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Smart Hardcopy Mapping Products Practices in University Records Management Program: The Ideal Criteria and Procedures for UiTM Library Archive

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Abstract
Purpose - The paper aims to examine the criteria needed to manage hardcopy maps in a library archive. The criteria are essential to highlight the best practice in managing the hardcopy maps, conserving, and preserving the maps' physical conditions and materials.
Design/methodology/approach - Since there are limited sources for applicable maps archive guidelines, the best and standard practices are vital to be developed for the library at Perpustakaan Tun Abdul Razak (PTAR) Universiti Teknologi MARA (UiTM) Shah Alam, Selangor in dealings with hardcopy maps and ensuring the materials are ready to be served either in a physical or digital environment. The research approach investigates the current situation at PTAR, National Archive of Malaysia (NAM), National Library of Malaysia (NLM) and Department of Surveying Mapping Malaysia (DSMM) by conducting an interview and site visits.
Findings - Therefore, essential criteria for managing hardcopy maps are created based on previous studies, including the local policy mapping documents such as the NAM and NLM.
Practical implications – In general, the paper proposed 15 essential criteria that able to be as a guideline in managing the hardcopy map storage, especially for library archive level. Consequently, the guidelines also are agreed upon by PTAR and prepared to be used in a future project for hardcopy map storage.
Originality/value - This study has suggested the best criteria to be practiced in the library, containing better security, room temperature, effective cataloguing system, and systematic preservation. By applying these proposed criteria, PTAR would benefit from better managing the hardcopy map resources and towards the realization of the Fourth Industrial Revolution (IR 4.0) in the University.
Research limitations – The paper presents findings from the interview and previous studies and guidelines in managing hardcopy maps. These findings should be further explored with

other library institutions, especially worldwide, to compare in detail their guideline implementations. Since the study was also conducted during pandemic Covid-19, a lot of interactions, interviews, discussions, and meetings are implemented through online platforms such as emails and Google Meet.

Keywords: Hardcopy Maps, Library Archive, Perpustakaan Tun Abdul Razak PTAR, Storage Criteria
Paper type: Research Paper

Introduction

Academic libraries have always been the depositories of their universities intellectual content in terms of informational materials such as theses, dissertations, research reports, student's projects, and the various published and unpublished works of the University's (Azim et al., 2018). Digitalization is now seen as a significant activity for libraries to preserve essential documents digitally (Yunus & Kadir, 2017). Especially for hardcopy maps, storing the document requires applicable guidelines to store the document and ensure it is well preserved. Establishing guidelines through essential criteria in managing hardcopy maps in library archives also serves as a long-term preservation requirement.

The usage of the guidelines is vital to ensure a standard and specific guideline for storing the hardcopy maps is implemented in library institutions, especially in PTAR since they are undergoing the digitalization process of hardcopy maps. However, a big question is highlighted when the digitalization of the hardcopy map is completed. What action does need to be taken by PTAR for the remaining hardcopy maps? Does the map need to be kept or disposed of? Since the tressures remain, the research needs to ensure the hardcopy map continues its services as the primary reference for students and the public to search information relates to topographic hardcopy maps. Due to that, the guideline needs to be implemented to ensure it is preserved, and the services used for hardcopy maps in PTAR continues.

The lack of implementation of hardcopy map storage guidelines in PTAR is also why there is a need to propose new and applicable criteria in practising the best guideline in hardcopy map management. The implementation of the international standard for long-term storage and archive and library materials, ISO 11799: 2015 and Malaysia Standard MS ISO 11799: 2015, drive the current scenario in library archive as a guide applicable for hardcopy materials, especially hardcopy maps (Vest et al., 2015). The standards highlight building risk management, security of the building construction, installation of safety equipment and furniture for the storage equipment, which guide the library for starting and handling the paper document in applicable practice. However, it is good if the guideline is specific for hardcopy maps only.

The paper examines the essential criteria needed to manage hardcopy maps in library archives. Thus, the paper establishes and improves current guidelines by considering local and global reviews and comments included in the paper findings. Therefore, this paper suggests the best criteria to practically manage hardcopy maps in the UiTM library according to published articles, journals, and findings from interview sessions as the primary references. More specifically, the objectives of this paper are:

1. To review and analyse existing criteria in hardcopy map management in Malaysia and worldwide.
2. To propose the best criteria for PTAR in managing the hardcopy maps.

Literature Review

From a worldwide perspective, the implementation of ISO 11799:2015 for managing hardcopy map archives specifies the characteristics of repositories used for the long-term storage of archives and library materials (Vest et al., 2015). It covers the siting, construction, and renovation of the building and the installation and equipment used both within and around the building. It applies to all archive and library materials held in repositories, where mixed media may be stored with paper-based materials. Therefore, this International Standard avoids detailed rules and regulations in these fields, except when recommending what may be additions to these requirements.

Malaysia perspective

In Malaysia, hardcopy maps still are used as sources of references for mapping agencies and departments. However, with the existence and advancement in digital maps, the usage of paper maps decreased throughout the use of online and digital offered to the users (Yatin et al., 2018). Efforts in preserving these documents are actively being made in Malaysia, especially for archiving departments and library institutions. Malaysia also uses guidelines in managing the hardcopy maps storage and handling by using standards used worldwide to ensure the preservation activity is successfully done. For example, the NAM implemented MS ISO 11799: 2015 to store maps using flat drawer map cabinets (Flat File Cabinets) made of metal. The advantage of this cabinet is that it has a wide and shallow drawer; thus, it does not damage the material. In addition to the metal cabinet, the NAM also uses acid-free boxes. These boxes come in various sizes according to the size of the material. To ensure that all archival materials, including maps, remain preserved, the NAM provides repositories with set standards. DSMM also implemented their guidelines to manage hardcopy maps by using MS ISO 9001: 2015 Quality Management System in topographic map storage and handling. All the listed criteria in the ISO are applicable; however, a more holistic guideline specifically to hardcopy maps needs to be established for library archive through enhancement by considering established guidelines, expert reviews, and comments. An archive library could implement good storage and better management through a complete guideline for the long-term preservation of hardcopy maps.

Library of Tun Abdul Razak, UiTM

By looking at PTAR's scenario as the paper's case study, the paper needs to investigate whether PTAR owns clear criteria that act as guidance to manage the hardcopy maps in the library archive. Questions from the research are highlighted regarding criteria needed in managing the hardcopy maps. In ensuring the physical condition of the hardcopy map is in good shape, how librarian handles the document in library stages. The main questions highlight whether a guideline is implemented holistically at PTAR on managing the hardcopy maps in terms of storage and handling as the management requirements. The main issues arise when PTAR faces difficulties in storing unused hardcopy maps due to limited space and decreasing demand. The paper needs to find solutions based on the issues by identifying applicable criteria to store and manage the hardcopy maps. The research will strategize to digitize the paper maps and develop a geospatial database. The solutions will also benefit PTAR by introducing a new technique applicable for hardcopy maps and other drawings.

Research Methodology

The below figure shows the research methodology that acts as the research design conducted. The study has four stages: preliminary study, data collection, data processing, and result analysis.

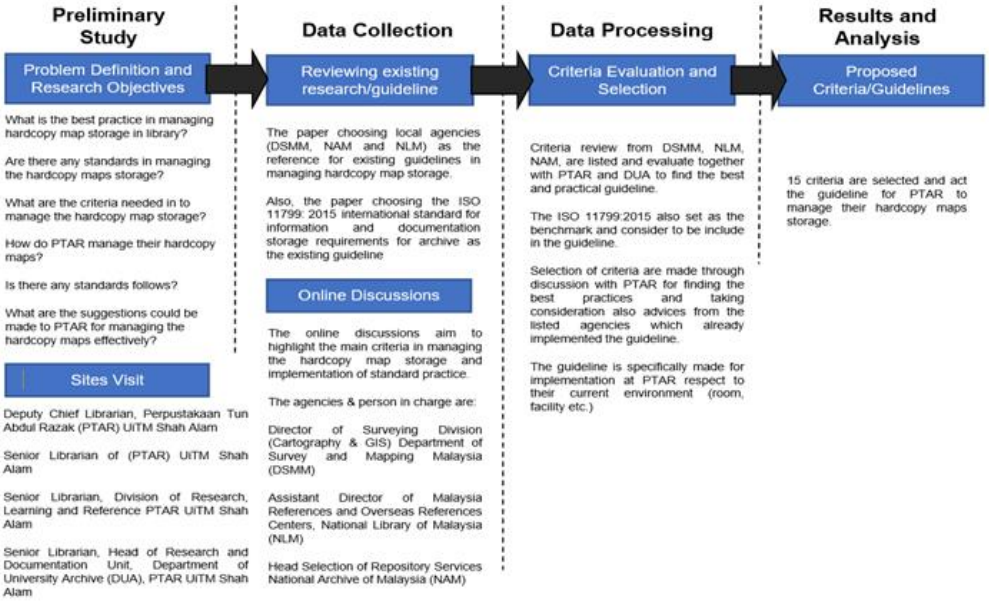

Figure 1: Methodology of research

The study starts with conducting the preliminary study for identifying the main issues faced by PTAR. As mentioned above, the research comes with several questions on standards in managing hardcopy maps. With the frame questions as stated in the above figure, the research aims to review and analyze existing criteria in hardcopy map management in Malaysia and worldwide and propose the best criteria for PTAR in managing the hardcopy maps. The second stage is data collection through reviewing previous papers and existing guidelines, online discussion, and sites visits. This stages also review the standards practice applied in Malaysia and worldwide managing hardcopy map storage. On local studies, three agencies are chosen as technical experts by considering their reviews regarding criteria used in managing their hardcopy maps.

For the worldwide, the ISO 11799:2015 act as an international standard for information and documentation storage requirements for the archive is chosen as a guideline on the practices applied for international. Since the research is conducted during a pandemic Covid 19, an online discussion is set with DSMM, NLM, and NAM to get feedback regarding the criteria highlighted in managing the storage and handling of hardcopy map documents. These agencies are chosen since the organization consist of experts in their field as cartographers, geospatialist, librarian and archivist. Especially in DSMM, there is a unit responsible for managing all related hardcopy maps documents. The unit is divided into six subunits: Photographic Unit, Mapping Material Unit, Monograph Unit / Serial Publication, Circulation Unit / Reference, Archive Unit, and Unit Documentation (At et al., 2009). DSMM National Map Library is one of the units under the Quality and Map Research Branch, Mapping Services Section, Mapping Division is headed by the librarian.

In performing conservation work, including scanning of materials and storing the hardcopy maps, DSMM requires specialized expertise for the work performed to comply with the standard specifications that have been set. In relation, therefore, DSMM needs to get views and assistance from agencies relevant governments such as the NLM and NAM (At et al., 2009). NAM is an archival agency in Malaysia that could also consider their archival materials policy, which is vital to take their reviews in developing the standard guideline. Then the data collection is proceeded to site visits with PTAR UiTM Shah Alam since during

the time are allowed for research to be carried out during Conditional Movement Control Order (CMCO). DUA and PTAR is the department to narrow down the issues in UiTM Shah Alam and the study area for the research. During the data collection stage, the online discussions involve several respondents, as shown in Table 1 below.

Table 1: Respondent's detail

No.	Respondents Name	Respondents Title	Agency
1	Respondent A	Assistant Director of Malaysian References and Overseas Reference Centers,	National Library of Malaysia
2	Respondent B	Head Section of Repository Services	National Archives of Malaysia
3	Respondent C	Director of Survey Division (Cartography & GIS)	Department of Survey and Mapping Malaysia
4	Respondent D	Senior Librarian, Head of Research and Documentation Unit	Department of University Archive UiTM Shah Alam
5	Respondent E	Senior Librarian, Research, Learning and Reference Division	PTAR UiTM Shah Alam
6	Respondent F	Deputy Chief Librarian	PTAR UiTM Shah Alam
7	Respondent G	Senior Librarian	PTAR UiTM Shah Alam

DUA and PTAR are departments that narrow down the issues in UiTM Shah Alam and the study area for the research. During the data collection stage, the online discussions involve several numbers, as shown in Table 1 above.

Results & Discussions

In Malaysia, there are several agencies and departments responsible in managing maps department which are the DSMM, NAM, and NLM. The paper chooses these three agencies as an indicator for local study cases. According to the Assistant Director of Malaysian References and Overseas Reference Centres, NLM, each map received by DSMM will be classified using the cataloguing standard managed by the National Bibliography Centre (NBC) of NLM. While the way to store the map is based on the classification number that has been set as shown in Figure 1. This is to facilitate the search for materials. NLM also emphasized several criteria in ensuring that the topographic hardcopy maps were stored and properly maintained (Ali, 2020).

Figure 2: Hardcopy maps storing cabinet recommended by NLM

According to the Head Section of Repository Services of NAM, the storage of maps and specifications guidelines is the same as other documents or archival materials such as files and publications regarding environmental control, including temperature and humidity (Osman, 2020). To ensure that all archival materials, including maps, remain preserved, the National Archives provides repositories with set standards MS ISO 11799: 2015. The paper also then gets a response from DSMM since the hardcopy maps in NLM are also being maintained by DSMM. According to the Director of Survey Division (Cartography & GIS), the DSMM uses the standard guidelines of each MS ISO 9001: 2015 Quality Management System in Topographic Map Storage and Handling (Nomanbhoy, 2020). Ready to print and Storage maps will be stored in the National Map Storage Centre before being left to users. Reflecting on the first objective, this section reviews existing criteria in hardcopy map management in Malaysia and worldwide. Table 2 shows for collected responses and criteria listed from existing practice.

Table 2: Criteria review and comparison

No.	Source	Criteria	Details
1	NLM (National Library of Malaysia)	Security	i. Ensures map security is constantly monitored as these maps are a limited collection. ii. Users who wish to refer to the material can only refer to the working day only, and they are allowed to refer to the reference space provided. iii. Users are also not allowed to scratch on the map. iv. Appropriate room temperature to ensure the map is not easily damaged.
		Hygiene	i. The cleanliness of storage space also plays an important role in ensuring that termites or mice do not damage the material. Food and beverages are also not allowed at all in the map storage space.
		Security	i. It is equipped with safety and protection features from fire. ii. All doors, walls, ceilings, roofs and repository poles shall have fire and fire resistance approved by the Fire and Rescue Department.
		Room temperature	i. Appropriate temperature and humidity control according to the type of material which for the map (paper document) is around 18ºC - 22ºC and RH 45% - 55% (this reading should be recorded daily).
2	NAM	Cataloguing	i. Guidelines and rules for record management are provided
		Preservation	i. Damaged records will be preserved in accordance with the prescribed method of both material conservation and digitization.
		Risk management	i. Avoid form hazardous areas that potentially occur flood or landslide, fire, pest, extreme temperature.
		Construction of the building (security)	i. Indoor climate change - constructing the external walls, roof and floor of the building from materials that, as far as possible, insulate the interior from external climatic changes. ii. Inner structure and load requirement - engineered with bracing to resist movement or tipping that could result in a collapse or other damage to the holdings.
3	ISO 11799:2015 (Worldwide)	Installation and equipment	i. Consideration on fire protection, fire detection, and fire extinguishing needs to be installed for emergency cases. ii. Storage environment (illumination, humidity, temperature,

			ventilation, air quality) must refer suitable for hardcopy maps.
	Furniture and equipment	i. ii.	The guide state does not mention hardcopy maps but only general for books and paper documents applied. The guideline mentions that the materials used shall not be combustible nor emit, attract, or retain dust.
	Maintenance	i.	All methods using disinfection using chemicals or radiation are likely to damage the materials, and deep freezing should be considered as a treatment for insect infestation.

Throughout the list of criteria details on the above tables, it shows that there are similar items that show their significance in the guideline. All the listed criteria are vital and applicable to set guidelines for managing hardcopy maps in the library archive. As stated in the above table, room security ensures the room is safe in all aspects. Its building materials must be fireproof and strong enough to protect the hardcopy maps mostly paper-based material. To ensure the room's security, the room's location also needs to be at low-risk disaster areas such as flooded and landslide areas. Another part that is applicable in setting up the guideline is room ventilation. The airflow of the room must be maintained to control the humidity of the room. Since hardcopy maps is a sensitive document, the room must have an air conditioner and air purifier to ensure the room's temperature could be set at 18ºC - 22ºC and 45% - 55% of room humidity. By following the specification as advice, the risk of damaging the hardcopy maps could be reduced and maintained for a long time.The room's hygiene must be taken care of to avoid the risk of inviting pesticides or enemies such as cockroaches and ants. The room also needs to have some rules by limiting the number of people entering the room and reducing human contact with the hardcopy maps. Hygiene also will avoid the risk of inviting any acidic compound that could damage the hardcopy maps. The hardcopy maps are the best to be stored using a steel rack and avoid rolling the map since it can damage it. The steel rack is the best since it has less chemical reaction while usage of wooden rack could invite pesticides and less time usage. Based on the above tables, the criteria listed are applicable; however, some additional details are included in the proposed guideline as stated in the next section, which answers the objectives of the research.

Experiences and Proposed Criteria for the PTAR in Managing Hardcopy Maps.

In PTAR UiTM Shah Alam consists of several departments that handle and manage the daily operation as a library institution. One of the Department of University Archive (DUA) is responsible for managing UiTM records. Any important document will be valued and archived by the department. DUA contain several units such as the Record and Archive Unit, Preservation of Materials Unit, Research and Documentation Unit and Tun Abdul Razak Gallery. In terms of mapping, the department does not keep or store the hardcopy maps; however, they only keep the buildings drawing related to UiTM buildings. The hardcopy maps are being stored by the Department of Library Services under the Research, Learning and References Section of PTAR. PTAR is currently in the process of renovating the hardcopy maps storage room for more convenient places. However, the current temporary room is unmanageable as new map rooms are underway being renovated. The condition of the room does not follow the specifications as advised by DUA since the store is only currently available. According to Senior Librarian, Research, Learning and Reference Division, PTAR is aware that the hardcopy maps must be preserved and digitized to ensure their continuous usage in the library since it used to be an essential reference at some point in

the past (Yusof, 2020). With the decrease in demand and the existence of digital maps, hardcopy maps are also almost disposed of. However, judging historical value, it is a massive loss if the hardcopy maps are eliminated. A huge number of hardcopy maps estimated at about 10,000 sheets causing storage space constraints which required it to be transferred to a temporary room.

PTAR has made efforts to purchase new shelves to ensure the hardcopy maps are stored in proper condition and placed as allocations have been made for the map room renovations. Although PTAR has used 100% digital maps, PTAR management also wants to revive the hardcopy maps services for students and the public for future references. The hardcopy maps need to perform reclassification and map metadata for reorganization purposes to revive it. Much effort needs to be put into the reorganization of the map since it consists of a topographic map throughout Malaysia covering maps of districts and states. The initiative from the discussion is very timely since PTAR also wants to reorganize the hardcopy maps for more manageable. PTAR no longer carries out digitization activities for hardcopy maps since the current activities focus on digitizing books and thesis (Yusof, 2020). In terms of hardcopy maps, PTAR is only classified through cataloguing and stored in the right place for customer retrieve. Documents such as theses, research papers and reference books actively conduct digital activities through scanning techniques using Optical Character Recognition (OCR) extraction. To manage the hardcopy maps, PTAR requires a knowledgeable person who has expertise in managing the hardcopy maps, especially in map classification and spatial data structure for GIS data format. In terms of metadata updates, PTAR is able to provide services for updating the data about data of the hardcopy maps for reorganizing the process. The discussion also expressed that the Centre of Studies Surveying Science & Geomatic, CSSSG UiTM Shah Alam is willing to collaborate with PTAR in terms of metadata preparation and map search to speed up the map classification process.

Due to the large volume and quantity of the hardcopy paper maps, it is advisable to plan a reasonable project period and implementation strategy. PTAR needs to re-create the printed and digital map service since PTAR was very popular in providing hardcopy maps services as reference material for students who need reference purposes. PTAR also suggests that the hardcopy maps will be saved depending on the storage space available on the PTAR and will be evaluated whether it still needs to be stored or relocated to the metro collection after the project is complete. If disposal is required, the hardcopy maps must have a copy before being sent to DUA for disposal (Rahman, 2020). However, several criteria are needed to be evaluated first before it is advisable to be disposed of. Due to this reason, it is required for PTAR to have a standard guideline for managing the hardcopy maps for ensuring it is well managed since PTAR is planning to reorganize the mapping section. The visits were made on 8th September 2020, and during the time, it is informed that PTAR is in progress to renovate the mapping room, and for a while, the maps are being stored in a temporary room.

Based on the above findings, the paper needs to evaluate the experience based on criteria highlighted in managing the hardcopy maps by considering several criteria highlighted in the next section. As well as the other documents, hardcopy maps are sensitive documents regarding several factors such as temperature, humidity, and pesticides that could damage the tressure. Through the interview session, DUA also stated that implementing the guideline for other documents such as books, journals, and other text-based documents wholly followed the guideline, including the drawing materials. However, the guidelines are not being fully implemented for the hardcopy maps in PTAR. Since the hardcopy maps are being stored by the Department of Library Services under the Research, Learning and References Section, the full guideline is already there. However, the implementation is not completely followed.

Since the department is in the stage to utilize back the hardcopy maps section in PTAR, it is the best time to implement the best criteria in managing the hardcopy maps.
The proposed criteria are considered based on ISO 11799:2015 Information and Documentation Document Storage Requirements for Archive that act as the international standard and worldwide practice. The ISO also applied in NAM in ensuring the archival documents, and especially hardcopy maps, remain preserved through provided repositories. To enhance the criteria selection, the paper also considers based on expert's advice and opinion to be included and the research proposing below criteria as practical criteria need to be fulfilled by PTAR for as the best practice.

Table 3: Proposed criteria of the research

No.	Criteria		Details
1.	Room cleanliness	i.	The possibility of damaging the paper map could be reduced.
		ii.	Dust, food waste, beverages and other pollution must be avoided.
2.	Chemical	i.	Avoiding pollution in the room prevents any damage to the materials since paper is a very sensitive material.
		ii.	The fumigation process is needed for ensuring the paper is in good shape and condition.
3.	Pesticides	i.	Mouse, ants, snakes, cockroaches, and other types of pesticides need to be avoided as paper would be their favourite.
		ii.	Manual cleaning is needed since no chemical allows to be used.
4.	Storage environment	iii.	No windows and closed room to ensure no sunlight entering the room. The heat of the sunlight could cause damage to the hardcopy maps.
		iv.	Only ceiling lamp is used when entering the room.
5.	Humidity	i.	An air conditioner and air purifier are used to ensure the airflow in the room is clean.
		ii.	The system needs to be running 24 hours to ensure the humidity and room temperature is maintained.
6.	Location	i.	Room located at less disaster possibility area.
		ii.	This includes a watery area, near air conditioner water, high humidity area, and any exposed area need to be considered when want to create an archive area.
		iii.	Fewer risk areas such as hilly and shade areas are chosen to ensure safer and more suitable.
7.	Room size	i.	Must base on the suitability of the place and condition.
		ii.	It is dependent on the building condition and size.
8.	Storage handlers	iii.	Storage boxes must be acid-free, such as metal, and stainless steel is highly recommended to avoid material and physical damage to the paper.
		iv.	All materials cannot include glue and need to be separate if there is.
9.	Unfolded cases	i.	Envelopes are used to store photos one by one.
		ii.	This is to ensure the photos do not stick with other photos and not damage the physical conditions of the photos.
10.	Map drawer	i.	It is recommended to use a metal rack since it is non-acid material, strong, and able to keep the paper map for a long time.
		ii.	Flat metal rack is suitable to ensure the paper map is not folded, hanging or rolling.
11.	Map folders	i.	Using oil paper to separate between other paper maps.
		ii.	This is to ensure that the paper map does not stick to other maps and protect the surface of the maps.
12.	File cabinets	i.	Using the strawboard, plan and map need to use the flat cabinet (steel). It could reduce the distortion on paper which could contribute to physical loss of the paper.
		ii.	It also could avoid and minimize the hand touch to the paper.
		iii.	Every piece of the paper map also needs to be separated by a piece of paper oil to avoid it sticking with another map because of the colour that will be damaged. Handling by using glove is highly recommended.
13.	Cataloguing	i.	Library Congress Scheme and Cataloguing as the metadata of the map and

	maps		references.
		ii.	Dewey Decimal Classification (DDC) method to reclassify the hardcopy maps.
14.	Room security and access	i.	A logbook is used to monitor the person who enters the room and CCTV to monitor archive room activity.
15.	Fire protection	i.	FM200 is recommended to be used as a tool for fire protection.
		ii.	The wall of the room also is fire protection, which is able to protect the document from getting burned.
		iii.	Water compounds are highly not recommended since they could damage the paper.

Conclusion

This paper has suggested the applicable practice in university hardcopy map management through proposed criteria, especially for UiTM Library or PTAR topographic mapping products. Due to the lack of implementation of standard guidelines in managing hardcopy maps, the findings from this paper identified the essential criteria that act as a guideline from standard practice national and international. Even though PTAR has been following some of the guidelines, it is not fully implemented, and therefore, PTAR crucially needs a systematic guideline for Hardcopy Map Storage Management. The guideline can act as the first step for the paper to collaborate and work closely with PTAR for the next project. This study has established a guideline with having 15 essential criteria; the uniqueness of this guideline is explicitly developed to hardcopy maps for library archive level. The guideline is based on the opinion of the selected experts (NLM, DUA, PTAR, DSMM, NAM). The next study will consider the opinions from local academic libraries, international libraries and institutions. The International Standards and experts are also considered for further research. With the current situation of PTAR and future direction, PTAR is urged to adopt innovative technologies to increase its reputation as one of the top university library institutions that manage hardcopy maps by adopting geospatial technology and innovation as an alternative approach towards IR 4.0.

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