An Examination of the Feasibility of Instituting a Philippine Digital Audio Library: a Case Study of UP Center for Ethnomusicology (UPCE)

Li Jia, PhD
College of Music, University of the Philippines Diliman

Abstract. The study seeks to examine the feasibility of creating a Philippine digital audio library to safeguard its rich musical legacy based on the experiences of other countries in setting up such a library. It will assess the possibility of replicating successful strategies in the Philippine context.

Overview

As a spearhead force in music research, especially in the area of South East Asia region, the UP center for ethnomusicology (UPCE) caters for a gigantic collection of audio materials which covers different music and musical traditions in the Philippines, South East Asia and representative areas from other continents. As an outcome of its former appellation, the "UP ethnomusicology archives", UPCE hosts an ethnomusicological collection of about 2500 hours of recorded music in open reel and cassette tape formats, under the authorship of Jose Maceda whose visionary work of putting together these valuable recorded materials left a treasure for ethnomusicology scholarship and research. In recognition of his influential contribution that made the UCPE an archive and repository of materials on music, philosophy, anthropology and other cognate disciplines, these audio materials, together with field notes, music transcriptions, song texts, photographs, music instruments, music compositions, personal files, about 200 books and journals, all of which he personally initiated and developed as a unified institution resource for music research are called "Jose Maceda Collection."

Jose Maceda Collection Digitization Project

The Jose Maceda Collection Digitization Project (UJMCDP) is a pioneering endeavor at UPCE to digitize the audio recordings, field notes and photo of the whole collection with modern digital technology, which helps prolong the limited life span of previous venerable media to unlimited access and time. The primary goal of this digitation project is to preserve and provide open access for scholars and performing artists to these valuable first-hand resources. In this paper, I will focus on the digitization of audio materials, which were recorded on the media of analogue formats, such as cassette tapes and open reels. I will explain in details the systematic, swift and economic process that the digitization working team has been following all the way long. Visual examples of the process will be provided to highlight the critical facilities and techniques. The objective of this paper is to establish a model in the Philippines to digitize institution-wise analogue audio materials which can be shared by open public and build up a similar digital audio library.

The core of the entire audio collection represents the traditional music cultures of 78 major ethno linguistic groups across the Philippine archipelago as well as field recordings of selected music cultures in South East Asia, including Indonesia, South china and Malaysia. To digitize this collection from analogue formats will serve four major purposes:

1. To make restorative and preventive conservation
2. To establish a new catalogue and systematic musicological data base
3. To provide access towards a digital audio library
4. To provide a title/song-based song indexing/search engine

This project is currently being funded by the National Commission for Culture and Arts with supporting grants from the chancellor of the University of the Philippines, Diliman and the Jikji Prize of the Austrian Academy of Science. On the technique aspect, the project team received considerable help from Phonogrammarchiv, an Austria based archive center, which provided human resource training and technical assistance.

Starting from November, 2009, the project team have almost finished the entire process of digitization of 1530 open reels of Filipino music and around 800 open reels of international sources, as well as 191 cassette tapes, which equates to around 2500 running hours of music .The current catalogue up to August 2012 has already accumulated 2649 titles, with the steadfast expansion as the project is still going on.
The whole processes were carried by the UPCE sound laboratory whose manpower consist of college achivist Mr. David Dino Guadalupe and his two student assistants. The whole project has been under the direct leadership of UPCE executive director, emeritus professor Dr. Ramon Santos and UPCE advisory board.

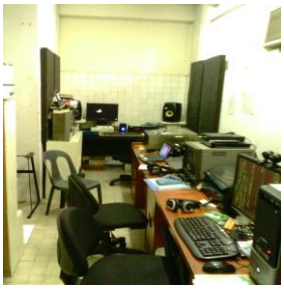
Figure 1 UPCE Sound Laboratory

Audio Material Digitization: An Introduction

In the area of library science, digital music library project has been arousing more and more interest from the academies in the past decade. In 2000, Amanda Maple and Tona Henderson described the issues that must be confronted by a librarian planning a digital music library project, and explained the decisions made for their own project at Pennsylvania State University. The issues fall into three broad: infrastructure (including the selection of hardware, software, streaming technology, and method of access); collections (including decisions on what to digitize and why, and related questions of copyright); and staffing (including who does what, who employs them, how the work is funded, and who provides training and public service) (Griscom, 2003)

A music recording provides a mean to unlimited access to a historical music event through electronic or mechanical inscription and re-creation of sound waves. The main two categories of recording technology are analogue recording and digital recording. Though historically speaking, analogue recording enjoys many merits in music events capture, due to its shortcomings such as distortions, speed variations, noise/hiss, low accessibility and deterioration of media with the passage of time, digitization of such material seems to be extremely necessary for both archival and scholarly purpose.

Digitization is the process of transforming analogue materials into its digital formats which can be more easily accesses for use and help preserve the recorded material, allowing it to be stored and transmitted by a wider variety of medias. From a more technical term, digitization is the process of converting information – analogue audio, text, and/or visual images – into a digital format by organizing information into units of data called bits that could be processed by computer related equipment. Instead of dealing with easily decayed and fragile original materials, digitization provides with extraordinary access and availability of information, as well as serving for the pedagogical purposes through computer network locally or internationally.

Jose Maceda Collection Audio Digitization Project at University of the Philippines, Center for Ethnomusicology

The whole working process can be graphed as in figure 2 which consist of five components as content digitization, content storage, content editing, content cataloguing and content distribution.

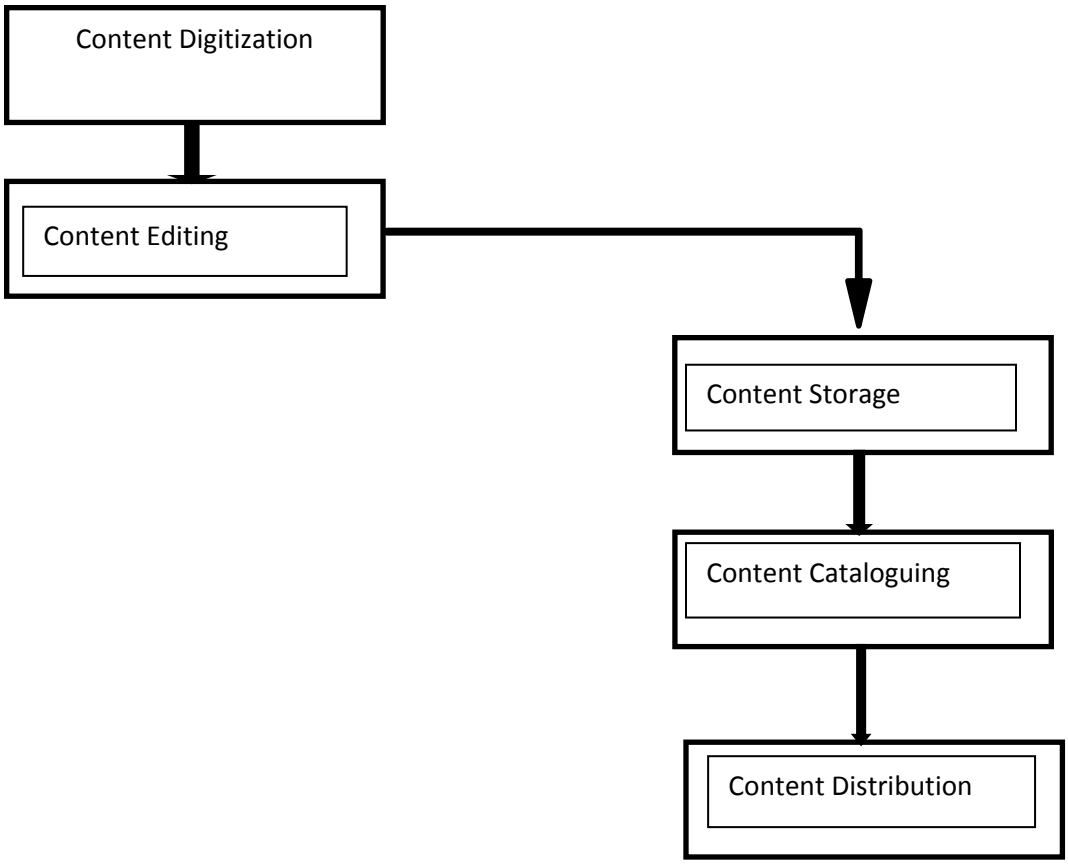

Figure 2. Audio Digitization working flow chart

1. Content Digitization

The digitization audio workstation has the capability as follows: CPU dual core 2.4 GHZ, Memory – 2 GB, DDR2, two hard disk drives (80 GB + 150 GB), with the operating system installed as windows XP. The audio interface is RME fireface 400. For the signal input equipment, a Studer A807 MKII function as open reel player and Tascam CD – A750 as cassette tape playback deck.

The major software in the digitization is wavelab 6 by Steinberg, together with two signal and spectrum analyzing softwares, digicheck (bundled tree from the RME interface) and Scan Input.

Figure 3 Studer A807 MKII open reel recorder.

Figure 4 Tascam CD – A750

Due to the critical conditions of the old analogue open reels, some restoration may be required to be done before the actual digitization. Some open reels need to be extended with lead tape at the two ends by 15 inches. Some need to be replaced of the old splicing tapes which were extremely fragile already. A good advantage of Studer A807 MKII is that it provides with a digital counter which can pin down and locate precisely any point of the music as you need, to avoid unnecessary rewiring and break the tape. The ready-to-convert open-reel was delivered to the Sound Laboratory at least 24 hours before the digitization to assure the tapes to be adjusted to the humidity and other environmental factors of the laboratory.

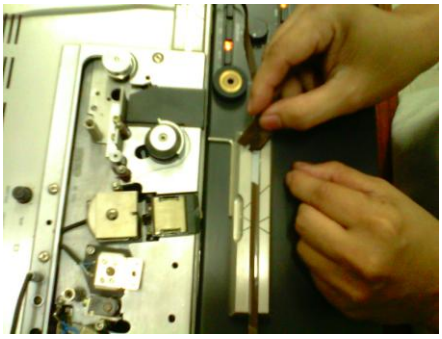
Figure 5 Slicing tape replacing

The different speeds that the music was recorded produced different specifications of frequency response at record/reproduce mode. Table 1 shows the most frequently encountered speed ratio during this project and their corresponding frequency response.

Speed ratio	3.75 ips 7.5ips 15 ips
Frequency Response	+/_2dB 30 HZ ~ 12 KHZ 30 Hz ~ 16 KHz 30 Hz ~ 20 KHz +/_1dB 30 HZ ~ 8 KHZ 30 Hz ~ 12 KHZ 30 Hz ~ 18 KHz

Table 1 analogue recording speed ratio and frequency response

Table 2 shows different types of open reel and corresponding total play time.

Type of Open Reel/Recording Speed	5” Reel 600ft	7” Reel 1200ft	10.5” Reel 2500 ft
1 7/8 ips	1hour	2 hours	4 hours
3 ¾ ips	30 minutes	1 hour	2 hours
7 ½ ips	15 minutes	30 minutes	1 hour
15 ips			30 minutes

Table 2. Approximating playing times for different reel sizes (one side)

Before digitization recording into workstation, the project team would use Digicheck to analyze the signal peak and frequency response range. If these factors showed symptoms of distortion or other undesirable situations, the playback head of the open reel player or cassette tape player would be adjusted accordingly. A good alignment of input signal level is of vital importance, especially in the case of the defective recorder during the original recording session. Digicheck's signal graphics engine would analyze and monitor a real time signal level match, which would be reflected as the expansion of both low and high frequency. Especially the high frequency part is the more important indicator of an input recording level.

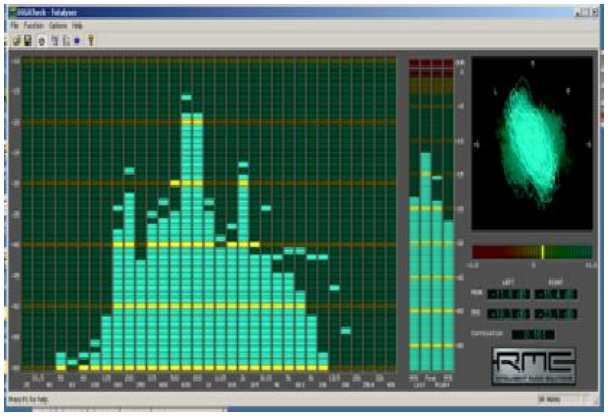

Figure 6 Ditticheck signal analyzing interface

Scan Input spectrum analyzer can be applied to minimize the noise level of the recording, the signal spectrum showcase the real time noise/signal ratio as reflected in the color change.

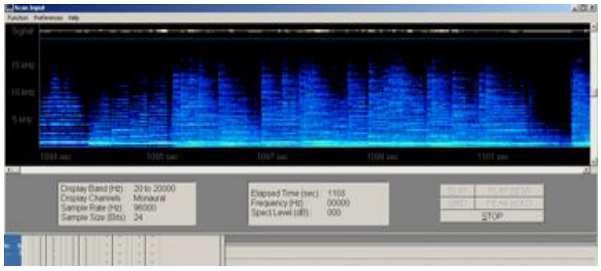

Figure 7 Scan Input spectrum analyzing interface

After these initial stages, the digitization recording would be starting. The Steinberg Wavelab 6 was used as digitization producer, which provided a full range of possibility in saving formats.

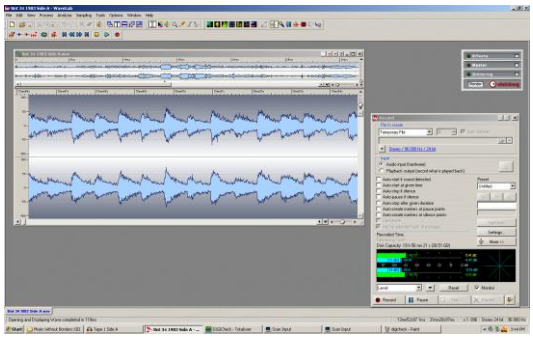

Figure 8 Wavelab 6 main interface

At this stage, the files were saved into two formats: wav (96 kHZ/24Bit) and mp3. The former is for archival purpose, while the later would be for further editing. The different digital saving formats during this project will be discussed in the section of content storage.

2. Content Editing

Due to the nature of analogue recording of open reels and cassettes, one side of open reel provides a variety length of playing time, as previous shown in Table two, depending on the length of the tape and recording speed ratio. The same case is with cassette tapes. Each side consists of a various numbers of songs by the same or different researchers. To serve for the purpose of easily search, indexing and appreciation purpose, the next step was to edit the audio file and cut it by the unit of song/title with corresponding metadata.

This stage was completed at ~~a~~ separate editing workstations, transfer by external hard disk and saved in mp3 format. The specifications of the editing workstation are: dual core 3.0 GHz CPU, 2 GB DDRII memories with Linux/windows XP dual operating system. The audio editing software was audacity 1.312 – beta, which is free software for downloading. The advantage of the software is that it operates on a copy of the original file instead of physical changing realtime, which provides high data security.

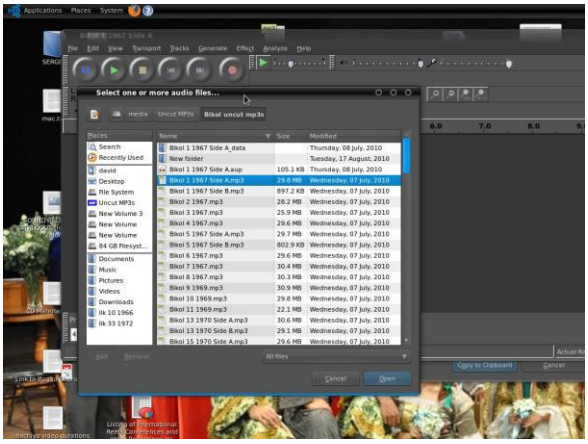

Figure 9 audacity 1.312 – beta file opening window

There are two main issues need on mind during this stage. Firstly, some audio file needs to change speed to its reel tempo. In early readings, some were conducted at an extremely low tempo. For example, the open reel with old catalogue number of Bikol-RK-1-1967 was a performance recorded on ST816 machine live in 1967 by Jose Maceda in Bikol. The side A was recorded at speed of 1 7/8 ips while side B at 3 3/4. However, this extremely low tempo at side A is beyond the capacity of the equipment available in the sound laboratory which could only reach as low as 3 ips. This means the current digitized archival data is actually much faster than the real performance. So at the editing stage, the project team needs to adjust the music speed back to tempo digitally. This can be achieved by using the speed change function which locates at "Effect – change speed", as shown in figure.

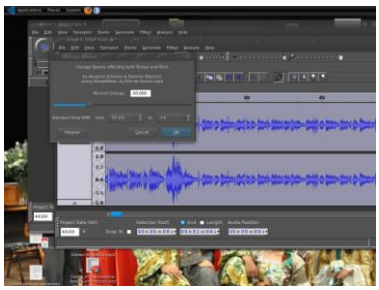
Figure 10 audacity 1.312 – beta speed change window

Secondly the context cutting and slicing demands a high expertise in music understanding, to assure the cutting point is at the right place. This professionalism differentiates the digitization of audio materials towards a digital audio library from other casual digitization projects. On top of the fact that all the members had the processional training and background in music research, the project team actually listened to all the music, corresponding to the original data from the recordings, to locate exactly where the song stopped, rather than mechanically relying on wave spectrum which is unsecure.

After done all these to secure the accurate starting and ending point of each title, the selection of audio data, which was in the original speed and song by unit, was saved again in mp3 and ogg formats to two new folders, by using "file – export selection". The reason for saving in these two formats will be explained thereafter. The metadata from the original source was tagged, including song title, author, year, genre, etc.

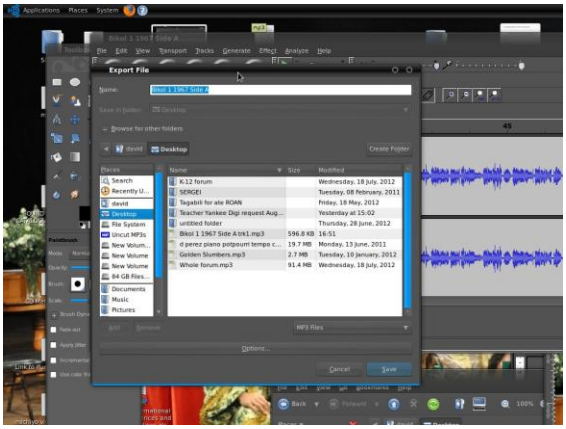

Figure 11 audacity 1.312 – beta file export window

3. Content Storage

The external storage device was 6 sets of Western Digital mirror edition Caviar ^{R} Green ^{TM}. The advantage of this external hard disk drive is its automatic back up function which would be pertinent for archival setting. One set of hard disk consist of two units, which function as a mirror to each other. Besides, it provides upgradability for capacity expansion in the future. Its reliability as shown in its cool and quiet operation guarantees its longer playing time which is valuable for such digitization of mega data process that usually takes hours. Its USB connection to the computer provides easy and flexible data storage and transfer.

Figure 12 Western Digital mirror edition Caviar ^{R} Green ^{TM}

The project team identified three types of usage/purposes for the digitized data, namely archival, academic, and distribution. Three types of formats were used to address these different needs, as reflected in three versions in the content storage during the whole process, which are archival version, research version and web version, taking into consideration of such factors as data size, and technical specifications, etc.

The three versions of digital audio data were stored in separate sets of hard disk. The archival version would be at UPCE archival storage. The researcher version would be forwarded to UPCE library for any scholarly research, which can be easily uploaded to a computer or digital CD or DVD. The online version would be for website uploading which would be still a process to follow in the future.

A. Archival version. The digitalized original files were saved in 96KHZ/ 24bit wave format audio file format for archival purpose. These are all unedited uncompressed data from the initial digitizing. So the file is saved by per tape side. Wav audio format is a Microsoft and IBM audio file format standard for storing an audio bits stream on PCs. It is the main format for raw and typically uncompressed audio.96HZ/24Bit specification provides a hi-fidelity of listening and space for future digital sound encoding or publication purpose while in the meantime does not make the size overwhelming.

B. The research version from the digital editing was saved in MPE G -2 Audio Layer III (MP3) format. The file is saved by title/song unit with new accession number to be allocated in the next stage. Mp3 format is a patented encoding format for digital audio which uses a form of lossy data compression. However, the compression was operated by reducing accuracy of certain parts of sound. This are considered to be beyond the auditory resolution ability of most people. Due to its much smaller size comparing to wave file, it is the ideal format for easily uploading to any computer at UPCE library for any listening and academic purposes.

C. The web version from the digital editing was saved in ogg format. These data is the same as in the edited compressed research version, but even smaller. The ogg digital format is format is a free, open container format maintained by the Xiph.org Foundation. Because the format is free, and its reference implementation is not subject to restrictions associated with copyright. Industry wise, its rather small size and high compatibility with different free and proprietary media players as well as portable media players, make it an ideal choice for web-based content distribution.

4. Content Cataloguing

A systematic approach towards cataloguing is of vital importance for instant location of a specific title/tune digitally as well as physically. Up to August 25, 1012, the Jose Maceda Digitization Project has already contributed 2649 songs/ titles to UPCE digital audio library. How to deal with such big number of audio data, based on the old paper book catalogue of the original sources (open reels, cassette tapes), a new digital catalogue was established for both library indexing and web search date base purpose.

Identification		Format		Locator		Description				Cataloguer/ Date	
data identification number	old catalogue #	original format	e-format	location of original	e-location	researcher	year	group/country	data captured		notes
UPCE-A-#	*Ayta 1971 Logan P1*	*acetate or polyester reel, tape, cd*	*wav/mp3*						*all descriptions/metadata available*		
UPCE-A-0001	Ata 10 1971 Side A	1/4" Open Reel	wav/mp3	A1		Lim, Isaias	1971	Ata / Philippines	Sasindog ka conocial "Konsehal"; vocal, instrumental ; female (singer); kudlong and saluroy (instruments), both plucked lute (Chordophone)	Opiso / June 3, 2010	

Figure 13 UPCE digital audio catalogue

As shown in figure 12, the new digital catalogue consist of such parameters as: data identification number (title accession number), old catalogue number , original format, digital format, location of the original data, electronic location, researcher, year, ethnic group, country of origin, meta data description, etc. This provided an efficient system to instant search online or at UPCE library by providing key words.

5. Content Distribution

To invite scholars, artists, pedagogues and students to make maximum use of such gigantic digital audio database, join and interact with CDCE in exploring traditions in the in the musical world, three ways of accession were provided.

Firstly, a website hosted at UPCE website (www.upcenom.com) was exclusively created for this digital audio collection. A powerful search engine was design for instant access by accession number, researcher, and ethnical group, country of origin or year of recording.

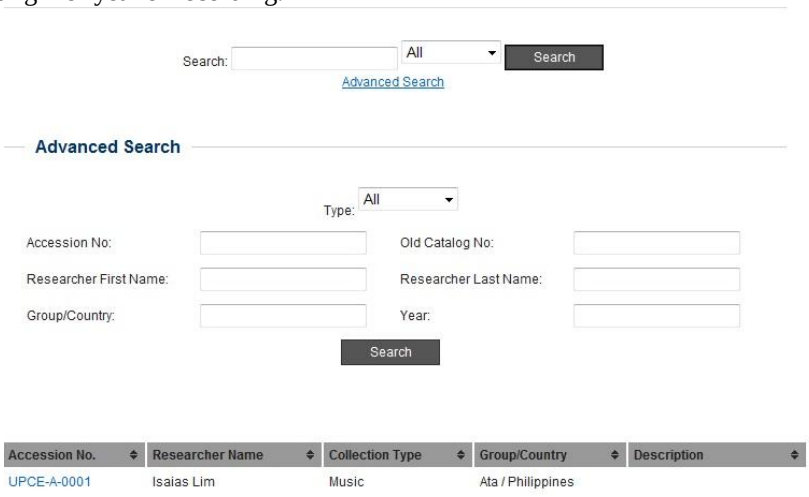

Figure 14 search engine of UPCE Jose Maceda Digital audio library

Secondly, this collection is open to public for on-site listening that audio data will be uploaded to the computer at UPCE library by simply filling a request form.

Lastly, for special requests, UPCE will be able to save the requested data on (CD or DVD) and mail to requested locations locally or internationally.

Conclusion

Digitization is an ever-evolving process which cumulates alongside with the advancement of digital information technology. In this sense, the currently on going Jose Maceda Digital Audio Library Project is not an end in its own term, but rather opens a new door towards a national and international – wise digital audio library with a mutual aims towards enchancing scholarly research, share musicological database and promote different indigenous or regional musical traditions and cultural identities. This paper showcased a cost-effective approach towards an institution – wise digitalize audio library establishment, which can be easily apply to other institutions that facing the same problems and situations with even very limited funding and human resource. However, there are two important areas of concern that I would like to recommend for further enhancing the scope of digital audio library projects.

Firstly, this initial project on digitizing Jose Maceda Collection aims to preserve the original analogue material which demands authenticity of digitized copy as to the original sources. However with modern digital audio technology, it is not difficult to enhance the current audio signal, such as noise elimination, post-production effect, etc. This extension of the digitization audio projects can further produce audio data at the fidelity ratio sufficient for publication in CD or DVD formats which can reach a wider audience of households.

Secondly, the Jose Maceda collection also consists of vast amounts of related ethnomusicological materials, like musical transcriptions, transcribed texts, photos, field notes, etc. How to incorporate these data as meta data into the

digital audio library is an important topic to solve to boost up the serviceability of the current digital audio library to a higher level in the future.

Figure 15 Shelves of Jose Maceda Collection textual materials at UPCE

Lastly, how to establish a more efficient music retrieval system which can describe the current audio data with more musicological data will be of vital importance for future scholarly research. New advancements in digitization like music information retrieval system, Melody Indexing System (MELDEX), adaptive content-based music retrieval system have already paved way for this purpose, from a technological perspective in general. However, how to install an efficient system which serves best the music of indigenous culture and record at old analogue technology live with low-fidelity is still calling for the collaboration and endeavor among musicologist, library scientists and engineering scientists. *In this perspective, the establishing of digital audio library is not a simplistic technical issue, but rather an integral part of ethnomusicology research that has been providing new knowledge and data to support and enhance this area of scholarship.*

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