

***Enrich Cultural Heritage and Museum through Linked Open Data:
The Content Analysis of Open Data Platform in Taiwan***

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Abstract

Recently, the concept of Open Data has drawn attention worldwide. It is suggested that the government or government-subsidized institutions should disclose data for public access, distribution and reuse, therefore, those data can contribute more values to the society. In the trend of Open Data, museums or cultural institutions have started to release datasets over the internet, this is to invite people to use datasets of the museums, with the purpose of creating more software and services for the public. Consequently, the society will pay more attention to cultural institutions and facilitate a positive cycle. For instance, upon alliance, the museums in Europe founded the Open GLAM to implement the cultural Open Data project. In Japan, LODAC was constructed to implement Open Data in museums of Japan. The government of Taiwan established the Open Data Platform last year. However, the characteristics of datasets of museums on the platform were not systematically explored. Therefore, this study treats Open Data Platform of Taiwanese government as the subject, use SPSS to conducts content analysis to probe into 186 datasets related to museums or cultural institutions. The purposes are to analyze the data content, data format and characteristics, as well as to derive means to enhance data usage. Finally, suggestions are proposed for future implementation of Open Data in museums of Taiwan. Thus, museums' data in Taiwan can be used by the public through continuous open data, and in turn enriching cultural and educational functions of museums.

Keywords: Open Data, Museum, Taiwan, Cultural Heritage, Linked Open Data (LOD)

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Introduction

The term “open data” refers to data disclosed to the public by government agencies (or private agencies that have received government subsidies) via the Internet. These open data can be accessed, spread, and reused by the public; they may even be used for commercial purposes (Baltussen, Oomen, Brinkerink, Zeinstra & Timmermans, 2013; Janssen, Charalabidis & Zuiderwijk, 2012). To promote and advocate open data in recent years, a substantial amount of data has been released by governments around the world; these data are used to develop numerous creative applications. In addition, by integrating open data with “linked data,” a method that is based on the Semantic Web technology, “linked open data” (LOD) can be formed. These endeavors have attracted considerable attention of the world to the subject of “open data” as well as the future applications and developments of these data.

The release of open data by government departments originated in 2009, when the U.S. government built data.gov to provide the U.S. Government’s open data. In 2010, the United Kingdom Government followed suit and created data.gov.uk (Chang, 2012). With the LOD concept gaining prominence and linked data showing great development potential as an artifact-searching tool between different domains, museums and cultural institutions began to actively promote open data and LOD (Van Hooland, Verborgh, Wilde, Hercher, Mannens & Walle, 2012). Similarly, in 2012, the Taiwanese government built an inter-government department open data platform that disclosed datasets of the government departments for the public to access. These datasets included those from museums as well as cultural institutions.

Although a number of museum-related datasets have already been released on Taiwanese government’s open data platforms, systematic discussions on the characteristics that these datasets and how these datasets can be effectively used to enhance the value of museums remain absent. In addition, studies on museum-related datasets and the raising of social values of cultural institutions remain deficient. Therefore, in this study, we will use 186 museum-related datasets from the Taiwanese government’s open data platform as the study subjects. Descriptive statistics will be performed using the content analysis method and SPSS Statistics 21.0, which will facilitate the investigation of the characteristics that these datasets have and to make recommendations to the museum industry concerning LOD development. The objective is for the museum industry of Taiwan to improve its values through the use of open data and LOD.

Background

Development history of open data and LOD

Although the concept of open data apparently originated in 2009, the development history of open data can be dated back decades ago. Since the 1990s, governments around the world had been actively promoting eGovernment with the anticipation of improving government efficiency and government-citizen interactions (Chen and Liao, 2013). Following the rapid spread of the Internet and the government's emphasis of public participation in recent years, open data, which featured public value creation characteristics, began to emerge in eGovernment environments. However, differences exist between open data and eGovernment; the biggest of which is that eGovernment emphasizes the ability of the public to access government data or services via the Internet, whereas open data considers the ability of the public to reuse or even make profits from using the data disclosed by government agencies (or private agencies that have received government subsidies). In essence, the concept of open data is built on two main premises: First, the public has already developed the ability to interpret and use source data. The government and the social groups have also learned the ability to think, discuss, and exchange views openly; second, open data can be used to create a more open government (Janssen, Charalabidis & Zuiderwijk, 2012).

In general, to the public, the greatest advantage of open data is gained when all sectors of the society fully utilize the data released by the government to create services needed by recipients such as the public, tourists, and businesses. Therefore, as a whole, source data disclosed on open data platforms promoted by governments around the world are displayed in the form of datasets so that the public can download them; sometimes, even open APIs are provided (Chang, 2011). Open data promoted by governments also have the effect of improving citizen participation and information dissemination (Chen & Liao, 2012). Others argue that open data feature additional advantages: socially and politically, they enhance the transparency of government operations, elevate public satisfaction, fuel the development of knowledge, and improve the government's decision-making process; economically, they stimulate competition and increase the likelihood of new product and service creations; technically and business operation-wise, they optimize administrative operations and increase the likelihood for the public sector to resolve issues using external mechanisms (Janssen, Charalabidis & Zuiderwijk, 2012). However, the promotion of open data by government departments is not without obstacles or side effects and support from social environments is necessary for the promotion of open

data. In general, technical obstacles encountered during the promotion of open data include difficulty providing, accessing, searching, and using data. Problems such as poor data quality, unclear metadata, and unfavorable data compatibility or linkage also exist (Zuiderwijk, Janssen, Choenni, Meijer & Alibaks, 2012). The failure of the government agencies to introduce relevant policies, complementary laws, and appropriate revenue-generating mechanisms also increase the number of obstacles involved with the promotion of open data (Janssen, Charalabidis & Zuiderwijk, 2012).

In recent years, open data are integrated with Semantic Web technology to create LOD, which improves the linkage between data and enables the reading of online information (most of which is found on webpages) to evolve from human-only to machines. Current Semantic Web technology primarily involves the use of resource description framework (RDF) to facilitate data description, uniform resource identifier (URI) to enable data display, and standard SPARQL to assist data query. In addition, Semantic Web technology allows data to be linked to other URIs or data hubs (Bizer, Heath & Berners-Lee, 2011).

Current Promotion of LOD in Museums

Museums and LOD

The aforementioned development history of open data and LOD shows that open data have become an important method for promoting public participation and improving the effectiveness of information dissemination. Because museums are accessible to the public, can be considered a form of educational institution, and receive subsidies and donations from the government and the public, respectively, many museums join the ranks as providers of open data; some even become promoters of LOD. In fact, by publicizing existing digital data, museums not only show that their cultural artifacts can be used to innovate and drive new artifact developments, but they also fulfill their missions to serve and educate the public. These efforts not only allow museum materials to serve their purpose inside the museums, but also enable them to be used by the public outside the museums, achieving the goals of museum education, museum promotion, research support as well as the promotion of learning (Baltussen, Oomen, Brinkerink, Zeinstra & Timmermans, 2013). Therefore, many museums home and abroad engage in the use of not only open data, but also LOD with the aim of not only taking full advantage of open data but also connecting it to Semantic Web technology. This enables data of different formats and hardware environments used in different museums to come together on the Internet and allows the reading of such

data to be done by machines. Data from different museums can thus be accessed, which maximizes the benefits of museum data.

Specifically, the promotion of LOD offers the following advantages:

- (1) Promotes the use of open data, particularly the disclosure of source data;
- (2) Enhances the richness of cultural data by linking the data from different museums, enabling scholars to conduct studies that were previously difficult (Hsiao, 2013);
- (3) Facilitates the design and development of terminal interfaces for Internet users, providing users with unprecedented experience (Hsiao, 2013); and
- (4) Improves integrated data query and the effectiveness of data exchange.

To achieve the aforementioned objectives, museums must use the standard Semantic Web technology or whichever Semantic Web technology made available to them to connect or produce data. Current attempts by museums to promote LOD generally emulate the methods adopted for Semantic Web promotion. These methods include RDF and SPARQL; currently, a number of software tools are available for converting database data into the RDF format (Szekely, Knoblock & Wang, 2013). However, for ontology, specific standards (e.g., the CIDOC Conceptual Reference Model (CIDOC-CRM)) used by museum industries must be followed. In addition, data vocabularies must be modified to match those used by other museums. In general, for museums to develop LOD, they must first convert existing museum data into RDF data, modify the vocabularies, and connect the generated data with external data hubs. However, when promoting LOD, museums face difficulties such as shortages of manpower and funding, lack of standards controlling data content and vocabularies, and problems converting museum database into RDF data because of overly complex database structure and content (Szekely, Knoblock & Wang, 2013).

The promotion of open data and LOD by museums as a unit

Because museum industries around the world are beginning to notice the tremendous effect of LOD promotion on artifact marketing, which elevates the values of the artifacts, museum-related professional organizations are starting to encourage museums to promote LOD. Some museums even worked together to develop LOD. For example, the United Kingdom's Open Knowledge Foundation founded a cooperative project called "Open Galleries, Libraries, Archives and Museums" (OpenGLAM), which called together museums and cultural institutions to host workshops as well as technology and information exchanges to promote the use of LOD by museums (Hsiao, 2013). LODLAM, another professional organization, has

similar missions.

In addition to the efforts made by OpenGLAM to promote LOD, many museums supported LOD by using them in practice. Beginning from 2012, European museums founded the European Project, providing descriptions of artifacts from over 1,500 European cultural institutions using a uniform data model called the European Data Model (EDM). These artifact descriptions are published using the RDF model and released using the CC (Haslhofer & Isaac, 2011). Apart from the European Project that promotes the LOD by having museums from different countries working together, some museums team up with domestic museums to promote LOD and open data. For instance, in 2011, the Netherlands initiated the Open Culture Data project, gathering six of the Netherlands' cultural institutions to promote open data and form a tight network for them to exchange ideas, offer courses to share experiences, and discuss various technical and legal issues (Baltussen, Oomen, Brinkerink, Zeinstra & Timmermans, 2013). In 2010, Japan launched the Linked Open Data for Academia (LODAC) project, bringing together 15 of the museums in Japan and providing them with the appropriate data model to enable them to publish the RDF data and to connect to the data hub (Kamura & Takeda, 2013). Fig. 1 shows the data query interface used for the European project.

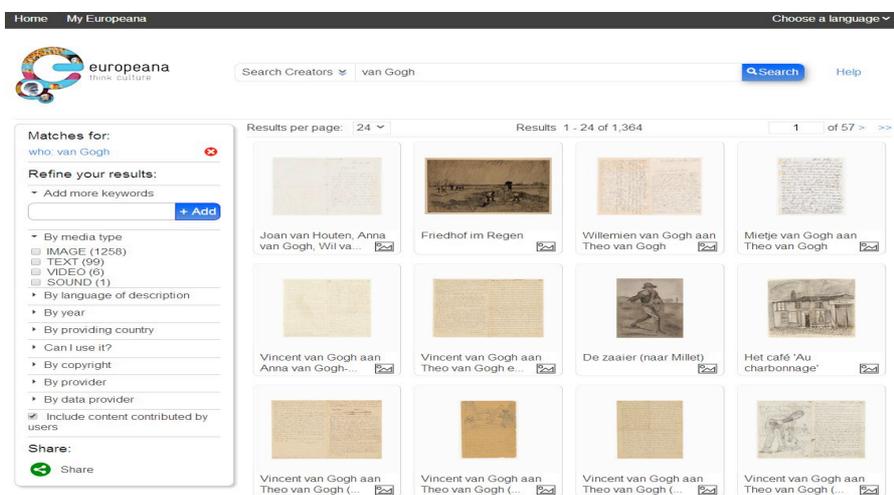


Figure 1. The Data Query Interface of European Project

Efforts made by each individual museum

In addition to collaborating with other museums to develop open data and LOD, each individual museum is able to, within the scope of their ability, promote open data or develop LOD. For example, since a few years ago, the British Museum used the CIDOC-CRM to describe the properties and relationships between data fields for the

field of ontology. The data were published in RDF format and the SPARQL Query service was provided. The artifact data of the British Museum, in RDF format, can also be downloaded from its official website. Moreover, the Powerhouse Museum (in Australia), the Smithsonian American Art Museum (SAAM; in the U.S.), and the Cooper-Hewitt National Design Museum (also in the U.S.) compare, process, and publish artifact metadata using various Semantic Web technology to enable them to be queried and used by the public (Van Hooland & Verborgn, 2014; Szekely, Knoblock, Yang, Zhu, Fink, Allen & Goodlander, 2013; Hooland, Verborgn, Wilde, Hercher, Mannens & de Walle, 2013).

Taiwanese government's open data platform and museums' datasets

To follow the global trend of open data promotion, in 2012, the Taiwanese government established its own open data platform and demanded that all departments of the public sector, including museums, to upload a set amount of datasets to the platform. The public can query or browse through the datasets provided by each government department by theme, name of the organization, or other categories. However, the category “museum” is yet to be made available. Therefore, users who wish to query or download museum datasets must try different query categories to find museum-related datasets. Currently, Taiwanese researchers are attempting to group culture-related datasets into a separate category on the said platform and are experimenting the feasibility of establishing a data model that can be used by the cultural industry (Chen & Liao, 2013). The goal is to use it as the basis for developing LOD for Taiwanese museums in the future. Fig. 2 shows the user interface of the Taiwanese government's open data platform.



Figure 2. The Interface of the Taiwanese Government (R.O.C.)'s Open Data Platform

Taiwan's central government also encourages local departments to build their own open data platform on their official website and to provide services that can facilitate data circulation and usage. Concerning the cultural industry, departments such as the National Palace Museum and the Ministry of Culture have all established their own open data platform; the Taipei City Government's open data platform also provides various culture-related LOD services (Wu, Yang & Tsui, 2012).

Research Method

In this study, museum-related datasets obtained from the open data platform of Taiwanese local governments will be selected as the study subjects. The content analysis method will be employed as the research method. The content analysis method is primarily used to analyze the content of specific data; statistical methods and other methods are used to understand the hidden characteristics of the content, such as newspaper content and TV program dialogues. The content analysis method has been commonly used in the field of mass communication (Busha & Harter, 1980); some had also used this method to study website content (Wu, 2002). The said method was used to analyze the characteristics of 186 museum-related datasets (e.g., content, format, and publishing departments) on the Taiwanese government's open data platform, and SPSS version 21.0 was used to perform descriptive statistics to identify the characteristics of these datasets. All data collection was completed by Sept. 2014.

Research Results

Number of Museum-Related Datasets on the Platform

Because the category "museum" remains to be found on the Taiwanese government's open data platform, to find out the number of museum-related datasets on the platform, users must search for and browse through the datasets from various categories. By adopting this method, a total of 186 museum-related datasets were identified by Sept. 2014. These datasets were scattered throughout the various categories such as cultural events and tourism; some were located by searching under the institutions responsible for managing museums. No museum-related datasets were found by simply entering museum-related datasets in the search bar. Further analysis showed that most of the museum-related datasets published on the platform were 3 star structured and unstructured data and that the data model used by museums to create the datasets

differed. In addition, the following results were obtained: the specialized vocabularies used by the museums differed; the LOD failed to match the 5 star LOD standards put forward by Tim Berners-Lee; no link nor association were found between the datasets; and no common API services that were shared across museums were found.

Institutions that provided museum-related datasets

There are three institutions that currently provide museum-related datasets on the aforementioned open data platform. They are the National Palace Museum, the Ministry of Education (that oversees nearly 10 public museums), and the Ministry of Culture (that oversees tens of public museums and cultural institutions as well as grants subsidies to private museums; the said public museums and cultural institutions all vary in size). The datasets provided by the three institutions differed; the number and characteristics of these datasets also differed. Concerning the National Palace Museum, it had uploaded 50 datasets to the platform for users to download. The datasets comprised exclusively metadata of the artifacts, which were their “source data.” Regarding the museums overseen by the Ministry of Education, they had uploaded 21 datasets to the platform; the datasets contained zero artifact metadata. With respect to the museums and cultural institutions overseen by the Ministry of Culture, they had uploaded 115 datasets to the platform; the datasets contained artifact metadata as well as other information. Although the datasets primarily came from public museums, those that were provided by private museums were also found, albeit more difficult to find. Fig. 3 shows a diagram comparing the number of museum-related datasets provided by the three institutions.

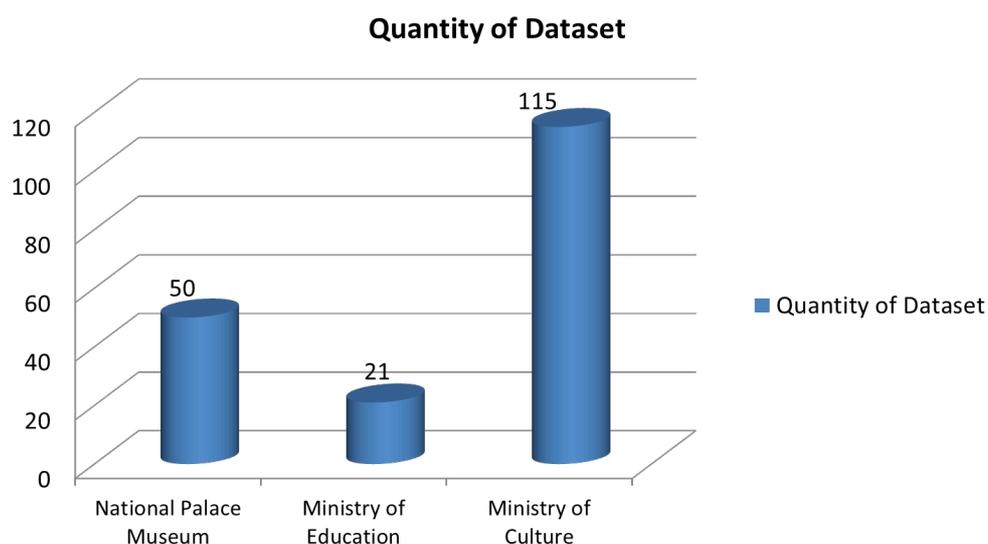


Figure 3. Number of Museum-related Datasets Provided by Three Institutions

Types of content found in museum-related datasets

Museums are a place that can be accessed by the public and one that can be used to educate. Museums provide source data of artifacts as well as other data to the public to enable it to create museum and culture-related software and services. Current datasets uploaded by museums to the open data platform feature a wide variety of content. Based on the characteristics of these contents, they can be divided into museum-related activities, source data of artifacts, descriptions of permanent and special exhibitions, museum's public facilities and cultural parks, learning resources, and others. A analysis of the 186 datasets showed the number of datasets for the six categories, which are listed as follows: museum-related activities, 17; source data of artifacts, 149; descriptions of permanent and special exhibitions, 3; museum's public facilities and cultural parks, 13; learning resources, 3; and others, 1. Fig. 4 provides a schematic diagram of the dataset content breakdown (in percentages) .

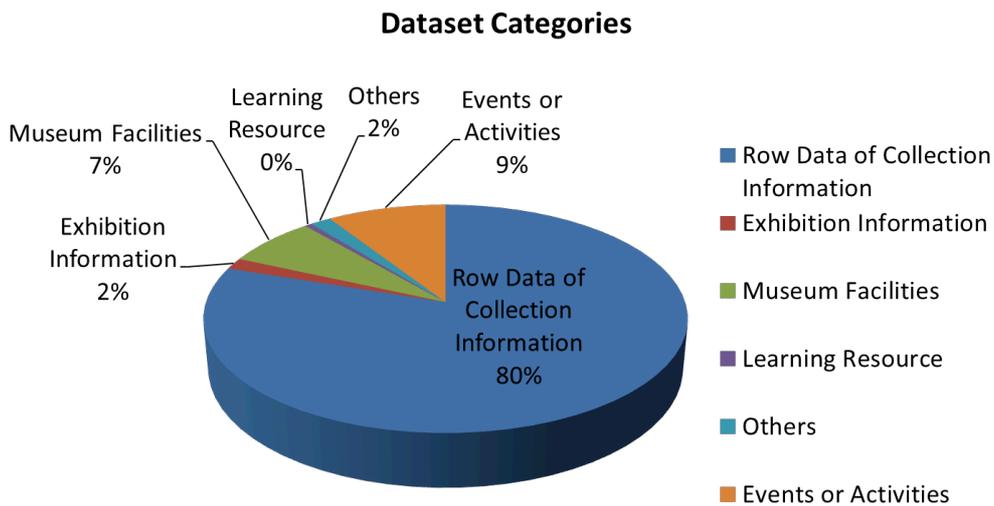


Figure 4. Content of Museum-related Datasets (in percentages)

A breakdown of the museums' dataset content reveals that artifacts remain the core asset of museums; they are also museums' most unique and irreplaceable data. A total of 149 datasets were source data of artifacts; although museums are responsible for preserving artifacts, their most important missions are to promote artifacts and educate the public. Therefore, museums have the tradition of designing numerous educational activities and teaching materials. However, of the datasets uploaded to the platform, learning resources are noticeably scant, which warrants further attention.

Format of museum-related dataset

The 149 museum-related datasets featured a variety of formats. Because the dataset formats differed between the government departments, it showed that the government departments had different views regarding the use of Semantic Web in the future development of museums as well as the use of planned and large-scale open data promotions. Of the 149 datasets, 62 were in xml format, 81 were in JSON format, and 9 were in CSV format; 18 were in both XML and JSON formats; and 16 were in XML, JSON, and Excel format. Fig. 5 shows a breakdown of the dataset types (in percentage) for each format.

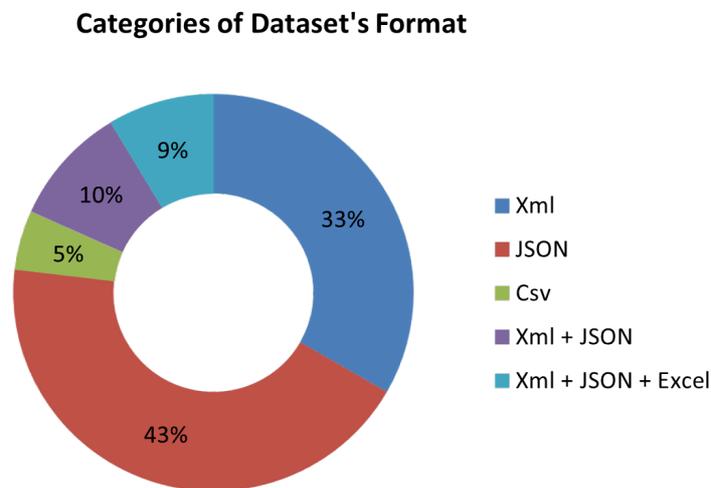


Figure 5. Formats of Museum-related Datasets (in percentage)

Among the various datasets types, those that were in XML or JSON format accounted for the largest proportion. These datasets were primarily provided by the National Palace Museum and the Ministry of Culture, which also provided the source data of museum artifacts. Datasets in CSV format were mostly provided by museums overseen by the Ministry of Education and no source data of artifacts were found. These results indicate that the National Palace Museum and the Ministry of Culture are more concerned with the development of open data; their plans are also more thorough.

Providing institutions with complementary measures and promotional activities to market museum-related datasets

The Taiwanese government's open data platform is used by various government departments (including public museums) to upload datasets to the platform for the

public to download. However, in order for museums' open data to be fully used by the society and to promote the Semantic Web technology-based LOD, museums must introduce complementary measures and promotional activities. Nevertheless, the complementary measures and promotional activities put forth by departments that release museum-related datasets on the Taiwanese government's open data platform are high dissimilar. A detail of the current situations is provided as follows:

1. Only the National Palace Museum and the Ministry of Culture have developed a special webpage on their official website, providing open data-related services;
2. Only the National Palace Museum has engaged in large scale open data promotional activities such as app competitions and seminars;
3. Only the Ministry of Culture provides API services and has formulated policies concerning the use of and applications for API; and
4. Only the Ministry of Culture and the National Palace Museum have issued the guidelines regarding the use and authorization of open data; authorization-related policies remain missing in most other museums.

Conclusion

The aforementioned analysis of the Taiwanese government's open data platform and statistical analyses of the datasets showed and compared the efforts made by foreign museums to promote LOD and open data with those by the domestic museum industry. The following observations were made:

(1) The Taiwanese government's open data platform is the biggest platform for publishing datasets. However, the category "museum" remains to be seen in the open data platform. In addition, searching for museum-related datasets by entering museum-related datasets in the search bar produces no results;

(2) Most of the datasets released by museums on the Taiwanese government's open data platform are textual and/or numerical in nature; image, video, and audio data remain deficient. Although there are quite a few museum artifact datasets, the majority of these datasets are artifact metadata and artifact-related images or multimedia materials are rarely categorized as open data. With respect to the number of datasets, there is still a lot of room for improvement to be made by Taiwanese museums to increase dataset numbers as well as in introducing more diverse dataset formats and content to facilitate the use of museum data. However, for more museum data or images to be included as a part of open data, museums must be aware of issues

such as intellectual property rights and management as well as related authorization policies. These issues all require the museums' due diligence to ensure a balance between museum management, profit creation, and the provision of accessible open data to the public;

(3) In a more strict sense, compared with the datasets provided by the British Museum and the museums that founded the European project, linked data provided by domestic institutions are not high in quality. Museums are suggested to work together to ensure that the use of vocabularies and the development of ontology concepts are consistent and that mature Semantic Web standards are employed to facilitate museums' development of LOD in Taiwan;

(4) Compared with the efforts to promote LOD in Europe, those made in Taiwan primarily come from public museums; efforts made by private museums remain insignificant. Seeing how public museums in Europe work together to promote open data and LOD, it brings into question whether private museums in Taiwan, especially those that receive government subsidies, should work jointly to promote open data and whether appropriate strategies should be devised; and

(5) To improve the level of consistency of the standards and the linkage between the museum datasets, the museum industries in Europe and Japan generally work together to promote open data or LOD. The museums also cooperate with each other and engage in various types of promotional activities. Similar methodology should be emulated by the museum industry in Taiwan; comprehensive planning or a collaborative approach should be used to promote open data and LOD. Various types of promotional activities may be hosted to elevate the level of consistency of museum data and improve the public's understanding of such data.

The results from the above analysis of Taiwanese government's open data platform and the statistical breakdown of the datasets were used to examine the efforts made by the museum industry in Taiwan to promote LOD and open data; these endeavors were compared with those made by foreign museums, which reveals that there remains a lot of room for improvement for the museum industry in Taiwan.

In short, the focus of Taiwan's museum industry in the future should be on improving the current deficiencies in LOD promotion so that museum data can be used by the public. This ensures the continued circulation and use of museum data in the information society, enabling the data to be utilized not only internally for museum

management, but also externally by the public for education, research, learning, and cultural and creative works. This will facilitate the public's understanding of museums and elevate their support of museums.

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