documentation of museum objects and historical and cultural immovable properties is being undertaken with the use of Vivid 9i and the collected data are saved in the digital database. Based on gathered data from 3D measurements, virtual restoration works have been done for some immovable properties (Fig. 11).

8.3 National Project for Digitization of Cultural Heritage-2

The implementation of the "National Project for Digitization of Cultural Heritage" (2006–2008) basically covered museums; it was not dedicated to and did not cover the creation of a registration and information database for historical and cultural heritage and intangible cultural heritage through the state.

For this reason, the Government of Mongolia has approved the "National Project for Digitization of Cultural Heritage-2" by its 215th decision in 2014, aiming to register and document cultural heritage, to take control of conservation and preservation of cultural heritage, to create a digital database for tangible and intangible cultural heritage, and to improve the system used in the registration and information database of cultural heritage.

The objectives of the project is to create a registration and information database of cultural heritage at the level of soum, province, and Ulaanbaatar City and related to this, to provide and decide necessary matters, such as human resources, budget, and equipment. Every soum and province will register and document the tangible

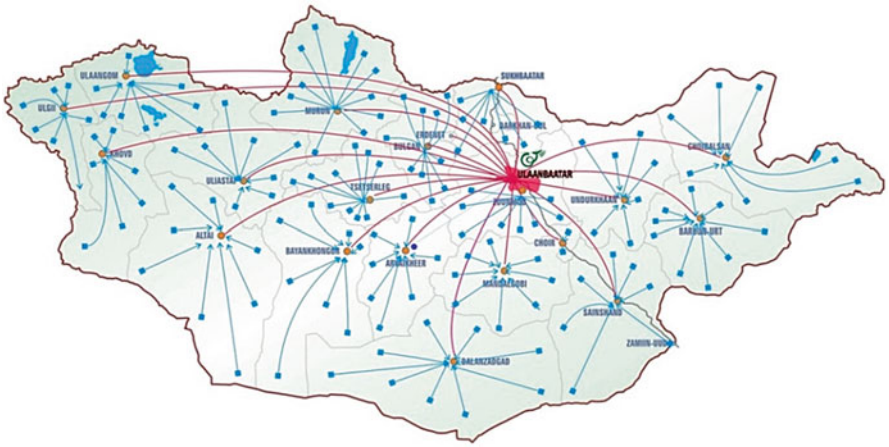

Fig. 12 Registration and information database of cultural heritage at the level of soum, province, and Ulaanbaatar City under the "National Project for Digitization of Cultural Heritage-2"

and intangible cultural heritage in their territory and create a registration and information database using the gathered data (Fig. 12). It will serve to improve the registration and documentation of tangible and intangible cultural heritage, as well as to create a registration and information database;

For museum objects and artifacts, it will improve the activity of the registration and information database in museums and research organizations; it will activate the research and study of objects and to use the research results in the registration; and it will improve the registration and documentation of museum objects and responsibility.

For historical and cultural immovable properties, it will make cadastral confirmation of historical and cultural immovable property, selected to be in the protection of "State," "Province," or "Ulaanbaatar City" by the decision of the Government of Mongolia; it can number the historical and cultural immovable property registered in the registration and information database; and it serves to organize registration and documentation work for historical and cultural immovable properties through the territory of soum and province.

For intangible cultural heritage, it will improve the registration system of intangible cultural heritage and create a registration and information database of intangible cultural heritage; it helps to increase the number of ICH elements in the list of Need of Urgent Safeguarding and Representative List of Intangible Cultural Heritage.

Notes

1. Thangka paintings on black background are called *nagtan*.
2. Thangka paintings on white background are called *gartan*.
3. *Ovoo* is a sacred cairn found in Mongolian shamanic religious traditions, usually made from rocks or wood. Ovoo is often made at the top of mountains and in high places.

4. Zel stone or *balbal* is an ancient worshiping stone without description (plain stone) which situated next to the burial. This kind of stone is one part of the burial complex that continues a long distance of about 1 km with many separated pieces (defends its burials type). Many of them are ordered and especially directed to the south east direction which means direction of sunrise.

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Rewiring Museum Information: Mobile and Cloud

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Abstract At the National Museum of Ethnology, Japan (Minpaku), ImageFinder was designed to connect different kinds of information on an object through a new digital device: People search information not by using text but images of the objects instead. Another instrument called MAP (Minpaku Anthropological Phototheque) shows pictures taken by Minpaku staff in their fieldwork. These examples show that rapid progress in the design of digital devices and growth of the Internet community have changed the way to offer information on exhibitions and the museum itself. By connecting the information, visitors and users might find additional information or produce new contents and feed them back to the museum. As Minpaku collects materials concerned with human culture, we can show the existence of material culture in each period all over the world. Objects and information related to them would be our inheritance of intelligence on this planet.

1 Introduction

The aim of this paper is to introduce new methods of supplying information on the exhibits in the National Museum of Ethnology, Osaka, Japan (NME, Minpaku) and discuss their significance for the museum. These methods can show fundamental information on the objects displayed or stored in the museum and the results, new findings, and special knowledge of academic studies. Visitors to the museum can use them when they see the exhibits.

I will introduce two instruments: one is called ImageFinder and the other is called MAP (Minpaku Anthropological Phototheque). ImageFinder was developed as one of the media in the information zone in Minpaku. ImageFinder can contribute to making visitors to Minpaku aware of the existence of various kinds of information on the objects. MAP is used to supply different kinds of information on the exhibits from ImageFinder. We have a MAP for the regional cultures of China and it shows pictures that have been taken by Minpaku staff members. Not all of pictures

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are directly concerned with the objects in the exhibition, but they often provide background information relevant to exhibition themes.

I show how ImageFinder and MAP can supply information and then discuss the significance of supplying information in the museum. I especially focus on mobility and collectivity of information and discuss the possibility of these methods being used outside the museum.

2 The Limit of Transmitting Information to Visitors in the Museum

We can share various kinds of information in Minpaku and classify them as follows: (1) information on how to use the museum, (2) information on exhibits in the museum, and (3) information on the academic research of museum staff.

The information on admission fees, open days, and access map to the museum or plan of the exhibition hall are included in the first category. We have to provide them inside and outside the museum. The second information type is complicated. The name of the object, the area or country where it was collected, and the ethnic group or population that owned or used it belong to the second type of information in Minpaku. At the same time, the context in which it was used or the significance of the object in society also belong to the second type. They might, however, be treated differently when offered to visitors. The name, area, and ethnic group's name might be indicated in a caption to the objects in the exhibits. The object not only has fundamental information such as the name or original owner but also its cultural and historical background. They have been studied by academic staff and accumulated in the museum. There is a large volume of them and they cannot be explained only by the captions or panels that are usually set in the museum. They can be explained by other methods including electric devices or lectures by the museum staff. We can use different methods or ways to supply information on the objects to the museum visitors according to nature of the information (Nobayashi 2014a).

We also have to understand the nature of the media when we use them to supply information in the museum. We should recognize different media according to the contents of the information and the subjects to which we offer the information. For example, it is necessary to consider what words we should use in a pamphlet, the utilization of *kanji* (Chinese characters used in Japanese transcription), the size of the letters, the language according to the target age, nationality, and so on.

We cannot supply so much information in the exhibitions. The museum has limited space, available media, and number of staff who can support visitors. We have to select information to offer it effectively and efficiently to the visitors to the museum. Visitors might also see the museum exhibition within a limited time. If the museum tries to offer too much information on the exhibits, the visitors will be unable to digest most of it during their visit to the museum.

When we understand that the information we can offer to the visitors is limited, we become aware of the strict conditions of offering information. Insufficient information about an object or exhibit might give visitors not only insufficient understanding but also wrong understanding. It is a major purpose of Minpaku to have visitors deepen their understanding of the history and the culture of human society with the exhibits. This cannot be achieved without enough information about human culture and society from the results of academic studies.

3 Rewiring Various Information in the Museum: ImageFinder

We were able to understand that we need to offer information at the museum to visitors for advancing their understanding. On the other hand, we know that information is distributed around the museum and some of it might not be in an easily accessible place. Some contents might be separated and visitors do not know that they are concerned with each other. Minpaku's exhibits are constructed with academic research and objects have been collected by the academic staff. They have also published books, articles, and essays as a result of their research and study. They have also accumulated at first hand materials including field notes, movies, pictures, and official documents while collecting materials. In fact, objects in Minpaku's exhibitions are rich in information concerning human culture and academic research. However, visitors do not necessarily have enough time to access them. The museum encourages its visitors to improve their knowledge or ideas by offering an appropriate means to provide information. It is most important for both visitors and the museum to have the chance and space to know the existence of various information relevant to the objects. We have to start sharing the information together.

We developed a new digital device offering information on the exhibits in Minpaku called ImageFinder under such conditions. It was designed to connect different kinds of information on an object through a digital device. The author engaged in developing it with the staff members of Minpaku, IT developers, and researchers. When we started the project, I showed a concept of the scheme to connect the existing contents in Minpaku (Fig. 1). We had used many kinds of media that offered information to the visitors to Minpaku but they were all independent.

We set the main purpose of the project as developing a means to show the connection of various information. We tried to make a new device that could wire the various information to the objects and show the connection and, as a result, have the users recognize the existence of information that is dispersed and not connected directly with the objects in the museum.

This system seems to work like a link collective site. It shows URL and users can move to the URL resource. What we tried to develop was different from such Internet linkage in the way of offering information. One reason is that we did not

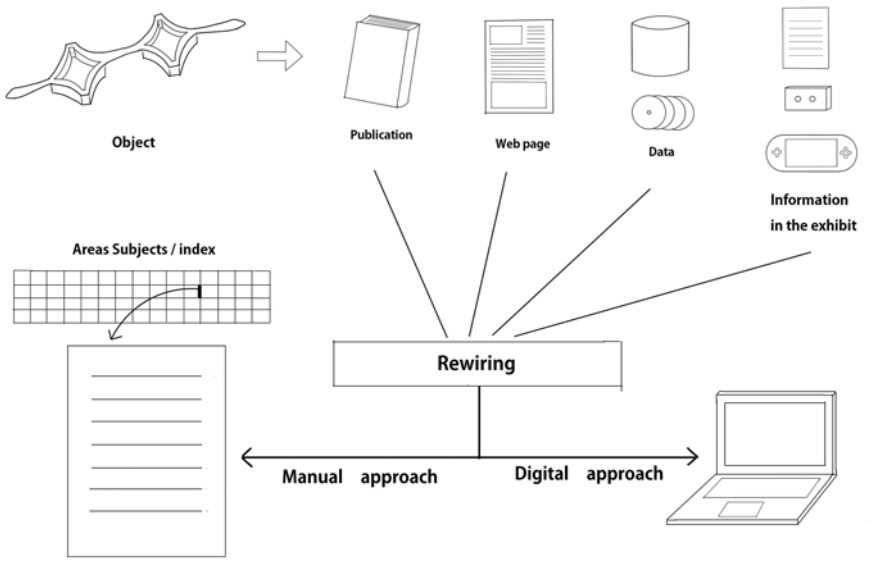

Fig. 1 A basic concept of the ImagFinder which the author offered at first

necessarily have all digital data of the information. It is sometimes difficult to make digital contents so that copyright is protected. We could not install all data in the same device. The other reason, what is more important, was that the new device was expected to encourage the visitors to search the information by themselves. To explore is the fundamental way of academic research. We expected the visitors to do autonomous activities (Fig. 2). We tackled the other important aspect in developing the device: a searching style without words. When we see an object for the first time and are interested in it, we try to collect information. We do not usually know the name, function, or its social context. We hoped that visitors would go through the same process as we did in our fieldwork. We therefore considered a way for people to search information not by using text but images of the objects instead. This might be an opposite direction for searching information in modern society where text searching is very popular for people using the Internet.

4 The Possibility of Big Data: MAP (Minpaku Anthropological Phototheque)

I also participated in another project to develop another digital device that could supply information on the exhibits. It was named Minpaku Anthropological Phototheque (MAP) and used in the exhibition “Regional Cultures of China” (Nobayashi 2014b). It showed pictures that were taken by Minpaku staff in their fieldwork. The picture itself is a useful medium in the museum. It shows the process

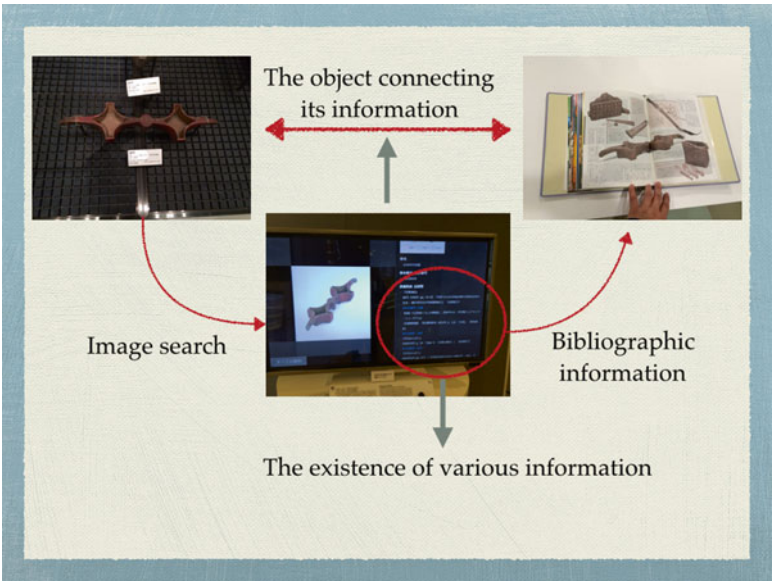

Fig. 2 Rewiring the object and its information by ImageFinder

of making or using objects concretely. It is used in museum exhibitions as a picture panel or printed in the catalogue. But there is limited space and we could not necessarily use pictures with the exhibits. In particular, the main purpose of the exhibition on "Regional Cultures of China" was to show variation in human cultures, and pictures were expected to be a useful medium for achieving it.

We planned a way of offering pictures to show the variations and changes of human culture as follows: to set pictures according to the location and time they were taken. We consulted with IT developers and designers to improve the operation system.

In MAP, pictures are distributed on a world map on a monitor screen according to the location they were taken. The users could select all of them according to the year they were taken (Fig. 3). The pictures were not necessarily concerned with the objects in the exhibition. But the users could understand the condition of the area that the exhibition was focusing on. They were also given plural "tags" concerned with the events and ethnic groups. Peoples could select and display pictures according to the time and the particular event. When a user selected a picture, a comment on it was displayed on the screen with a series of pictures that were taken at the same time.

The MAP system is currently working in the museum. However, it might be useful to use it outside the museum, especially on the Internet. In that case, it might be possible to supply and collect "big data" from the museum.

Fig. 3 Sorting pictures by years in MAP screen

We tend to think that an exhibition needs information concerned with the objects in the exhibition or the museum itself. The exhibits are a visible part of the museum and directly linked to the public. The museum has a chance to be evaluated with its exhibits. On the other hand, the exhibits change and the museum might collect additional information or new materials related to existing exhibits and materials or not. Individual exhibitions cannot continue to contribute to the museum and the public. We have to pay more attention to the materials stored in the museum. They also have rich contents or information as do the objects in current exhibitions. The museum could always open them to the public by other methods different from the exhibits. MAP could also be one of them.

A picture has rich information about people, animals, geography, weather, and artificial things including instruments, buildings, crafts, and so on. Even if a photograph has no image of people or artificial things and just shows the image of a cloud, it might be useful for meteorology with the data on the time and location. Digital cameras now record the time and location easily with a picture. It is much easier for us to order pictures according to the space and time than before.

They would also be historical records to those people who live in the area where the photographs were taken. It is more efficient and effective to open them to local society through SNS or other methods. The accumulated data would be passed down to the next generation and spread horizontally among the population with additional information. It is not necessary for the information in the museum to stay in the museum.

5 Conclusion

The rapid progress of digital devices and the growth of the Internet community have changed the condition of museums, especially the way to offer information on exhibitions and the museum itself. Digital devices can handle various information that is separated from the object together because digital contents are easily duplicated. It lets the museum offer this information to the public in the museum and outside the museum at the same time. It is important to connect the information so that visitors can understand the exhibits efficiently and effectively. As a result, visitors and users might find additional information or produce new contents and feed them back to the museum. We are rewiring information from outside to the museum information. The museum and the users share the information that is not only in the museum but also in the hands of the users. This is mobility and cloud computing for information of the museum.

On the other hand, digital devices cannot autonomously offer information to visitors. We cannot imagine the museum without them, and digital devices and other digital media will become more important and develop further in future. We have partly achieved connection and integration of the museum's information by utilizing IT technologies. However, it depends on their utilization whether we can share the information with the museum visitors or users or not. We have to develop a way that stimulates visitors' intellectual curiosity and raises their literacy in dealing with museum information.

What do the objects and their information in the museum mean to us? In Minpaku, we have collected materials concerned with human culture. We have experienced rapid changes in our world during the twentieth and twenty-first centuries. We cannot see some of the material culture stored in Minpaku in their original places. We can show the existence of material culture in each period all over the world. People who are the original owners might use this information to create a new local material culture. The objects and their information in the museum will be our inheritance of intelligence on this planet.

Note ImageFinder and MAP system were developed by the cooperated work of the museum staff, designers of the exhibits and the developers of the computer system. It was also to rewire the knowledge and experience among the peoples.

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Managing and Analyzing Museum Environmental Data

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Abstract Two specially customized computer programs have been developed at the National Museum of Ethnology, Japan to facilitate the analysis of the museum environment: a pest monitoring data analysis program; and a temperature/relative humidity (RH) monitoring data analysis program. These analysis programs improve understanding of the museum environment and support efficient and quick discovery of any abnormalities from a preventive conservation point of view. Daily and advanced uses of these data analysis programs were described. For example, a comparative study of the results of temperature and humidity control under the normal regime and under the power-saving regime was carried out based on actual readings, and permitted use of more energy-efficient air-conditioning control since FY2014. For the next development, it is intended to incorporate these analytical programs into "data analysis small packages" that can be used freely by other museums and related institutions.

1 Introduction

In this time of globalization, the role of museums in valuing tangible cultural heritage from different communities or nations, through ensuring broader access to the collections while managing their proper conservation, is gaining importance. With increasing demand of access to the collection, museums need to take good balance between access and conservation.

At the same time, the museums of the twenty-first century are required to pay consideration to its environmental impact. Two important environmental issues affecting museums are protection of the ozone layer, and climate change. The former led to a comprehensive review of policies regarding the use of chemical fumigants on cultural properties in Japan, resulting in the implementation of Integrated Pest Management (IPM). Climate change affects not only the outdoor environment but also the museum environment. We face to a dilemma how to reduce the energy consumption without generating an adverse effect to climate control within a museum.

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Moreover, in Japan, energy saving becomes a serious matter after the Great East Japan Earthquake occurred in 2011.

Considering that museum collections and especially those in a museum of ethnology are frequently composed of organic materials susceptible to insect and fungal attacks, control of the museum environment is an important task. Each museum is taking action for sustainable museum environment control based on the results of museum environment investigations. Among these investigations, a huge amount of data has to be handled for pest monitoring and temperature/relative humidity (RH) monitoring. A key point is how to analyze these data effectively and efficiently from a conservation point of view. For this purpose, two specially customized computer programs have been developed at the National Museum of Ethnology, Japan in order to facilitate the analysis of the museum environment: a pest monitoring data analysis program and a temperature/RH monitoring data analysis program. These analysis programs contribute to improve understanding of the actual state of the museum environment and to find out efficiently and quickly any abnormalities from a preventive conservation point of view. Based on this, a new development is ongoing at the National Museum of Ethnology, Japan to improve these analysis programs into museum environment "analysis small packages" that can be used free of charge by any other institution.

This paper first describes examples of computer-assisted analysis of the museum environment performed at the National Museum of Ethnology, Japan and then describes briefly the ongoing development of the analysis programs.

2 Pest Monitoring Data Analysis

As a part of the efforts to implement IPM, pest monitoring using insect traps has been ongoing since 1992 at the National Museum of Ethnology, Japan. Two kinds of insect traps (327 sheet traps and 181 pheromone traps for cigarette beetles) are set at fixed points in different parts of the museum including the storage zone, the gallery zone and the other zone for 2 weeks and then collected. The pests captured in each trap are then counted and identified. The results are collected on a Microsoft Excel sheet in which the pest species damaging the museum collection and captured so far in our museum are figured (Table 1).

2.1 Daily Use

The pest monitoring data analysis program is currently used to make different graphs (line graphs or bar graphs) and traps mapping.

After each seasonal investigation, the newly acquired data are checked systematically through comparison with data from the same season of the previous years; this is in order to judge whether the current situation is normal or not. If any problem

Table 1 Pest list used at the National Museum of Ethnology, Japan for monitoring pests

Coleoptera (Beetle, Weevil)	Anthrenus verbasci
	Attagenus japonicus Reitter
	Other Dermestidae*
	Dinoderus minutus (Fabricius)
	Other Bostrychidae*
	Lyctus brunneus (Stephens)
	Other Lyctidae*
	Stegobium paniceum (Linnaeus)
	Lasioderma serricorne (Fabricius)
	Other Anobiidae*
	Ptinidae
	Sitophilus zeamais
	Other Rhynchophoridae (added in April, 2007)
	Tribolium castaneum
	Other Tenebrionidae
	Curculionoidea
	Oryzaephilus surinamensis
	Other Silvanidae
	Cerambycidae*
	Other Coleoptera*
Lepidoptera (Moth and Butterfly)	Tinea translucens Meyrick
	Tineola bisselliella
	Pyralidae
	Other Lepidoptera*
Blattaria (Cockroach)	Periplaneta fuliginosa (Serville)
	Periplaneta americana (Linnaeus)
	Blattella germanica (Linnaeus)
	Other Blattaria
Thysanura (Bristle teil)	Ctenolepisma villosa (Fabricius)
	Other Thysanura*
Psocoptera (Booklouse)	Liposcelidae
	Other Psocoptera*
Orthoptera (Orthopteron)	Rhaphidophoridae
	Gryllidae
	Other Orthoptera
Isoptera (Termite, White ant)	Reticulitermes speratus (Kolbe)
	Other Isoptera*
Diptera (Fly)	Diptera, orinigated from inside (added in July, 2008)
	Diptera, originated from outside (added in July, 2008)
	Other Diptera or all Diptera before July 2008
Hymenoptera (Sawfly, Wasp, Bee, Ant)	Formicidae*
	Other Hymenoptera

(continued)

Table 1 (continued)

Thysanoptera (Thrip)	All Thysanoptera
Hemiptera (Truebug)	Heteroptera
	Aphidoidea
	Cicadellidae
	Homoptera
	Psylloidea
	Other Hemiptera
Collembola (Springtail)	All Collembola
Dermaptera (Earwig)	All Dermaptera
Other Insecta	All other Insecta (added in April, 2007)
Arachnida/Acari (Mite, Tick)	All Acari
Arachnida/Araneae (Spider)	All Araneae
Malacostraca/Isopoda (Woodlouse, Pill bug)	All Isopoda
Diplopoda (Millipede)	All Diplopoda
Chilopoda (Centipede)	All Chilopoda
Others	All others

*If found, species should be specified

is discovered, the possible causes of the abnormalities are to be clarified through an in-situ inspection by museum staff and necessary measures taken.

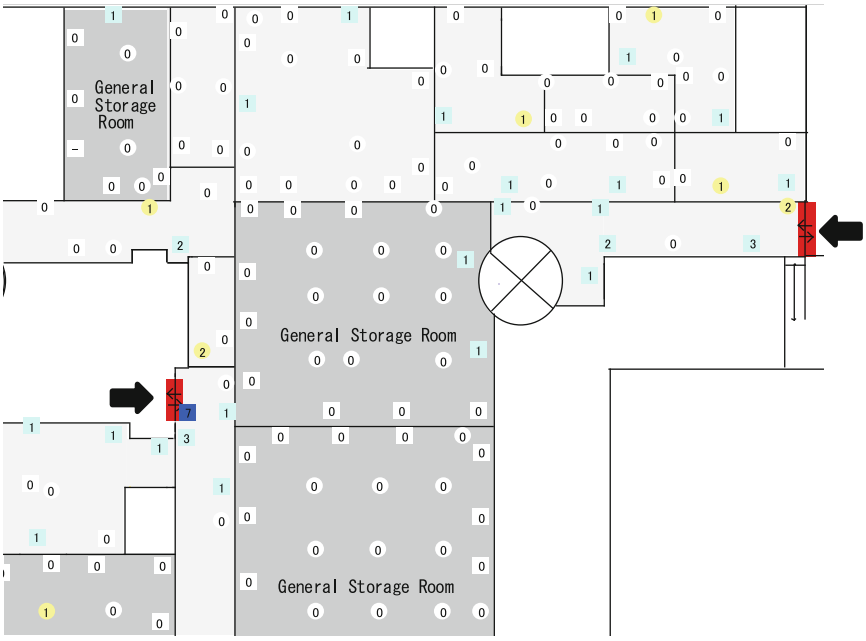
The original traps mapping program based on Microsoft Excel is an effective tool to visualize the geographic concentration of the pests as well as the distribution of the pest species. As an example, the traps mapping of the results of our investigation in winter 2015 is given in Fig. 1.

- The geographic concentration of the pests is presented; the darker the color, the more concentrated the number of the pests captured. We remark that a very few pests are captured in the storage zone (dark gray area).
- From the distribution of the pest species, we observe that pests trapped in the other zone (light gray area) are mostly flies ◌ in the corridors near the shutter doors (➡).

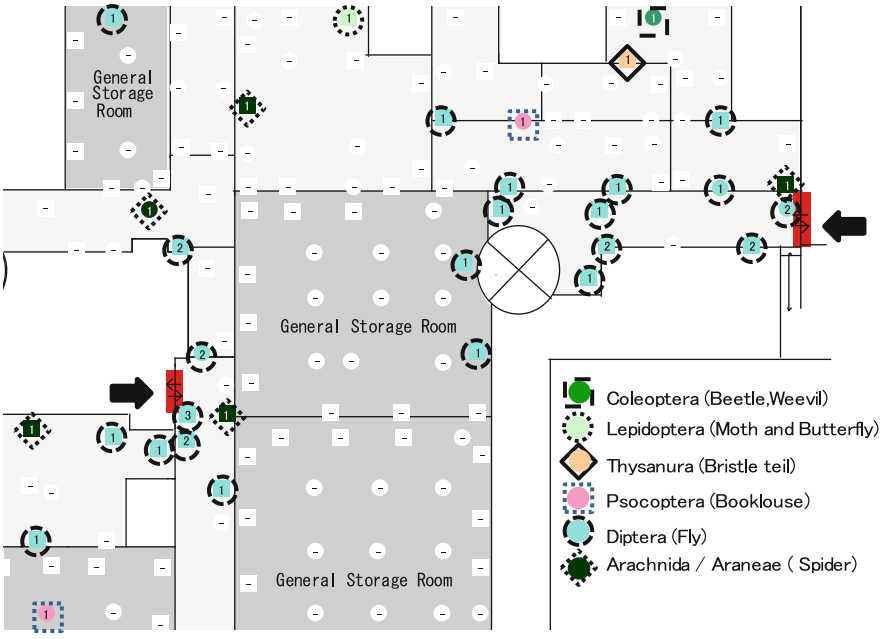
2.2 Advanced Use

A review of the data accumulated since 1992 contributes to understand the pest trends in the museum (Sonoda and Hidaka 2011).

- Pests are most frequently captured in summer, followed in order by spring, autumn, and winter. There are no clear seasonal characteristic in the species captured, probably because the museum environment is controlled for human



Geographic concentration of the pests: the total number of the pests captured in each trap (*upper*)



Distribution of the pest species: the most captured pest species in each trap (*lower*)

Fig. 1 Traps mapping: Geographic concentration of the pests (*upper*) and distribution of the pest species (*lower*) from the results of the investigation winter 2015. *Dark gray area*: storage zone *Light gray area*: other zone. □ Sheet traps ○ Pheromone traps

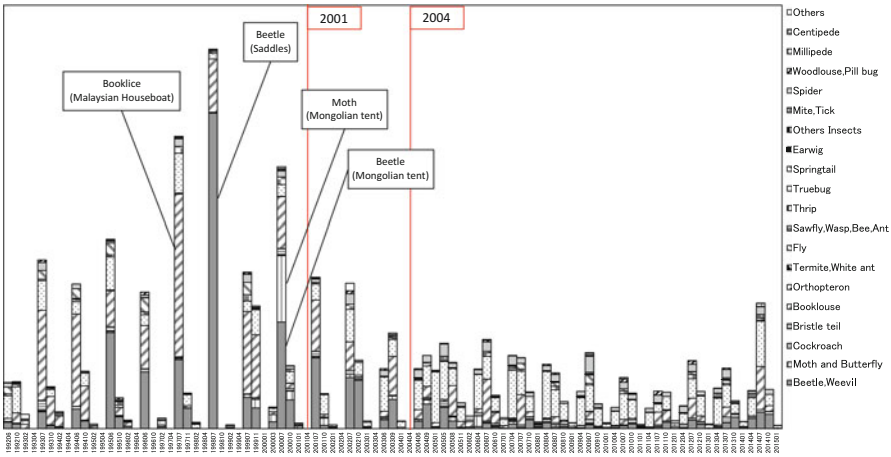


Fig. 2 Relative changes in the numbers of pests trapped in the gallery zone from 1992 to 2015

comfort and consequently for pest comfort throughout the year. In the storage zone, constant attention should be paid to booklice, beetles and moths. In the gallery and other zones, pests originating from outside the museum are frequently captured: flies in all seasons; spiders in spring and winter, and woodlice in summer and autumn. Booklice always rank among the most frequently captured species, except in the gallery and other zones in spring, which is a dry season in Osaka (where the National Museum of Ethnology, Japan is located).

- In the period 1992–1999, the most frequently captured species were booklice and beetles, the latter becoming more prevalent around 1997–1999. Between 1999 and 2000, there was a local outbreak of moth, and from 2001 a marked increase in flies. At the beginning of the investigation, booklice were found mainly in the storage and gallery zones, yet are now observed mainly in the other zone. Beetles are captured mainly in the storage and gallery zones, although their numbers have clearly decreased in recent years. Moths were found almost exclusively in the storage zone in 1999–2000, during work to replace air conditioning ducts. Flies have appeared frequently in the other zone since 2001. The occurrence of pests has changed location from the storage and gallery zones to the other zone; this change occurred in 2001 when we started to strengthen communication between different sections based on the principles of IPM.
- In the gallery zone, there is a clear tendency for pin-point attacks. Some objects such as a houseboat in the Southeast Asia gallery and a Mongolian tent in the North Asia gallery have been suffering regularly from pest attacks. This observation led us, in 2004, to introduce an IPM inspection (visual observation of the objects most prone to pest/fungus attacks) at the time of the daily rounds in the exhibition galleries before the museum opens. Figure 2 shows relative changes in the number of pests trapped in the gallery zone from 1992 to 2015, indicating that the situation improved on two occasions, in 2001 and in 2004. The former is

the date on which we started to strengthen communication between different sections as noted above, thus confirming the importance of better communication and daily attention.

- In the storage zone, pest attacks tend to spread. This can be attributed to the density of the objects in the storage zone. Another possible reason is that, in the storage zone, in comparison with the gallery zone, the objects are not exposed to human eyes as often, thus preventing early detection. Therefore, it was decided that different storage rooms be cleaned regularly, finishing with a rapid IPM inspection of all the objects stored in the respective rooms. In this way, each room is cleaned and each object is given a cursory inspection at least once a year.

3 Temperature/RH Monitoring Data Analysis

Monitoring temperature and RH with data loggers started in 2004, to complement the classical monitoring using thermo-hydrographs. Currently, nearly 150 data loggers are used mainly covering the storage zone and the gallery zone. As of January 2015, we have accumulated 26 GB of data in our temperature and RH database.

3.1 Daily Use

Temperature and RH data are checked sequentially by the central surveillance center and necessary measures taken as the need arises. Data are solely reviewed every 2 weeks and shared between museum staff of different sections. Every month, the newly acquired data are presented in graphs using the temperature/RH monitoring data analysis program and checked in order to judge whether the current situation is normal or not. If any problem is discovered, the possible causes of the abnormalities are to be clarified and necessary measures taken.

3.2 Advanced Use

In order to overcome the electricity shortage due to the Great East Japan Earthquake of March 2011, 10–15 % reduction in electricity use (in comparison with 2010) was requested in winter 2011 and in summer 2012, leading us to adopt a power-saving regime for several general storage rooms.

The storage rooms at the National Museum of Ethnology, Japan are divided into two types: general storage rooms and special storage rooms. Most of the items in the museum collections are made of composed materials and are placed in general storage rooms under collection classifications, without any sorting by material. Special storage rooms house artifacts made of sensitive materials requiring finely tuned air-conditioning control, as well as items which require special security arrangements.

Table 2 Temperature and RH settings under the normal, power-saving, and new regimes for general storage rooms

	Spring	Summer	Autumn	Winter
NORMAL regime	Adjustments made in increments of 0.5 °C/week	26 ± 2 °C	Adjustments made in decrements of 0.5 °C/week	20 ± 2 °C
	52 ± 5 % RH			
	8:20–18:00			
POWER SAVING regime	OFF	26 ± 2 °C	OFF	20 ± 2 °C
		52 ± 5 % RH		52 ± 5 % RH
		Only Wednesdays and Sundays		3–4 h at night everyday
NEW regime since FY2014	OFF	26 ± 2 °C	OFF	20 ± 2 °C
		52 ± 5 % RH		52 ± 5 % RH
		8:20–18:00		8:20–18:00
		Air conditioning starts when temperature >25 °C or >65 % RH for more than one week		Air conditioning starts when temperature is too cool for museum staff to work or <40 % RH

Before the power-saving regime (normal regime), the general storage rooms were air-conditioned daily between 08:20 and 18:00. The temperature was set at 26 ± 2 °C in summer and at 20 ± 2 °C in winter, varying 0.5 °C per week in the transitional periods, while RH was set at 52 ± 5 % all the year. The power-saving regime was adopted for general storage rooms. Under the power-saving regime, the air-conditioning was turned off during the transitional periods. During the winter of 2011, air-conditioning was run only at night during the off-peak period. In summer 2012, air-conditioning was only run for 24 h, 2 days a week (Table 2). However, one of the general storage rooms (Room No. 5) was exempted from these power-saving measures as it was situated in upstairs and not surrounded by other rooms. Consequently this room is easily exposed to the effects of outside air.

The results of temperature and humidity control under the normal regime and the power-saving regime were examined and compared based on actual readings (Sonoda and Hidaka 2013).

- For the transition periods, temperature changes occurred more gradually with the suspension of air-condition under the power-saving regime than under the normal regime, resulting in smaller fluctuations in temperature and in RH.
- Under the normal regime, the average temperature remained within the control range in all of the storage rooms, whereas it tended to drop below the control range under the power-saving regime. The maximum daily difference between the lowest and the highest temperature readings was less than 4 °C (even less than 2 °C in several rooms) under both regimes, except in Room No.5. The average daily difference was around 2 °C or less (even less than 0.5 °C in several rooms) under both regimes, except in Room No.5.

- The average RH was slightly higher during the summer period under the power-saving regime (around 60 % RH) but otherwise remained largely within the control range. The maximum daily difference in RH was 10 % RH or less under both regimes in most storage rooms, but in some storage rooms this value exceeded 10 % RH during spring and summer. The average daily difference in RH was less than 5 % RH under both regimes except the summer period under the normal regime where it exceeded this value.
- No significant difference between the two regimes was observed in the annual temperature difference. The annual RH difference was greater under the power-saving regime than under the normal regime. However, weekly transition in temperature and in RH was comparable under both regimes except the summer period under the power-saving regime where greater temperature and RH fluctuations were observed.

From all these observations, it was concluded that the temperature and humidity control level was acceptable under both regimes except the summer period under the power-saving regime. This study resulted in the adoption of energy-efficient air-conditioning control (the new regime) since fiscal year 2014 (Table 2). Under the new regime, air-conditioning is switched off in spring and autumn, and starts when the temperature or RH values become too high in summer or too low in winter. If the power-saving regime is requested, we opt to reduce the air-conditioning time by running the air-conditioning for just a short period every day and not by alternating between no-air-conditioning days and 24-h-operation days in order to avoid temperature and humidity fluctuations.

Figure 3 compares actual data from one of the general storage rooms under the normal, power-saving, and new regimes.

- For spring and autumn, temperature changes occurred more gradually with the suspension of air-conditioning under the power-saving regime and the new regime (⬚) than under the normal regime, resulting in smaller daily fluctuations in temperature and in RH.
- After a period of no air-conditioning in spring 2014, the temperatures in the storage rooms were actually lower than the temperature setting of the air-conditioning on the day the air-conditioning was scheduled to be switched on, and this allowed the use of air-conditioning to be delayed (▭).
- At the beginning of December 2014, several museum staff felt that the temperature was becoming too cold. We started air-conditioning 1 week earlier than the estimated starting day of the air-conditioning (⬚).
- The above two observations led us to conclude that the suspension of air-conditioning in the transition periods may allow the use of air-conditioning to be delayed, but this depends on the outside climate at the time.

Figure 4 compares the weekly distributions in temperature and RH for each season for the same general storage room as in Fig. 3. An ellipse was drawn for each week to include 90 % of the data. The size of each ellipse reflects the fluctuation; the greater the size, the greater the weekly fluctuation in temperature and/or RH. The idea for this ellipse analysis came from a previous study done in our museum (Morita 1981).

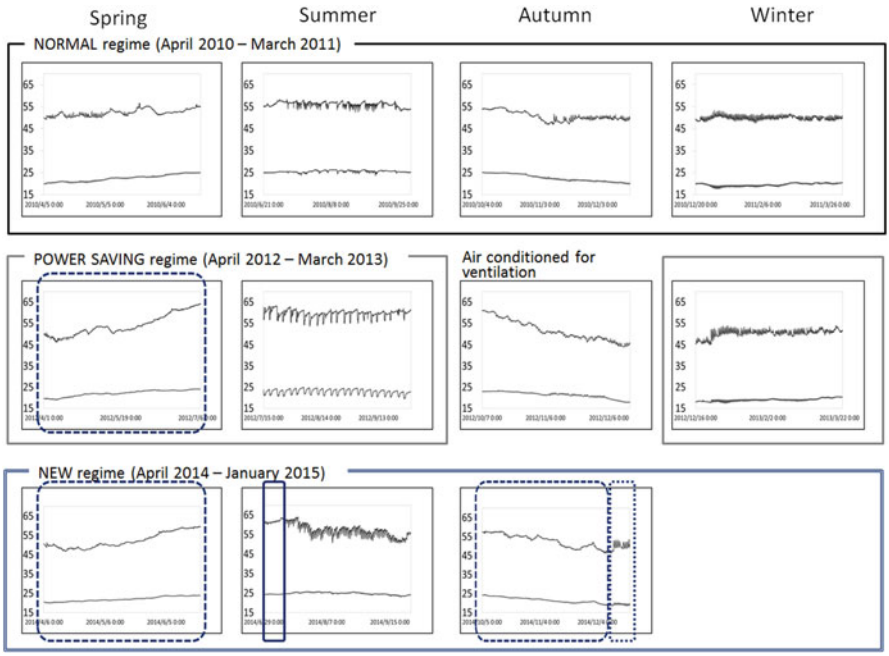


Fig. 3 Annual data from one of the general storage rooms under the normal (*upper*), power-saving (*middle*), and new (*lower*) regimes. *Upper lines*: relative humidity (%RH). *Lower lines*: temperature (°C)

- At the weekly level, fluctuations were comparable and acceptable under the different regimes for the transition periods of spring and autumn as well as for winter, as shown by the similar small sizes of the ellipses.
- In summer however, much greater ellipses were observed under the power-saving regime, suggesting bigger temperature and RH fluctuations (▢).

Overall, we estimate that, except for the summer period under the power-saving regime, there were no sudden fluctuations in temperature and RH, and weekly transitions in temperature and in RH were more or less comparable under the three regimes.

4 Future Development

As the next development, we plan to develop these data analysis programs (pest monitoring data analysis program, and temperature/RH monitoring data analysis program) and to make "data analysis small packages" that can be used free of charge by any other institution. We are at the stage of making further program changes and

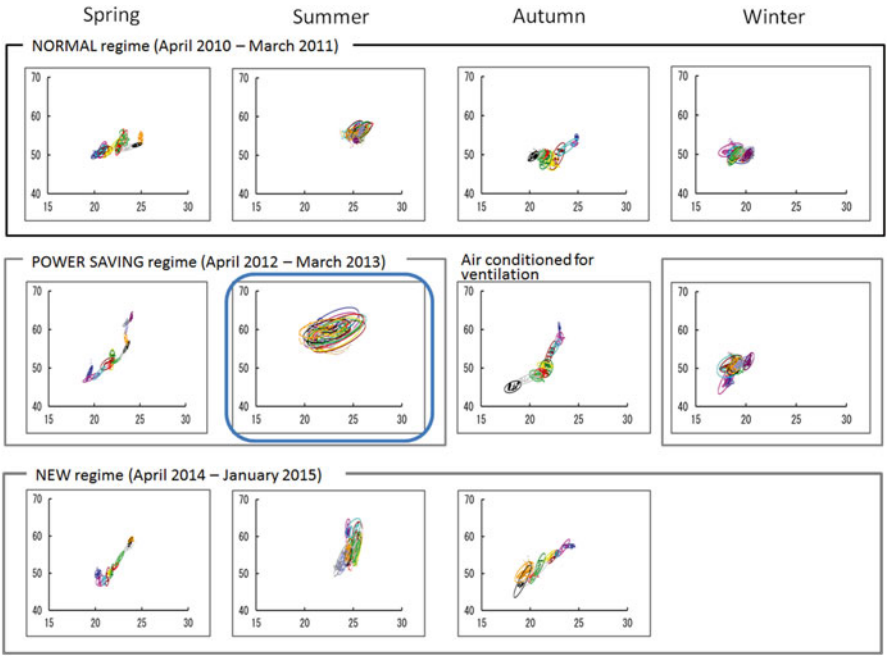


Fig. 4 Weekly distributions in temperature and in RH for each season for the same general storage room as in Fig. 3 under the normal (*upper*), power-saving (*middle*), and new (*lower*) regimes. *X axis*: temperature (°C). *Y axis*: relative humidity (%RH)

improvement, after having received comments and requests by researchers who kindly had accepted to use the prototype version of the "temperature/RH monitoring data analysis small package." We hope that the Japanese version will be available in the near future. The English one is in the planning stage.

Both the "pest monitoring data analysis small package" and "temperature/RH monitoring data analysis small package" are conceived on the same principles: simple and easy for anyone to use without receiving any special training. The systems required for these data analysis small packages are: Windows 8 (64 bits) or Windows 8.1 (64 bits); CPU Intel Core i5; memory 4 GB; Microsoft Excel 2010 (64 bits); and disk capacity of more than 500 GB.

The starting window contains six tool buttons (Fig. 5):

- The "Data Fetching" button is used to go to a data fetching window.
- The "Graphs Making" button is used to go to a graph and/or mapping setting window.
  - In the case of pest monitoring data analysis, we have a choice between graphs making and maps making. Graphs can be chosen between bar graphs and line graphs. Maps are of two sorts: geographic concentration of the pests; and distribution of the pest species.

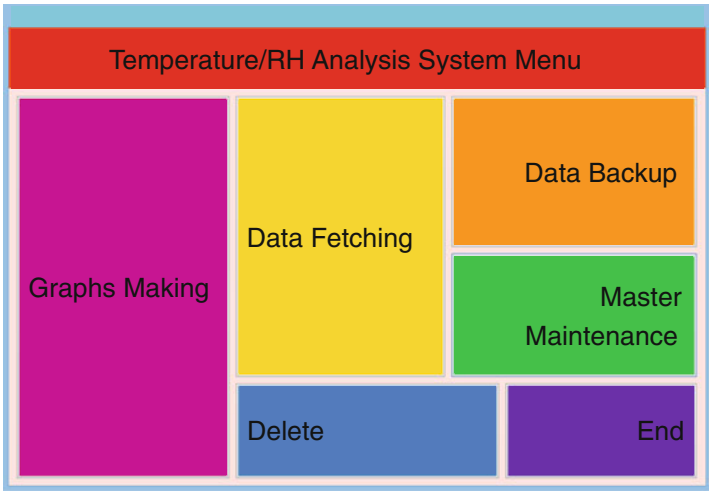


Fig. 5 Starting window of the temperature/RH data analysis small package (image)

  - In the case of temperature/RH monitoring data analysis, we can select either graphs making or temperature/RH distribution maps. Graphs can be drawn for temperature, for RH, or for both. For temperature/RH distribution maps, each data is presented as an intersection of temperature (X axis) and RH (Y axis). An ellipse can be drawn to insert 90 % of data, and thus it becomes easy to find out the abnormal data.

- "Master Maintenance" is used to go to a master maintenance window. It allows the registration of the master information, such as the geographic information and the pest species list.
  - The geographic information is given using three levels: in case of National Museum of Ethnology, Japan, the first and the biggest level is "Zone" (such as the storage zone, the exhibition zone, and the other zone), each zone is divided into the second level "Room". In each room, we have the third and the lowest level corresponding to each trap. It is up to the user to select the three levels, for example, the others may choose building as the first level, floor as the second level, and trap as the third level.
  - The species list is classified using two levels: the first level "Order" is divided into the second level "Family, Species ".
- "Data Backup" is used to go to a data backup window.
- The "Delete" button is used to go to a delete window from which we can delete acquired data.
- The "End" button is used to end the program.
- From each window, we just need to follow and check the instructions one by one. It is designed to be used instinctively.

5 Conclusion

Two specially customized analysis programs (pest monitoring data analysis program and temperature/RH monitoring data analysis program) have been developed at the National Museum of Ethnology, Japan for the analysis of the museum environment, and some concrete examples of use and application in our museum were shown. As the next development, we intend to improve these analysis programs into "Data analysis small packages" that can be used free of charge by other museums or related institutions. The Japanese version will be available in the near future and the English one is in the planning stage.

It goes without saying that the development of the analysis programs and that of the "analysis small packages" are not the sole aim in itself. These computer-assisted analyses are just a tool for giving insight into general trends, highlighting deficient areas of the museum from the viewpoint of museum environment control, facilitating further analysis of the museum environment, and helping us in decision-making for a short- to long-term collection management strategy. They are certainly of some help especially when dealing with a huge amount of data. However, the most important thing is what we do, after obtaining the analysis results, in order to improve the museum environment.

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