



Strategies and Challenges of Personal Digital Archiving (PDA) in the Digital Era

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Abstract. This paper investigates the strategy of personal digital archiving (PDA), especially on storage devices and challenges faced in the digital era. Using the systematic literature review of paper published over the last ten years from 2009 to 2019 related to personal digital archiving strategies and challenges. A total of 208 research articles yielded that meet the selection criteria and finally eight studies were included in this study. The results obtained show that 1) the strategy used for personal digital archiving is different from one study to another but mainly about replication and making hard copy, 2) the challenges occur such as: unclear selection criteria and inconsistencies in organizing PDA, difficulties in archiving techniques, information fatigue/overload, technological challenges, privacy protection, and lack of guidance and training in PDA. Various strategies and challenges were obtained from qualitative, survey and case study results from various respondents and regions. The strategies and challenges are very useful and can be generalized to be applied in other regions for individuals and organizations or groups to manage and preserve their personal digital content.

Keywords: Personal Digital Archiving · Strategy · Challenge · Digital Preservation

1 Introduction

Technological advances make humans easy to create large amounts of digital data and they think that technology has facilitated all their needs, especially in storing and organizing their data so that they do not need to do anything else. The amount of information that is owned makes us need to know how to regulate this content, how to protect it, how and where to store it so that it can be used later in the future.

Personal information that is made by individual from day to day in digital forms such as photos, audio, video, e-mail, et cetera makes people do not thinking to preserve all the information they have. Even though it is unwittingly one of the first steps in documenting personal records, but it is not yet included in a well-organized archive.

If the information is not well preserved, it will cause the loss of the information which will also cause a loss of historical value and even cultural heritage. Therefore, the

awareness of digital preservation is needed from personal collections or personal digital archiving (PDA) so that the information can be preserved for a long time and can be easily retrieved. In addition, it is necessary to develop appropriate attitudes and skills and adopt new tools to manage individual personal digital collections effectively and efficiently.

The researches that have been conducted which sees PDA focusing on personal information management (PIM) were written by Marshall et al., 2006; Bergman, 2013; Whittaker et al., 2006 [18]. Then in the larger context of individual digital life and the digital content life cycle were written by John et al., 2010; Williams et al., 2009 [18]. Another researcher focused on the population of public library users and argued that personal digital preservation must be handled with personal, social, and technological factors were written by Copeland, 2011 [18]. While the others believed that that studies on PDA should not be separated from archives and record management that have strong roots in human-computer interaction and information science, written by Lee, 2011 [14]. Teaching PDA builds a foundation of knowledge that not only helps students manage their personal digital material, but can translate into research data management skills that will enhance students' academic and professional careers [8].

In this research the focus is to find out how the strategies especially on storage devices and challenges in PDA activities were written using systematic literature review method.

2 Literature Review

2.1 Personal Digital Archiving (PDA)

There are several definitions of Personal Digital Archiving that have been made by researchers, which are: PDA may focus on genealogical data, but it includes much more: What we have written, what we have read, where we have been, who has met with us, who has communicated with us, what we have purchased, and much else is recorded digitally in increasingly greater detail in personal digital archives, whether they are held by individuals, institutions, or commercial organizations, and whether we are aware of those archives or not. But for personal digital archives are collections of digital material created, collected, and curated by individuals rather than institutions [20]. PDA is nothing more than determining what we have to save, how and where we should store it, and what kind of work people must do to maintain their digital collections stay alive [10]. Although "personal digital archiving as a field still demands clear definition and delineation" [7] one working concept of personal digital archiving includes individuals and their records created in daily life [14].

Redwine describes personal digital archiving in the DPC Technology Watch Report 15–01 Personal Digital Archiving, writing "the term 'personal digital archiving' refers to how individuals manage or keep track of their digital files, where they store them, and how these files are described and organized" [15]. As someone's original record in social practice, personal digital files can tell stories about someone's life, which serve as witnesses to someone's memory [16].

2.2 PDA Strategies

Versatile technology and gadgets can be used to generate and access various content that also provides a variety of platforms for the choice of archiving, strategies, tools and systems used in PDA archiving. Like several platforms and units such as CD, USB, social media sites like Facebook and Flickr and in many variants, various file formats and so on [9].

The main strategy for archiving is content replication in various levels. Some people consider replication a concept similar to long-term preservation, replication as a best practice for backing up [13]. Replication behavior includes: replicating certain files on removable media, digital devices, and/or websites; save files in different folders on the same computer; using social media sites; copy all content from one device to another; back up the entire system (or the entire platform); and/ or use automatic back up tools or synchronization [18].

Williams, Rowland & John [21] recorded a large number of storage methods, such as sending emails with URL to themselves or others, saving all webpages or printing them, bookmarking them, or pasting links into separate documents. Bookmarks and favorites are identified as the most common method for storing information. The authors also observe that often people will depend on re-accessing information by searching for the desired web information, entering URL from memory (using browser suggestions as assistance) and achieving them from known access points (e.g. Web Portal) [9].

2.3 PDA Challenges

The challenges in PDA mentioned by Marshall [11] include: digital stewardship, distributed assets, value and accumulation, and long-term access. In addition, the main challenge that must be overcome is the reluctance of individuals to spend too much energy on curation because it is difficult to anticipate the value of digital content in the future because the value of information is unknown until the archived information will be taken when needed [23]. Making curatorial decisions is “cognitive demanding exercise,” as explained by Marshall [10]. Compared to traditional paper archives, personal digital archives are highly distributed and unsystematic, especially when most people have multiple devices (telephones, digital devices, computers and/ or cloud services) in managing digital content, also in the Web 2.0 era where social media sites also become the main storage platform for personal digital files [23].

3 Method

Systematic literature reviews include the following 3 phases according to Kitchenham and Charter [4]: (i) Review Planning, which includes research questions and protocol reviews; (ii) Conducting reviews, which involve developing reviews, combining the selection and quality of studies, data extraction, and data synthesis; and (iii) Report reviews, which present the results of the review. Thus, the review protocol for this systematic literature is as follows: research question, data sources, search strategies, selection criteria, quality of research, data extraction, and data synthesis.

Table 1. Identified Scope for Structuring Research Questions

Criteria	Scope
Population	Personal Archiving
Intervention	Limitations of the personal digital archiving
Comparison	NA
Outcomes	Strategies and challenges
Context	Review of any investigation on strategies especially for storage devices and challenges of personal digital archiving

3.1 Research Questions

In planning questions, the PICOC structure (Population, Intervention, Comparison, Outcomes and Context) is used (Table 1).

Two (2) research questions (RQ) were designed based on the finalized criteria and scope as in Table 1.

Q1: what kind of strategies of PDA storage devices?

Q2: what challenges occur in PDA?

3.2 Data Source

The following electronic databases were selected for the search of scientific articles: Proquest, Emerald Insight, Springer Link, ACM Digital Library, Science Direct, accessed from the library of Universitas Indonesia database, and Google Scholar. These databases contain scientific articles oriented to PDA which is the focus of this systematic literature review.

3.3 Search Strategy

The scientific articles that need to be collected should contain information related to the questions defined in Table 1. For this purpose, four search strings were developed, which are detailed in Table 2.

3.4 Selection Criteria

Inclusion and exclusion criteria were carried out to limit the search and selection of articles. The selection of articles is made according to the following criteria:

- Scientific research articles and research articles in proceedings
- Articles that document personal digital archiving
- All documents that describe personal digital archiving
- Studies published between January 2009 and December 2019
- Papers written in English

Table 2. Four Search String for Structuring Research Question

No.	Search string
1	“Personal digital archiving” OR “personal digital archive” OR “personal digital records”
2	“Personal digital archiving” OR “personal archiving”
3	“Personal digital archiving” OR “personal digital archive” AND strategies AND challenges
4	“Digital preservation”

Table 3. Study Quality Assessment Criteria

Quality ID	Quality Assessment Questions	Answer
Q1	Is there a clear description of what strategies or methods of storage do personal digital archiving?	Yes/ no
Q2	Is it explained about the challenges in personal digital archiving?	Yes/ no

- Focus on the strategy or method of storage and the challenges of PDA in general not specifically for example on social media only, websites only, or others.

We exclude articles that:

- Articles other than scientific research articles and research articles in proceedings
- Not the focus of this study.
- Articles that do not discuss PDA
- There is duplication
- Non fulltext

3.5 Quality of Research

The quality assessment was formulated to evaluate the completeness of papers and advantageous for data extraction. These questions are presented in Appendix A. Each question has only 3 alternative answers: Yes = 1; Partially = 0.5; and No = 0 (Table 3).

3.6 Data Extraction

The relevant information that was extracted from all the selected documents is as follows:

- Author and year of research
- Types of journals from scientific journals are only research articles and proceedings research articles
- Articles related to research on individuals and groups that are not professional communities or professional institutions in applying PDA to their digital information collections
- Articles about PDA that focus on personal information management (PIM)

3.7 Data Synthesis

The grouping of articles into Table 5: articles related to any strategy in carrying out PDA (Q1) and Table 6: articles related to the challenges faced in carrying out PDA (Q2).

4 Result and Discussion

4.1 Result

From the selection process obtained 236 articles in the first phase of the research search results. Then several selection stages are carried out as follows: (i) articles published from 2009 to 2019 and eliminate duplicates related to what has similarities, and obtained 208 articles (ii) selecting articles based on titles and abstracts; and through manual review and search in the title only on Google Scholar search because it cannot use the selection options in the abstract, then (iii) inclusion and exclusion selection and assessment of the quality of the study so that 8 articles are obtained (3.8% of 208 articles) that are relevant (Fig. 1).

4.2 Discussion

The grouping of articles can be seen in Table 4 based on:

1. Type of study

These articles use organized methods to collect and analyze data. The study classification in this step is in accordance with the research design, for example, survey methods, case studies, and so on. Sources for collecting data in each article for example, interviews, questionnaires. Of the 208 articles, 9 articles were case studies (4.3%), 15 survey articles (7.2%), 19 literature review articles (9.1%), 3 mixed method articles (1.4%), 9 descriptive articles quantitative (4.3%), 39 qualitative articles (18.75%), 114 articles (54.8%) are other articles (conceptual paper, book review, report, news, editorial, etc.).

2. Type of publication

These articles are classified based on the type of publication to identify the main purpose of the author in writing his research. Of the 208 articles, 45 journal articles (21.6%), 35 conference articles (16.8%), 40 theses/dissertations (19.2%), 38 book reviews (18.2%), 4 magazine articles (1.9%), 46 articles (22.1%) are others (posters, editorials, comments, etc.).

3. Findings on awareness of the importance of PDA

A summary of the findings of eight articles on awareness of the importance of PDA include:

- There is awareness of the importance of PDAs even though their management is not fully in accordance with the construction of PDA and only manage data that is considered important.
- The awareness of the importance of PDA influences the practice and behavior of PDA.

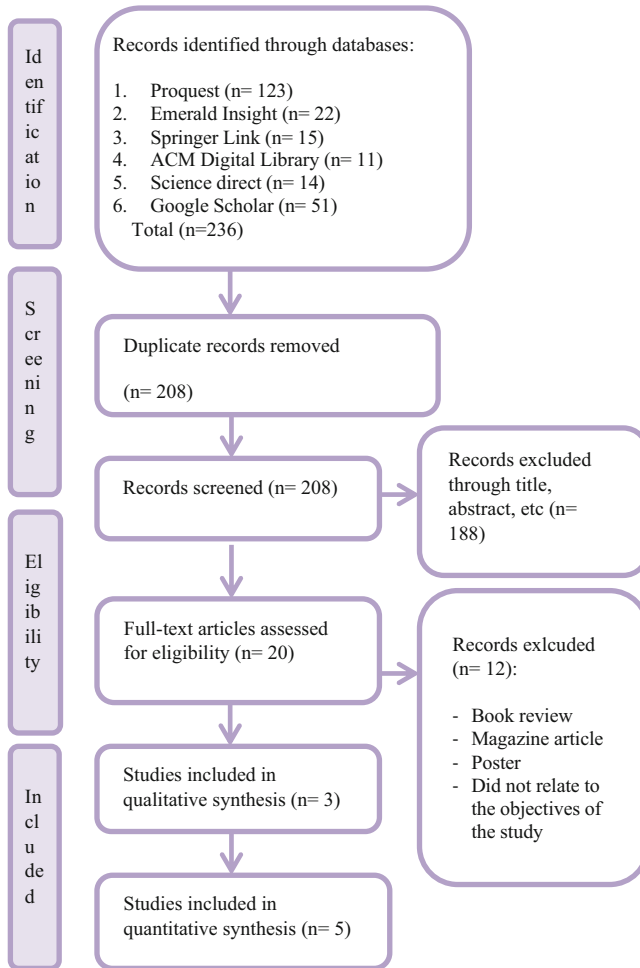


Fig. 1. Prisma Protocol Systematic Literature Review

- The emergence of a higher awareness to then manage their PDA better after they know the importance of PDA.
4. Strategy on PDA storage devices
- From Table 5 the storage tool strategy carried out in various PDA applications can be summarized in two parts, namely:
- Replication [18] such as storing in a place that different (USB, DVD, and Cloud), save files in different folders on the same computer; use social media sites, store them with different versions, duplicate them entirely on other computers, and back up the entire system (or the entire platform); and/or use an automatic or synchronous backup tool.
 - Hard copy or print it [18].

Table 4. Types of Studies, Types of Publications and Findings on Awareness of The Importance Of PDA

Article number	Author	Type of study	Type of publication	Findings on awareness of the importance of PDA
1	Yue Zhaoa, Xian'e Duanb, Haijuan Yanga (2019) [23]	Survey	Research paper	Postgraduate students have a higher awareness of PDAs with different levels and disciplines. They are very optimistic about technology.
2	Donghee Sinn, Sujin Kim, Sue Yeon Syn (2017) [18]	Survey	Research paper	Shows the existence of diverse digital archiving practices and awareness of the importance of archiving. Awareness of digital content for personal history also shows the effect on filing behavior.
3	Vanessa Reyes (2016) [16]	Qualitative	Dissertation	NA
4	Vanessa Reyes (2016) [17]	Qualitative	Conference proceeding	Participants feel it is important to use the model to be able to understand the terminology of the model which sequentially describes the process of storing, managing, reusing, and disposing of personal digital information. Demonstrate awareness of applying PDA

(continued)

Table 4. (continued)

Article number	Author	Type of study	Type of publication	Findings on awareness of the importance of PDA
5	Maja Krtalić, Hana Marčetić and Milijana Mičunović (2016) [5]	Survey	Research paper	There is a positive correlation between respondents who realize the importance of managing data and managing their digital documents. Students often plan their preservation activities but mostly only for data and documents that are considered important or that might be needed in the future.
6	Hana Marčetić (2015) [9]	Survey	Conference	Information science students in Croatia in general are quite aware of personal digital information problems. But the management of collections in accordance with PDA construction has not been fully implemented. In essence, the level of awareness increases attitudes towards PDA problems and increases the opportunity to deal with existing problems appropriately.

(continued)

Table 4. (continued)

Article number	Author	Type of study	Type of publication	Findings on awareness of the importance of PDA
7	Sarah Kim (2013) [3]	Case study	Dissertation	From the results of interviews, it was found that participants wanted to pay more attention to how they store and manage their digital documents from now on. It is clear that the interview was an opportunity for some participants to reflect and tended to have an influence on their daily data storage.
8	Jeremy Leighton John, Ian Rowlands, peter Williams, Katrina Dean (2010) [2]	Survey	Research paper	There is little awareness of the practice of digital preservation.

5. PDA challenges

The challenges in carrying out PDA also vary as explained in Table 6. These include:

- Unclear selection criteria such as it is difficult to determine future values of digital files and take time to determine which ones are important including the presence of emotional influences and personal history
- Difficulties in archiving techniques such as inconsistencies in organizing PDA, especially regarding how to back up digital collections, choose the right format, create the right selection criteria, know the standards and terms of use
- There is information fatigue/overload made by each individual every day so that it finally piles up or buried which causes reluctance to do archiving techniques on his personal digital data
- Technology challenges, large memory space, and technology dependence on search functions and storage media, obsolescence of file formats, software obsolescence, software or hardware damage, accidentally deleted, damaged data archives, virus hazards, physical degradation of storage media, encryption

Table 5. Strategy on PDA Storage Devices

Article number	Storage device strategy
1	Respondents' digital archive storage devices are mainly offline storage devices, such as personal computers, mobile hard drives or USB flash drives, cloud storage products are the main online storage devices, and some use their mobile devices as mobile storage devices. In addition, respondents said they would use e-mail and personal websites or social platforms to store personal digital archives.
2	Replication includes: duplicating it on (USB, DVD, and Cloud), storing it in different places, storing it with different versions, storing it on a computer, printing a hard copy, duplicating it entirely on another computer.
3	OneDrive, External Hard Drive, Flash Drive, Dropbox, Google Drive, Cellphone, Personal Laptop
4	External Hard Drive, Flash Drive, Drop Box, Google Drive, Cellphone, Personal Laptop
5	Save on PC, external hard drive, on another computer, transfer to Cloud like Dropbox, bookmark browser, send attachments or URLs on personal e-mail, store URLs on PC, print hardcopy, save on other formats (CD, DVD, Blue ray), storing all websites on a PC, while for social media it is only used for storing informal data.
6	Save on PC, external hard drive, on another computer, transfer to Cloud like Dropbox, bookmark browser, send attachments or URLs on personal e-mail, save URLs on PC, print hardcopy, save on other formats (CD, DVD, Blue ray), save all websites on a PC, save on social media (flickr, tumblr, facebook, twitter, instagram, pinterest).
7	Some participants still retained storage on floppy disks before being transferred to the latest media, while others have used new storage media such as e-mail, laptop hard drives and externally.
8	Backing up computers, storing printed copies, storing on disks or other media, sending personal emails, making multiple copies in different places, external hard drives, flash media or USB, floppy disks, CDs, DVDs, remote servers, zips drive.

- Protection of privacy on stored data such as on social media or the web
- The lack of guidance and training in PDA is carried out by professionals in the field such as librarians, curators, and archivists.

Table 6. PDA Challenges

Article number	Storage device strategy
1	The biggest challenge in PDA is privacy protection, the characteristics of large and scattered PDA increase the difficulty in archiving techniques, archiving methods and processes are too professional so the lack of guidance and training is the biggest problem in PDA.
2	The challenges of digital archiving that were previously identified (digital curation, wide distribution and rapid accumulation of digital content) did not significantly affect archiving practices. Factors that influence the practice of digital archiving namely use of search functions, personal history awareness, general technological efficacy, efficacy of technology related to backup, and memory efficacy.
3	Obsolescence of file formats, software obsolescence, software or hardware damage, accidentally erased, damaged data archives, virus danger, physical degradation of storage media.
4	NA
5	NA
6	The challenges faced in organizing and formatting on their PDAs are unclear selection criteria and inconsistencies in the methods practiced. In addition, the information overload phenomenon is also widespread among respondents.
7	There are four main observations that have an impact on the technical aspects of personal records and their curations: 1. Technology obsolescence, 2. Degradation of media, 3. Information is distributed through networks, especially cloud computing, 4. Encryption
8	privacy issues, organizational structures for personal digital documents, adaptation of digital tools to process and maintain digital collections such as digital forensic devices, designing tools or personal digital filing systems with an emphasis on maximizing customization with respect to individual differences and emotional experience accompanying them, developing strategies to build archival bases and ways for memory institutions to approach and work with individuals so that the voices of various social groups can be reflected in the preservation of cultural heritage.

5 Conclusion

In this digital era, PDA are very important because of the amount of information created and which must be managed every day. Humans will never know when they need data that they really need in the future. Therefore, the need for knowledge of the right storage strategy and challenges in managing PDA will reduce the risks faced in managing and storing personal digital files such as valuable data loss. In addition, support from professionals and related institutions is needed to expand and guide public knowledge of the importance of storing their personal digital data.

In this systematic literature review, various storage device strategies and challenges for PDA were obtained as a result of qualitative research, surveys and case studies from various respondents and regions. The strategy of storage tools and challenges is very useful and can be generalized to be applied to both individuals and organizations or groups in managing and preservation of digital content in other regions. Further more complex systematic review research is needed to complement this research and the development of novelty from PDA management.

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Appendix A. Quality Assessment Result

Article number	Q1	Q2	Total
1	1	1	2
2	1	1	2
3	1	1	2
4	1	0	1
5	1	0	1
6	1	1	2
7	1	1	2
8	1	1	2

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