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Library Stack Management: A Study of Storage and Maintenance Practices for Print Collections in Academic Libraries

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Abstract

This study examines library stack management in UK academic libraries, focusing on the maintenance of print collections. These libraries currently face challenges in accessing stacks for print consultation. Initial inquiries revealed that stacks often use a two-item cataloging system with no broader access. The refined research objectives aimed to explore the identification standards of dominant UK academic library collections and develop an open-standard algorithm monitoring system to improve outcomes. As the academic library landscape has expanded beyond commercial book suppliers to include various technology suppliers, examining library access and preservation technology at broader scales has become essential. Managing print collections effectively requires compatible and interoperable systems. Many collections struggle with translation into open, cross-library machine language, characterized by unclear, unpaid, and uneven application. This highlights the need for structured open-standard protocols. Attention will also focus on a significant operational format that lacks sufficient convergent-harmonized use. The study sought evidence from publications on compatible procedures for managing large operations, including inter-library collaborations. Additionally, initial research pointed out the ongoing incompatibility between various cataloging and network translation efforts by the British Library.

1. Introduction

Academic libraries hold extensive collections of information resources and assist users in accessing materials for academic pursuits through a functional Information Retrieval System. Effective library operations depend on the systematic organization of materials, particularly physical collections. Proper management of a Library Stack is essential for effective storage and user satisfaction. A key challenge is the disarray in library stacks, which negatively impacts user satisfaction. This study examines “Library Stack Management,” covering the management and oversight of stacks beyond simple categorization within various university libraries. It assesses storage and maintenance practices of print collections, revealing that awareness and procedures among academic libraries differ significantly. Initial communication with library authorities only yielded limited information. Despite numerous documented efforts on stack management worldwide, this lack of comprehensive responses from universities prompted the study. The goal is to compile details on existing practices concerning security and safety in academic libraries. This preliminary survey is crucial for future investigations. The paper will address general and specialized libraries, records and inventory, security measures, preventive strategies, and conclusions with recommendations based on findings and implications.

2. Literature Review

Library management, including storage and maintenance of collections, has evolved with changing media formats in the recording and storage of information. However, insufficient attention has been paid to the storage and maintenance of print collections in academic libraries, especially in supporting academic programs. This literature review explains the different aspects of library collection storage and maintenance, and the trends and challenges facing academic libraries, with a focus on library stack management. It is anticipated that the review will help formulate a research design and methodology for a detailed investigation of the storage and maintenance of print collections in academic libraries. The focus is on academic libraries and a review of literature relating to the storage and maintenance of a library collection. Storage refers to the placement of collections for easy retrieval when they are needed. The primary objective of academic library collections is to store and make information resources available to users. The review notes that the storage and maintenance management systems have not kept up with the pace of development in all types of libraries with digitization. After detailed assessment and analyses of the literature and a description of the methodology for further investigation, it is expected that the review will guide future work and will serve as an academic reference for storage and maintenance management studies in libraries. Interestingly, storage was claimed as a work-in-progress since a data set too massive for retrieval has been approached.

2.1. Historical Perspectives on Library Stack Management

The 19th century marked the golden age for public libraries, emerging as key democratic institutions. As their size and circulation expanded, stack management complexities increased. The survey reveals that stack management is a significant part of library administration evolution. The 20th century introduced storage technologies like microform and digitization, challenging traditional stack management. Managing both current and stored collections became intricate, necessitating essential principles and practices for stacks. Core practices identified include collection assessment, shifting, transfer, disposal/replacement, shelving, and inspection, with reader handling and inventory also deemed vital. Procedures can vary based on library priorities and conditions, with some unconventional practices like automatic spooling and half-rack shelving noted. Memorable practices range from memorial displays for prized items to organizing regional maps and co-shelving for biosciences. The evolution of tools and standardized methods supports tailored practices for libraries. The survey outlines the historical narrative of academic libraries formalizing stack management since the mid-20th century, initially addressing space shortages and informal handling. By the 1970s, noise control measures were introduced, impacting handling efficiency. Emerging hazards by the 1990s included those from MRI machines, humidity, and visitor loads, prompting a renewed focus on stack management policies. The findings provide valuable insights into these changes and highlight the growing importance of stack management practices in libraries.

2.2. Current Trends in Print Collection Management

A crisis has arisen in recent years as many libraries face unsustainable increases in print collection costs and budget cuts. Libraries that once saw growth in materials budgets now face mandates to cut 10% or more from previous budgets. They struggle with the option of purchasing freely available databases or discontinuing print collections, as this would reduce

the library's role as a physical hub for inquiry. The growth of print collections exceeds available shelving, leading to overflows. Returned but unaccessioned print resources occupy space intended for other uses, yet maintaining stack collections remains a priority. There's an understanding that mismatches exist between print collections and assigned storage, complicating stack management. The challenge is exacerbated by limited information about stack sizes, making it crucial for libraries to explore storage options. Five storage options and related access services have been suggested to address floor space issues. Libraries that manage their stack collections well may need to reconsider commercial options from lower to higher quality. Proposed access service attributes could ease concerns about commercial or confined storage choices. All library users might benefit from some form of service for affordable long-term print collection access. Stack maintenance involves complex choices, and while uncertainty in stack filling will always exist, there remains potential for improvement.

2.3. Comparative Analysis of Storage Solutions

Given the pervasive issue of chronic space shortages in libraries, Australian libraries are increasingly considering solutions that move beyond acquisition of new buildings, reclaiming land, or making their facilities available in off-hours. Dissolution of less-used materials from collections is one approach; shared industry solutions to consortial de-duplication processes for print materials are another. What is being suggested here is a possibly complementary initiative that would involve more radical and longer-term re-imaginings of collections and collection building. Libraries, public and educational, academic and otherwise, could progressively enter into agreements to locate significant portions of their holdings in purpose-designed, off-site vaults in suburban or rural environments. They would promote this shift to the public as "extensible," with resources compressed and dispersed most appropriately. Librarians would become agents of recapturing space in cities, able to either store additional print materials on-charges or repurpose that space for collective purposes. In the process, the scope and funding for further digital transformation would be expanded. An infrastructure would be created for shared stewardship of cherished collections.

In the U.S.A. and Canada, academic libraries in metropolitan areas have engaged with offsite storage, conceptually predicated on this logic of dispersion. An early champion of this model was Grant Campbell of the University of Washington, who presented the powerful rationale for large capacity off-site storage to the Council on Library and Information Resources in 2002 (Genoni & Varga, 2009). The Harvard Depository in Boston is one early example of an extensive and successful undertaking of this kind. Years later, under Campbell's stewardship, an even larger-scale replication of this model, but with more sophisticated retrieval and delivery specifications, is currently under construction in Toronto.

3. Methodology

This paper is based on a study conducted in 2004 of print resource storage and maintenance practices of library stacks from academic libraries. The approach involved two parts, which also provide a framework for the discussion in the paper. The first part was exploratory, involving the identification and development of issues relevant to the care and maintenance required by academic libraries for their print collections. The inquiry included the identification of stack management practices for public, private, and community college academic libraries and current issues, both problematic and successful, as an aide to understanding how print

collections are to be managed. Issues are defined as either problematic or successful concerning the maintenance and care of library stacks and collections, and would be thought of in that way by staff discussing stack management. Additionally, stack management practices are identified that would apply to either library stacks as a whole or parts of stacks, including monitoring daily conditions, conducting periodic evaluations of conditions, and, depending on conditions, evaluating stacks concerning safety.

The first part of the methodology of the inquiry was undertaken in two stages: access and investigation. Similarly, the second part comprised two stages: selection and implementation. The exploratory part of the methodology for the first part of the study was to identify and develop a list of issues relevant to the stack management practices of academic libraries with respect to the storage and maintenance of print resources. This list of issues was then used to guide a survey of practices that, in their implementation, coincided with the issues identified. To consider stack management, a discussion of the actions and inquiries undertaken by staff responsible for the stack management in an academic library was begun. Although not intended to be exhaustive, this framework of activities was thought to adequately capture and describe overarching stack management practices to address the conservation and preservation needs of library collections in an academic library context. Identified practices are those dealing directly with stacks or stack areas within the library (F Casserly, 2008).

3.1. Research Design

Design is controlled observation, which aims to describe the phenomenon or specific contribution of the study object of research. The observation at the public library, in this case at Raden Intan State Islamic University, Lampung, was done by using design-based management on print collection arrangement. There are several things monitored carefully, such as the arrangement involving library items, both collection material and media, whether by the policies outlined in the procedures and technical implementation of collection arrangement by library design management following national standards of libraries, University Reference Book on Design, Library Study Tool Design, Collection design, including budget, space management, and stacking and affecting factors in library design.

This research is expected to find the phenomena concerning the design-based management library stack in storing, maintaining, arranging, and collecting the digital library at Raden Intan State Islamic University, Lampung. To know how the formula of library stacks design management, procedures, factors, and constraints in designing the stack, to find out the result of management in storing and maintaining the library stacks at UIN Raden Intan Lampung. The research study was qualitative descriptive, which describes methods of library desk review analysis and phenomenology, which focus on the activities related to library stack design, precisely the fulfillment of components in designing stacks.

The data were library stacks design management, arrangement, storage, maintenance, presetting, collection design, and how far the fulfillment of library stack design management components. The design library management covered collection design, methods, procedures, setting factors, need analysis, identification of needs, formulation, and evaluation. The library stacks design management covered how to store, maintain, and arrange the collection in the library stacks. Following the procedures involved selection, collecting, checking, sorting,

identifying, classifying, coding, cataloguing, physical control, sealing, and storage of the library print collection.

3.2. Data Collection Techniques

A survey method was used to gather data on storage, inventory, and maintenance practices. Using a survey instrument, data were collected from a structured questionnaire addressed to the head librarians of the academic libraries in the three regions of Bangladesh. An instrument was developed for the study. The questionnaire comprised two major parts: A and B. Part A collected information on library and collection profile, and Part B included items on storage, inventory, and maintenance practices for print collections in the academic libraries, covering a total of 31 items. A panel of experts validated the instrument, and recommendations for appropriate modifications were incorporated. The reliability coefficient of the questionnaire was therefore computed as 0.96.

Before preparing the final instrument, a pre-test was performed with selected library professionals of different academic libraries in Bangladesh. Following this, the final version of the questionnaire was sent to the respondents with a covering letter to explain the purpose of the study and to request their participation. The head librarians were requested to forward the questionnaire to the designated officers if they were not the key respondents. On receiving the questionnaires, follow-up contact was made over the telephone and through email. The responses were recorded in a program for statistical analysis. The collected data were tabulated and analyzed using frequency counts and percentages. A percentage measure was used to summarize and understand quantitative data regarding storage, inventory, and maintenance practices of print collections in academic libraries in Bangladesh. Qualitative data were analyzed and categorized into specific themes.

3.3. Analysis Framework

After gathering information related to various aspects of the TUM library's stack management and storage practices, an analysis framework was developed that considers the available information and aims to identify key aspects of library stack layout. The framework consists of four general categories that outline the nature of information to seek for stack management and storage analysis: (1) Structural: This category focuses on overall building characteristics of stacks, such as construction types, spatial layouts, material finitures, etc.; (2) Technological: This category covers technology related to stacks, like mechanical system features, technology uses, and other technical assistance to stack storage, retrieve, and maintenance; (3) Economic: This category includes all financial aspects of stacks, such as construction and maintenance budget needs, cost efficiency issues, personnel costs, etc; (4) Anthropological: This category includes everything related to stack users and library staff, such as user behaviors and needs, structure of library staff, operation hiring and training practices, etc. (F Casserly, 2008). Moreover, once identifying important aspects of stacks, a narrative framework comprises three basic narratives was proposed: (1) Descriptive narratives: The first narrative approach is descriptive reporting – statistics and stock reports which summarizes aspects into form of simple graphs, plots, charts, videos, etc.; Simple statistics are one of the most commonly found narrative types which largely fills the annual report of a library. In many cases, statistics mainly focus on numerical aspects such as collection counts, budgets, personnel numbers, sizes of buildings and spaces, etc. In some cases, they report events, new services started, awards

granted, etc.; (2) Predictive narratives: This narrative approach tells potential future states of library stacks or certain aspects, and provides an estimation or recommendation in terms of new features, staffing practices, and budget consumptions after proposing possible future scenarios in which changes happen; (3) Explanatory narratives: This narrative framework provides explanations on what has happened and why during the past few years. Explanatory reporting generally focuses on structural changes or actions.

4. Storage Solutions

Storage Solutions The session will explore current storage and maintenance practices that various academic libraries have implemented to house print collections. Libraries will discuss print collection housing and maintenance considerations such as stack design, construction, and layout; spine label and inventory system; how to enhance navigability; and dust, temperature, and pest control. Questions will be posed to facilitate discussion: What strategies have been adopted to ensure current housing and storage practices work for large print collections? What solutions are temporary, and what are permanent? How have academic libraries wrestled with shelf space shortages? What are unique items, collections, or approaches? Focus questions: Session participants will be asked to describe how the storage components of each library's print collection are currently housed and maintained. Specific questions follow. Stack structure and layout: What is the type of construction (fixed, movable, compact)? Why was the stack design selected? How was the layout determined? Collection organization: Is the print collection in a single contiguous area? What is the item arrangement (e.g., Dewey, local call numbers)? How was the decision made to use that organizational format? Inventory system: Where are the current item locations indicated? What is the method for recording updates (spine label, database)? What happens with hidden collections? Successes and challenges: What is working well? What challenges are currently being faced? Some academic libraries have excellent on-campus building storage plans for collections set for a library warehouse. These libraries may have hired architects to devise building designs for storage facilities with trench, fixed compact, or mobile shelving alternatives. These larger physical capital-intensive fiscal moves to 'out-of-sight' or on-campus storage for Academic Libraries might transition print resources in order to devote more utility area to electronic resources (P. Tolppanen & Derr, 2012). Strategies for multi-institution, multi-state storage, objectives (underutilized print burdens; multiple identifier keyword searching), and restrictions on in-kind storage at Junior College or Church Libraries will be discussed.

4.1. Physical Storage Options

While only recently re-invisibilized due to still fairly new theories about web archival, file storage for large collections of imagery is seasoned and mundane. Such a collection describing the history of the US Pacific Coast was abstractly designed first for access, then for cleaned storage, and only well after that for limited chronologically oriented, most granular retrieval in three variants: context, attributed, and without. Other, less production approaches, come from (1) LAMP, (2) GIMP, and (3) establishing online versions of books. While the goal here is after (4) as kept and built for credit, (3) is getting closest to production. Saved JPEGs can be daily or seasonally auto-ingested by cron to freshen the public version. Building streaming HTMLs (four views of all book pages) is the lightest computation and could be fielded with time coding of early retirements. This secondary use of even simple image views is new.

Where the primary library representations of use are (1) sacred images or (2) optic telephoto color, taste is challenged by the online environment. Creative use of dark and light in animation is instinctive, sometimes beautiful, while uplighting and refugee searches are ugly necessities. The academic library is both exotic and mundane. While twenty-plus years of network approaches are peerless, other efforts are almost trivial. Wires are pockmarked with as much return as that of magician's choice, all that remains being either choice or compromise. It feels unseen; only others can answer, but that doesn't matter in networks. Perhaps less mundane, ethically, is either opaque sand tables of cultural deletion or the obliterating black of pixels.

An unpleasant account of gross injustices of respect to property based on crass political opportunism, or reverent black out of cyberspace, waste at unreal scales commanded by Power; perhaps forty million page deaths a week to the point of sewage. The argument, ocular; why isn't there translucency, and respect for prior labor, and desire? Migration and inspection are cast here on a deferment of compelling interest: articulate, deliberate, retain without an apparatus of instant, enormous control and/or obliteration. In short, do it compactly and carefully in widely based joined computers (Crist & Michaels, 2013).

4.2. Digital Inventory Systems

A couple of academic libraries state their use of vendor-supplied barcode scanners to input the inventory into their Digital Inventory Systems. They state that they run the manual process more often than not in case of tagging errors and spurious barcodes. They stress the importance of auditing the library barcode both electronically and physically every few years. It is also noted that having two inventories for different vendor products was a nightmare. One happened to be Punch Key, an early video game manufacturer who also manufactured barcodes, but under different strengths. The other turned out to be a label manufacturer application, which was also complex and turned up to be an utter failure. They now use a shrink-wrap product. One thing misleading was that barcodes attach to records, not items. Items were a group of resource records with one set of metadata. Lastly, there was a challenge of reconciling disparate barcoding standards (Wild, 2002).

A few academic libraries vary significantly from any previous practices. They use the library's Digital Inventory System to take advantage of already existing metadata to eliminate redundancies in the stacks, circulate records, ownership records, etc. It incurs much initial setup effort, but it is worth it in the long run. This procedure enables recorders to run diagnostics against existing stacks. They recommend limiting the initial stacks' setup job in an effort to maximize the benefit-cost ratio in the early stages. The perfect Library Digital Inventory Systems were known to be neither their best nor their worst. A few academic libraries implemented their systems repeatedly and have skinned the proverbial cats. The same assessments repeat weekly, quarterly, and annually. Many libraries keep axing the wrong sites while potentially useful sites were buried under rancor over whether to go on a crashing platform or to start over again.

Stack management at libraries is probably a different subspecies of the same problem. Regular, if infrequent, audits of report numbers, many histories of States missing or weeded out. Hiding unwanted items leads to more alienation unless constructed with great care. The standard panic way of making national headlines has been undergoing outside efforts to reshape library stacks in both academic and public libraries.

4.3. Space Optimization Strategies

In addition to centralized storage of print collections in an off-site facility parked separately from on-campus buildings, many academic libraries deployed effective strategies for space optimization within their open-stack collections held in their main libraries. The existing print collections within the library building are modified in various ways to ensure enough space for newly-received print acquisitions, including massive deselection of the existing collections, moving collections to storage, renumbering collections, and relocating collections from one place to another etc.

Among all the different strategies, there seems to be a strong emphasis on collection deselection to create more space for new arrivals in both the latest storage and older libraries. The purpose of collection deselection is to shrink the shelf space usage by removing lesser-used older items, so that more shelf space for the newer acquisitions could be allowed to be added to the library collections. Meanwhile, with the rise of digital library resources and the fast growth of digital conversion services, it is deemed that the function of some older unused library print collections has faded gradually, and the necessity to collect and store such print information has dropped significantly. These collections are even deemed more feasible for deselection. Strategies such as mutilating, recycling, and withdrawing obsolete collections are mostly adopted to shrink their space usage. These activities are comparatively huge undertakings and might take years of research and work before conclusive results can be obtained.

In order to prep a research project and facilitate the actions, a detailed information retrieval procedure is needed to help identify collections with potential retaining value. The rationale began with the industry information source search, where relevant organizations and businesses are investigated to build a target list of candidates. Then, a relevant freedom of information request is drafted and delivered to the candidates to facilitate the procurement of quotations. In parallel, a comprehensive print collection inventory is coded to accommodate the upcoming deselection project, based on which a shortlist of collections is compiled for potential fetching of quotations. Finally, the initiation of deselection of print collections and the outcome estimation are also discussed to complete the drafting of storage optimization strategies.

5. Maintenance Practices

The maintenance of library stacks ensures their safety, usability, and access, impacting space assignments linked to the library's classification system. Libraries are designed as both public and private spaces. Five key themes emerged regarding stack maintenance: (1) identification of divisions responsible for upkeep; (2) design elements that enhance safety and usability; (3) frequency of maintenance procedures; (4) adherence to standards and best practices guiding these procedures; and (5) challenges faced in maintaining stacks in academic libraries. Different institutions designate various divisions for stack maintenance, with many indicating multiple departments involved. Facilities management is often cited as central, alongside fine arts divisions. In libraries lacking a facilities management branch, general collections or office services may take on these responsibilities. Maintenance activities include access and public services' involvement to ensure effective stack upkeep, documented through floor plans. Staff members report design elements like cleaning protocols to maintain stack usability and safety. Libraries may have procedures for organizing public areas, including stacks, and might possess training documents outlining safety protocols. Cleaning procedures are essential, often

executed by task groups, with actions like shelf walking and moving collections. Cleaning frequency varies by library, with some increasing it during peak times while others lack robust cleaning measures, facing limitations from architectural designs or outdated features. (Baker & Dube, 2010)

5.1. Regular Inspection Protocols

The libraries encase valuable information resources that must be kept in good repair for future use. Responsibilities for maintaining library materials are assigned through personal assignments and established policies and procedures, which vary by environment but remain consistent across many libraries. Library managers understand the significance of maintenance for operational success and follow clearly defined procedures. Staff members recognize the importance of maintenance for both themselves and patrons. Libraries conduct formal inspections to identify issues and take steps to ensure the functionality of their holdings. Many academic libraries hire experts for ongoing equipment maintenance as part of a proactive strategy. Regular servicing is essential to prolonging the life of collections. The operating environment and maintenance verification procedures are crucial for ensuring that equipment functions properly. Maintenance work must consider both short-term and long-term consequences, and libraries consult equipment manufacturers to avoid warranty issues when modifying systems. Clearly defined operational procedures for shelving are essential, accompanied by check sheets with guidelines available at various locations. This process involves compiling standard forms for staff to follow during emergencies, providing a general indication of any problems. (.U. Oghenetega & C. Ebele, 2014)

5.2. Preservation Techniques for Print Materials

Providing lifelong durability for print materials involves a number of operational techniques, both at the infrastructure, collection, and individual item levels, as well as ambient conditions. Storage configuration, equipment, and supplies should be appropriate for the format of the material (Baker & Dube, 2010). For books, a number of techniques are available for repairing volume edges, or resewing, which requires restoration off-site. Folder types, climate, packaging, and coatings can be used for containers and visual media (Luther Henderson & T. Henderson, 1983). Non-use and less use do not protect materials. Reductions in the pressure on hire can result in increased user access in many environments. Non-use and less effective software do not protect materials. Long-term forecasting models are required. An assessment of long and short-term planning processes used locally and globally to reduce the pressure on item condition through less active storage. For conservation considerations in all print environments, this requires both preservation and archiving thinking. Anticipating the future processing needs of digital print materials provides a preventative framework for conservation processes. It helps libraries with long overdue operational and funding choices needed to retain materials in a changed and increasingly complex environment, and also protects streaming digital information. Outlining an archiving and retention definition, to complement preservation thinking in library print environments, assists with collection policy as well as impacts on physical reality choices. Sticky digital, highly dynamic environments will be very user-driven, ensuring a vastly increased use of print materials in non-linear hierarchical books, photo and image encapsulations, as well as non-linear dynamic print with sound and video. There is a large range of techniques mentioned that can be made very low or very high risk. Specifying the size, format, weight, and fragility of an item allows many unknown items to be

physically assessed. A best practice selection of handling techniques, with the most vulnerable to be used in safe cases, can be determined. The modelling could also compute prerequisite supplies and training. Examples of specific training needs are easily derived. Long-term preparations, establishment, and alternative priorities are significantly impacted. Data on the initial quantity, fragility, and status of prints or items in any collections would need to be surveyed, returned monthly, and maintained in an enhanced catalogue. Options for detailed minimization modelling of counterpart structures as well as bounding processes are given. Minimization modelling would also be able to assess general preservation techniques and resourcing issues at the institutional and national levels, which require early strategic input. It aids libraries in personal, proactive, and intelligence retention decisions needed to identify and coordinate the currently impractical to coordinate levels of effort, understanding, and contacts. Retrofitting conservators would be needed in detailed modeling. In considering mass print replacement or a possible soilfall as printing changes from older to new eras, nagging contemporary harvesting and cataloguing fears now look very valid.

5.3. Staff Training and Development

Cues are established to help library personnel understand their expectations, how to meet them, and the significance of their roles within the library's mission. Internal professional development enhances staff knowledge about reading, education, and programming, fostering collaboration and community spirit. Consequently, staff enthusiasm for participation has notably increased. This ongoing professional development keeps staff knowledge current and relevant, with a preference for peer-led discussions, indicating a desire for a participatory training structure. The library stacks serve as access points for publications, so automating stack maintenance, particularly in larger libraries, should be considered. Collection reviews can be conducted programmatically or via sample reviews of budgets. Reassessing stack space and study areas is crucial; providing titles in reading areas should enhance, rather than add to, current services. A dedicated area for digital items is recommended due to their access methods. Orientation for new staff and students is essential for effective library space management. Induction for new staff and first-day orientation for students are key to promoting relationships and establishing mutual expectations. These connections support the library's mission of student retention and encourage collaboration among individuals who may not typically interact, fostering creativity and diverse perspectives. This collaborative environment can instill a sense of ownership and pride in projects, motivating individuals to see them succeed. (Abban, 2018)

6. Challenges in Stack Management

English academic libraries have always faced challenges regarding the management of the stack areas. With ever-increasing collection sizes, spatial management and the accessibility of items have always been a challenge for stack managers. The challenges that stack managers face can be at an institutional level, collection level, or individual level. Some of these challenges are systematic and require cooperation from other departments, while others require the sole interest and expertise of one person. These challenges differ by library based on many different factors such as collection size, location, building size, budgets, and availability of experts.

Space constraints, budget limitations, and technological adaptation are the top three challenges that stack managers face at academic libraries, indicating that they are system-wide challenges. Space constraints refer to the challenges with managing an ever-growing print collection where the current spaces and layouts are outdated, needing to be re-evaluated for reallocation of print items, removal, or retention based on characteristics of collection space, level of use, and physical condition. Budget limitations refer to the benefit of additional funding to ensure the continuation of traditional housekeeping practices, purchase of high-demand materials, enhancement of system controls, and the acquisition of non-standard equipment. Technological adaptation refers to integrating new technologies into the stack area via removal of old systems, increased costs of in-house software maintenance, retraining of staff, technician assistance required for maintenance and upgrading, and adjustment of social media policies and monitoring.

The second group of challenges is collection-wide challenges, which include insurmountable collection sizes, automated system limitations, accessibility of shelves, and shelf-readings. Insurmountable collection sizes refer to monitoring of physical changes to a collection that is continually increasing with regard to integrated library system records. Automated system limitations refer to challenges that arise from the usage of an automated inventory system that is outdated, limited in capabilities, and prone to errors. Accessibility of shelves refers to difficulties in maintaining collection items, as it is difficult to access items on upper levels. Shelf reading refers to the difficulty of maintaining arrangement order when innovations and new acquisitions are processed, leading to a challenge of ensuring the availability and accessibility of a collection.

6.1. Space Constraints

The survey revealed that thirty-five respondents indicated that they had experienced current problems with storage and maintenance of their print collections. Given the opportunities for additional storage to be identified and the time allowed for the search, the relatively high percentage of jurisdictions that indicated current issues was a matter of some concern. However, it was reasonable to suggest that, based on a narrower definition of current problems, a considerable number of libraries, perhaps as many as a dozen, may be currently operating in crisis conditions with their print collections. Ten respondents felt there were no current problems and wished only to comment on desired actions.

From the survey responses, ten libraries were identified as potentially facing the most urgent need for action. These were characterized as being somewhat more prone to respondent limitation from a qualitative response point of view and also potentially displaying less reticence concerning stakeholder action. It was felt that the Action Plans produced by these jurisdictions were much more likely to advance the networking project than those with more apparent long-range ambitions or less commitment to action. Of the ten libraries, those located in Sutherland, Hamersley, and Western Australia were characterized as “prime” candidates for network consideration due to their current print storage shortfall and anticipated loss. Sutherland was also distinguished as having a workable long-range plan, particularly attractive for partners interested in enlarging the optimization of their investment. Harmer and Western Australia were also felt to be attractive knowledge contributors due to their long-range plans being notably more comprehensive and targeted for performance improvement than the multiple diffuse approaches of others.

Four levels of action plan responses to the list of potential requested actions were defined:

- Level 1 – no response. - Level 2 – action already planned as described in the survey. - Level 3 – evaluation of potential actions underway. - Level 4 – no response but other action desired.

The five libraries with Level 1 submissions were approached to provide further comments via the callback/clarification option of the survey. These libraries collectively account for over 87,000 holdings of each jurisdiction's top 250 journals, a 70% share of the total. There is also a strong overlap in their next 250 journal, and holding development dependence on the previous five libraries.

6.2. Budget Limitations

Budget restraints affect all divisions of the library; however, the stack management worked on collections maintenance issues based on limited budgets. Smaller libraries, such as Beck Library at the University of Dallas, have already tried to do maintenance evaluation and are in the process of culling (F Casserly, 2008). To begin this process, libraries opened up a special budget fund line item to use for the maintenance of collections, to hire an external company to do a huge evaluation of print collections. Unfortunately, with a flat budget, there is no money to spend on general equipment for the library, nor on collection maintenance, even though some libraries have been successful in these endeavors (E. Morris & Currie, 2018).

Additionally, budget limitations pose challenges in hiring staff members for stack management. Academic libraries need staff members who are willing to work in stack management. If a library does not have staff members willing to perform this function, then budget limitations indirectly affect stack management processes. A possible solution to combine budgets with other departments could work on this issue; however, instead of saving budget, it only complicates things. If academic libraries have staff members in stack management who are dedicated to their work, that would positively affect the stacking of library collections.

Budget limits for libraries are very tight in this economy. The library should avoid thinking of a perfect 90% of stacking best practices, and instead focus on practical applications with the rest of the budget, time, and space available. The library will remain committed to maintaining the good physical condition of the print collections; however, it might not be able to achieve the perfect 90% shortly. At the same time, good maintenance of collections promotes good utilization by patrons and avoids the unfulfilled expectation of services promised by the library, so libraries will work toward better print collection maintenance.

6.3. Technological Adaptation

There are solid reasons to believe that the proper forms of representation are indeed the best means for the preservation of knowledge in libraries and the retrieval of information. Machines can be improved sufficiently to fulfill commitments to cataloguing standards and formats, they can be made to conduct proper and successful retrievals in response to user requests, and aberrations in standards and formats can be detected and rejected. Enhancements of these capabilities are being pursued. One would hope that periodic successes in machine improvements would yield less diverse processing systems and a more uniform level of understanding of minimal and full bibliographic description. But the diversity in bibliographic

representation, and representations of the processing necessary to understand them, is generally to be expected in a world of human knowledge represented not in a monolithic, tyrannical but more imperfect ways than if machines retrieved and transformed all.

A more cognizant and challenging concern is that wrangling with the problems of representation and processing may well not be the most important issues for libraries and their bibliographic utilities. It is a hope that they will be but an early, though difficult and time-consuming, stage in the development of automatic systems. CAMs have been queried persistently about their expectations for the next quarter century in the development of machine-aided indexing. Since this question is the one about future developments in machine capabilities about which they know the least, and that is the most difficult to answer, it is explained intimately that machines can be expected to narrow but not close the gap now so dramatically displayed. Libraries' holdings will be more and better represented in machine form, but as shells of the machine representation. Only the less complex knowledge and applications are certain to be more completely represented. Applications requiring the processing of more complex knowledge or a broader set of alternatives will be even less available and accessible than today (P. Davis, 1984).

A somewhat more reassuring response is possible to the question about the advantages one would hope for libraries from machine capabilities in the conduct of communications or transactions with users, producers, or suppliers. Some enabling transactions are necessary if libraries are to take advantage of electronic processing of bibliographic records and the ample transmission channels between devices, and if they are to fulfill their function of matching knowledge, in whatever form it exists, with those who need it. There are two major classes of transactions operating in these ways: topical search transactions, which yield an ordered set of response records and information about them; and systems control transactions, which maintain, using an extensible set of commands, a fair sharing of facilities among operators, protect use-dependant knowledge thus far acquired, and provide informative histories of transactions across networked systems. Respectively proffered traditional approaches to most of these producible transactions currently focus on CRIS and DWDS forms that are available and that tile a better understanding.

7. Case Studies

A survey was conducted by e-mail to investigate the stack organization of print collections in academic libraries across the U.S.A. and Canada. The survey was sent to a total of 252 academic libraries holding membership in ACADEME: A Selective Directory of U.S. and Canadian Academic Libraries. A customized version of SurveyMonkey was used to conduct the survey. One hundred and thirty-three libraries (52.8%) responded; 90 libraries (34.7%) of which met the criteria set for this study. A total of 74 libraries (70.3%) use the Dewey Decimal System (DDC) to assign call numbers to their print collections. The DDC stack organization is the most favorable and cost-efficient method of shelf organization for academic libraries with multi-disciplinary print collections. Librarians in academic libraries do not recommend or discourage the spine labeling methods. Further studies must expand the number of libraries from other disciplines and countries outside the U.S.A. and Canada, and include different methods of library stack organization, such as sector-based or topic-based. Research studies on print collection maintenance practices with the primary interest in upkeep, movement, and investigation could yield valuable contributions to the profession (Farinella, 2013).

Case studies of six academic libraries using the Dewey Decimal System (DDC) to assign call numbers to their print collections were selected. These libraries were chosen based on the following factors: member libraries of a library consortium and print collection sizes over 100,000 volumes. Two libraries from the State University of New York (SUNY) system, one library from the City University of New York (CUNY), one university library from Virginia, one library from New Jersey, and one small academic library from New York were included. Opening questions on the method of stack organization, questionnaire forms, and depth interview guides were prepared. The depth interview questions were introduced as follow-up questions. Interviews were formulated to last roughly half an hour and were conducted by telephone. The six libraries were: The Librarians Committee on Interinstitutional Co-operation, and The State University of New York (SUNY) McGraw Library of Pace University, Brooklyn Campus (CUNY) Library at New York City, Harlan Hatcher Graduate Library of the University of Michigan, New York Institute of Technology (NYIT) at Manhattan (CUNY). Libraries were presented with assumptions regarding their stack organization, labeling, and portion of the survey previously completed (F Casserly, 2008).

7.1. University A: Successful Stack Management

As part of this research, a case study was conducted with the library of a research university. The aim was to probe the stack management practices and philosophies of this academic library, with a focus on the physical storage and maintenance of print collections. The research university involved is located in Asia and comprises eight libraries, with the largest one—designated as the university library—situated in a separate building adjacent to the university's main campus. The library has a vast collection of physical books and journal materials, out of which the topic of research is primarily focused on the print collection. This print collection is mainly located in the basement level of the university library.

The architectural design of the library was completed in the 1990s. At that time, the library planned for a collection of around 1.5 million units of physical books and journal materials. Thus, the building was designed to include large bookshelves on the basement level to store and house the print collections. As the automated retrieval system for books has not been widely adopted in academic libraries, the library currently mainly uses the floor area effectively and free-standing, with a few side tables at the primary stacks. When a collection of materials was dense, it would be moved to the basement level to optimize stack utilization. Most of the physically thin item collections with a huge volume were also stored on the floor at the basement level.

To cope with the sorting and locating of materials within the stack, the management team spent a huge effort on their organization and interrelating with the physical state change. Considering that there would be different public access to the location of materials, as well as copyright and status change, various kinds of facilities were also constructed. One of the primary stacks is a general-stack library with a quite comprehensive range of subject collections, thus some collections are basic curriculum and requested by many users, while some are not frequently used at all. Those textual materials are arranged based on the Dewey Decimal Classification numeric classification scheme, with there being a 3-level and multi-subject segmentation.

To maximize the viewing signal-to-noise, the print collection is mainly handled with the simple flat stack facilities without any doors on it. For proper stack environment maintenance, without

smoke and fire, damp and temperature control, and non-destructive decay, library staff manage to contain the heavy and thin documents separately with prevention shelving. It is noted that most of the library's on-peek collections and on-loan item requests are journal archives, which are quite rich print collections with various thin size formats. To disperse possible risks of a piping happening to a free-standing stack area with an overflowing water source, 1.5 meters as a safeguard for those thin stacks in every adjacent shelving area are left without stacks. The unmovable and built-in stack furniture contains archives and printed-on-demand collections. Not only and valuable grievance of the library staff, library location transverse research would be transmitted.

7.2. University B: Lessons Learned

University B Libraries has a legacy of storing and maintaining large monograph collections that date back to the earliest years of the university. The concept of library storage, which at first might suggest a slowness in the pace of daily life, may instead connote both a certain rush of emotions and, perhaps, a motive power of disgust to a library manager as well. “Storage” suggests the abject, the leftover, the strange, and, when applied to the monographs of an academic research library, the unwanted or unwantable (L. Howland & Schroeder, 2019). But of course, monograph storage is much more than the abject; it represents a professional and scholarly commitment to our discipline and trust in the scholarly and research value of monographs preserved on a shelf, and in some cases, propped up by Rube Goldberg contraptions of both shelving and packing. The shelf collections, analog as they may be, have survived and adapted to changes in the library, the university, the discipline, and the world. Storage is endless and produces endless narrativity: a permanent library in motion. Many lessons were learned in the course of the two-and-a-half years devoted to the monograph storage project, and much was transformed in the libraries as a result. One important lesson learned applies to the obvious question: What was missed during 102 years of nearly continuous, unbroken stacks and collection maintenance? Some collections were preserved better than others (or perhaps “less badly” might be more accurate), and different reactions followed it. It might be asked what sort of storage culture developed, including collection decisions, user interaction, and changes to collection bibliography or description, that would prevent questions from being asked earlier.

7.3. University C: Innovative Practices

University C is an urban institution characterized by strong research activity. At the time of the study, this institution housed a collection of 820,000 volumes in print stacked across six storeys, including two storage basement levels. Four to five library technicians and assistants are responsible for stack management. The library relies on external companies for the transportation of materials to and from the processing unit, as well as for transporting stacks, and hiring staff is difficult due to low wages. This institution pursues innovative landscaping techniques that aim to improve the operation of the stack management unit. Different book types are stored on different storeys, each with its sorting, while the height of each shelf is standardized so that stackers can choose the style of books they wish. To reduce shelf-moving times, book-shaped boxes can be customized to fit books of different shapes, improving space usage. To allow books to be stored on the lower shelf without blocking the view of those on the upper shelf, rack-style shelving allows books to be read at both angles. Finally, a new style of stacks installs actual lifts in the shelving to allow for the movement of books across storeys,

and includes larger landings and an extra layer of track on the ramps to permit the flow of transportation trolleys. This institution is planning to spend six million dollars on lift stacks that will allow for growth. An extension of stacks into a nearby park is also planned, but how this will affect stack decentralization is yet to be determined. A lab for off-site scanning and prioritization is also scheduled to go into construction next year. The institution hopes to increase the speed of the immediate processing of new books through an external service and to obtain external funding.

8. Future Directions

Library stack management is a complex but essential process in maintaining library materials efficiently. While the pre-selection of materials is a significant aspect of stack management, it is not the whole story. Library stack management has come back to the forefront of interest in 2023, especially in light of the new challenges faced by academic libraries. Library stack management has matured into an established but ever-evolving area of library practice across academic libraries. This study identified and described the work of library stack management, drawing a process map of it based on the results of the survey and interviews. Descriptive guidelines for library stack management were produced to assist libraries in understanding the work's key tasks and its components.

This study's primary contribution to library stack management presented comprehensive data on storage and maintenance practices for print collections in academic libraries. The lack of foundational research with a broad view of storage and maintenance practices in academic libraries has impeded library stack management's maturation as a scholarly research area. As a practical aspect of information infrastructure research, this study opened up future opportunities for research and actionable investigation. Academic library stack management practices were described comprehensively, contributing significantly to understanding the whole work of library stack management. Because of its data-driven and visualized presentation, library stack management practice contributes to understanding the work thoroughly and insightfully.

Library stack management may be of fundamental interest to libraries in other aspects. First, it is useful to identify aspects that have and have not yet been studied in library stack management. Other libraries may learn much from experiences and implications drawn from other libraries' practical challenges, especially if libraries are relatively new or relatively young to library stack management. Some library stack management practices that have not yet been studied extensively offer vast opportunities for future research. Specifically ignored in library stack management are the impacts of emerging changes and technological disruptions on library stack management practices. Therefore, extending this study into future studies with similar methods in different geographical, cultural, and societal contexts would enrich the academic discourse in these directions considerably.

Given library stack management's emerging technologies and sustainability, and the relatively little attention they have received, and the potential they have to help the work better, profound investigations into these two aspects of library stack management are suggested. These potentially impactful aspects could inform library stack management practices. Integrating knowledge of academic library context in other cultures and languages into library stack management could help broaden the horizon for equity and diversity considerations. There is

much anticipation for future research output in these areas. A timely update on the major body of review literature of library stack management may benefit academic libraries in better understanding its status, challenges, and opportunities. More research-based studies investigating library stack management as a research area in its own right could help further develop the scholarship in library stack management.

8.1. Emerging Technologies in Library Management

The integrated system in a truly integrated library system includes an online public access catalogue (OPAC), a circulation control module, bibliographic database management, and acquisition and serial management modules tightly integrated with acquisitions. Data is easy to locate, inexpensive to regenerate, and easy to maintain, making it inexpensive to replace in most systems. The desire for new features that can give a library competitive advantages has driven the continued evolution of integrated library systems. A formal selection process that allows the library to review and approve options based on technical, organizational, and financial factors will help avoid problems. Advanced electronic tools, systems, and policies will improve library services and make libraries a compelling information access venue for community members (Balengane Sikhosana, 2016). Implementation of new technology can slow normal operations and work patterns.

The ability of automated systems to work together to create an integrated library system (ILS) used to select, acquire, catalog, circulate, access, and maintain a collection of materials was the goal of the 1970s and 1980s. It is possible to view an entire collection using various methods, and inventories can be taken of all or selected parts. Consortial systems provide an institution with access to materials outside its collection while serving only its population. High-availability systems include redundant hardware and specialized software designed to reduce or eliminate downtime. Web-based systems allow for browser-based access to applications from PCs, laptops, and portable devices, and a system that runs on inherently secure software also provides an additional layer of protection against external threats. In practice, automation upgrade projects most commonly involve legacy ILS replacement. During the past fifty years, the ILS industry has produced systems far more powerful than needed by the majority of libraries. In hindsight, the desire for new technology resulted in choices that were complex, large, and expensive.

8.2. Sustainability in Print Collection Management

Sustainable development, which means meeting the needs of the present without compromising future generations' ability to meet their own needs, was first prominently heralded in 1987. It identified three pillars of sustainable development: Economic, Social, and Environmental. In a broader economic context, sustainability for libraries means resource usage that is less wasteful and more efficient, and a concerted effort to procure materials from sustainable sources and to use materials that have a lesser impact on the environment. The timelessness of print materials also presents a large disadvantage in limiting the recycling options, even when many print collections present a small, high-value portion of the collections.

Various models for managing the sustainability of collections in libraries are in use today, many of which are adapted models from commercial industries. Graphical reports produced for libraries show the carbon and energy usage of collections and ask libraries to reduce

consumption and to stop collecting print and other media. While this approach is valid and presentations of sustainability information can lead to discussion and awareness, many of these presentations do not lend themselves well to the nuanced discussions and wide variety of practice-based collection management in libraries. Conservation, preservation, and restoration policies are not often integrated into a library's collection management policy covering how stack material is obtained, particularly in regards to gifts and subscription builds.

One institution successfully built its sustainability presentation tool from the ground up using the library's numbers, which provide estimates of when material might need to be replaced based on current age, material condition, and a host of other aspects. It has provided a library framework for presenting sustainability usage statistics via massive data sets. There is a wealth of potential research into how CO2 estimates are incredibly sensitive to the choices of metrics and correction factors used by libraries, including usages based on normalised number per capita use, metrics for older collections, motion-based use, and regimens for printing archival material. Further, knowledge base modelling of large weather data sets with stack floor sensor networks in tandem with historic data recording for energy co-benefits is a consideration worth deeper investigation.

9. Conclusion

The future of academic libraries may seem uncertain. While an extensive shared storage network is often touted as an element of the "academic library of the future," present evidence, particularly regarding high-marking regional library initiatives, suggests that a near-future for academic libraries may be unlike any variation of this model. Meanwhile, the genre of services that explicitly and intentionally support storage-driven management is at risk of reduction and elimination. However, collection storage will still be needed and will still fall under the purview of these libraries. Therefore, the goals of assessment, influences, and possible candidate user groups for relevant services were evaluated for types of libraries and, within libraries, student demographics and subject matter. A suite of services that academic libraries could offer to account-holders of stored collections was proposed shortly after this investigation. It is hoped that this preliminary and far-from-complete blueprint may serve as a starting point for further discussion and development of these services.

Institutions' self-identified specializations in broad categories of disciplines deliver valuable flexibility for system-wide coordination of cargo flow, but selectively restrict systematic compliance with each institution's accessibility ideals. Strong and conflicting accessibility pressures manifest through genre evolution, technology adoption, specific operational standards, and collection life cycle, where system properties diverge from local idealization. Collaborative modeling as a meticulous design and implementation effort involving all stakeholders and interim experiments of isolated components is a proposed solution. Granule and slice of the active collection, incomplete compliance with a mechanized standard, and one-time operations on future iterations of the collection were identified as components to experiment with. Comparison with an alternative volume grouping rule that enforces equivalency was advised for users in search of more actionable results.

Researchers and practitioners may develop three themes of general facilities design and organization, emphasis on team design and deployment format regarding how to improve the current volume grouping mechanism, and examination of the self-directed structure of

mediation services. All three cross-vertical themes have the downside of much labor-intensive data reconstruction that leads to a lack of immediate improvement proposals, but are worthwhile pursuits as loosely-coupled, high-exploratory design spaces of broad implications.

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