

Digital Scholarship Services at Universities an Investigation of Academic Library Websites

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Abstract-In the context of digital transformation, academic libraries is offering digital scholarship services to support various academic activities. To investigate digital scholarship services being currently implemented in academic libraries around the world, this study analyzed the website content of nine academic libraries in Australia, Canada, China, Singapore and the United States. The study's results help identify the functions, support areas and service types of current digital scholarship services. The functions of digital scholarship services are explored, comprising (1) supporting digital project management, (2) supporting digital data, (3) supporting digital methods and tools, (4) supporting digital sharing and publishing, (5) supporting digital scholarship connections. Based on these functions, the study identifies the following key support areas of digital scholarship services: (1) project management, (2) research grant, (3) copyright and licensing, (4) data management, (5) data curation, (6) digital scholarship information technology infrastructure, (7) digital and open publishing, (8) digital scholarship connections. The types of digital scholarship services are also recognized: (1) consulting, (2) teaching and training, (3) providing digital resources including information technology infrastructure, digital and physical spaces, and information resources, (4) promotion event services, (5) connection assistance, (6) technology assistance, (7) implementation assistance.

Keywords: Digital Scholarship, Library Services, Academic Library, Website Analysis.

Introduction

In the context of digital transformation, the application of digital technologies to teaching, learning and research activities is becoming increasingly popular. Many academic libraries around the world have established digital scholarship services (DSS) to support academic communities (Li et al. 2), particularly in the context of the Covid-19 pandemic (Baxter et al. 3). Although many academic libraries have provided services on digital information resources, DSS is still relatively new in Vietnam's universities (Nguyen and Ngo 17). In an effort to promote Vietnamese universities to implement activities for digital scholarship development, a research proposal titled Developing a digital scholarship service model for universities at Vietnam National University Ho Chi Minh City (VNU-HCMC) was approved to conduct from 2020 to 2022. This research project aims to provide a guiding model for establishing DSS system at VNU-HCMC, expecting to be a supporting solution in order to build digital universities, to support digital transformation at the universities, and to overcome challenges during the crisis. This paper is part of the above project. Analyzing the content of the academic libraries' websites is the chosen approach to identify the practical experience on several aspects related to DSS. This method helps update knowledge of DSS in a comprehensive and timely manner, reflecting the practices of daily DSS operation and provision at academic libraries. Nevertheless, studies broadly analyzing DSS based on academic libraries' website content are not popular. Therefore, this paper aims:

- To examine the content of the selected academic libraries' websites around the world through which provide DSS;
- Based on the results of the analysis, to propose a DSS model related to the functions, support areas and service types.
- The result of this paper provides a component for building the theoretical framework of the lager research project as mentioned above.

Background

In the digital environment, universities need to deliver greater in number and more varied information services to the academic community through digital and networked channels in order to meet the ongoing changes of academic activities (Zhifang and Huifang 2). This results in a transformation in the support areas and types of library services. However, "the provision of DSS is not completely different from traditional library services" (Zhou et al. 109). In fact, DSS is an extension of support areas and the application of technologies at a higher and more comprehensive level than research support services. By leveraging the benefits of technology, libraries support academic activities in new ways that create shared spaces, both physical and virtual, for exploratory purposes of the academic community.

Previous studies have helped identify the support areas and service types of DSS. A literature review by Zhou et al. (113) synthesized 25 DSS, which were grouped in six themes: supporting services, formulating research ideas, locating research partners, writing proposals, conducting research and publishing results, under two main categories: (1) digital scholarship support services, and (2) DSS for a research lifecycle. Using Zhou et al.'s DSS model (120) as the core combined with previous studies, the support areas and service types of DSS are synthesized as shown in Table 1.

Table 1: Support Areas and Service Types of Digital Scholarship Services

DSS-Supporting Services	
<ol style="list-style-type: none"> 1. Consulting service (Hurrell 8; Li et al. 9; Zhou et al. 120). 2. Providing information technology (IT) infrastructure (Li et al. 6; Zhifang and Huifang 5; Zhou et al. 120). 3. Teaching and training services (Hannah et al. 711; Li et al. 9; Zhifang and Huifang 5; Zhou et al. 120). 4. Digital and physical spaces (Hurrell 8; Zhifang and Huifang 5). 	
DSS-Specific Services along the research lifecycle	
Formulating research ideas	<ol style="list-style-type: none"> 1. Developing research hypothesis or research questions (Zhou et al. 120). 2. Finding information resources for research projects (Zhou et al. 120). 3. Providing bibliometric and altmetric services (Craft 66; Zhou et al. 120).
Finding research partners	<ol style="list-style-type: none"> 1. Identifying potential collaborators (Zhou et al. 120). 2. Contacting potential research partners (Zhou et al. 120). 3. Recruiting members for research teams (Zhou et al. 120). 4. Building project partner relationships (Hurrell 7; Lippincott and Goldenberg-Hart 3).
Writing research proposals	<ol style="list-style-type: none"> 1. Seeking grant funding (Lippincott and Goldenberg-Hart 5; Zhou et al. 120). 2. Supporting grant proposal development (Zhou et al. 120). 3. Supporting project planning (Zhou et al. 120). 4. Supporting data management planning (Zhou et al. 120).
Conducting research	<ol style="list-style-type: none"> 1. Consulting digital technologies (Hurrell 11; Lippincott and Goldenberg-Hart 5; Wang Z. and Wang X. 10). 2. Managing digital projects (Lippincott and Goldenberg-Hart 4; Zhou et al. 120). 3. Developing digital tools or software (Hannah et al. 713; Zhifang and Huifang 5). 4. Managing data: discover, collect, process, analyze, organize, present data (Craft 68; Hannah et al. 713; Lippincott and Goldenberg-Hart 9; Wang Z. and Wang X. 6; Yoon and Schultz 931; Zhifang and Huifang 5; Zhou et al. 120). 5. Digitization and preservation (Craft 68; Wang Z. and Wang X. 6; Zhou et al. 120). 6. Intellectual property, open access, research ethics (Craft 68; Lippincott and Goldenberg-Hart 5). 7. Embedded research services (Wang Z. and Wang X. 8; Zhou et al. 120).
Publishing support	<ol style="list-style-type: none"> 1. Providing publication guidelines (Craft 68; Zhou et al. 120). 2. Digital and open publishing (Craft 68; Zhou et al. 120). 3. Providing advice on copyright and fair use (Zhou et al. 120). 4. Digital repositories (Wang Z. and Wang X. 6; Zhou et al. 120). 5. Building digital collections and exhibitions (Craft 68). 6. Research dissemination (Ciro and Bowker 630; Zhifang and Huifang 5; Zhou et al. 120). 7. Research impact measurement (Zhou et al. 120). 8. Supporting development and management of media contents: Audio, video and website formats (Craft 68).

Through literature review, it is noticed that the main types of services comprise a provision of IT infrastructure, digital and physical space for developing collaborations in research, teaching and training services, and consulting services. These supports act as a catalyst for the fusion of traditional forms of research and teaching with the application of modern technologies in order to test models and generate new knowledge in the context of multidisciplinary collaboration, especially in the humanities and social sciences (Wang Z. and Wang X. 11).

In addition, support areas are based on the research lifecycle. The provision of DSS is considered an innovative and more effective approach, allowing libraries to proactively reform their old structure, change the way they manage and provide new services in addition to the provision of user-centered academic support services (Zhou et al. 121). DSS is developed more comprehensively and meets the needs of the academic community more systematically than traditional research support services, research data management services, digital library services and subjects' support services (Zhou et al. 109). In other words, DSS can include all of the traditional services mentioned above.

DSS studies are conducted using various research methods such as website content analysis (e.g., Ciro and Bowker, 2020; Isuster and Greene, 2020; Nagpal, 2021; Yoon and Schultz, 2017; Zhifang and Huifang, 2018), systematic review (e.g., Zhou et al., 2019), survey (e.g., Hurrell, 2019). In general, previous studies have mainly focused on the support areas and service types of DSS.

As for the studies using the website content analysis method, they primarily concentrate on a specific country or geographical region (e.g., Nagpal, 2021); or one aspect of DSS such as scholarly communication (e.g., Ciro and Bowker, 2020), research data management services (e.g., Yoon and Schultz, 2017), and digital scholarship research guidance (e.g., Isuster and Greene, 2020). Although Zhifang and Huifang's (4) work surveyed websites of some countries comprising the United States, Canada and Hong Kong, it mainly focused on the form and content of DSS.

Existing literature has reported the support areas and service types of DSS, yet the compatibility between support areas and service types with DSS functions remained understudied. Thus, this study intended to address this gap.

Methodology

A qualitative research approach using content analysis was chosen for this study to examine academic libraries' websites. According to Bryman (306), documents served as the source of data for content analysis should be authentic, credible, representative and meaningful. The study used the information related to DSS sourced from academic libraries' official websites. The information therefore meets the predefined quality criteria as described by Bryman above.

Sampling and data collection

Sampling and data collection were divided into three stages as follows:

Stage 1: Two criteria were established to identify appropriate academic libraries' websites: (1) presenting in English; (2) setting up a separate page focusing on DSS. The study began by doing a Google search for "digital scholarship service*" AND "university library*" on February 15, 2021. After flipping through the first 40 results displayed to access the DSS pages of the academic libraries' websites, 28 pages that matched the criteria of the sampling strategy were identified. Of these, 24 were from United States universities; one for each of the following countries: Australia, Canada, China (Hong Kong) and Singapore.

Stage 2: The study selected an academic library website from each country (Australia, Canada, China, Singapore, and United States) to be able to explore the practices of DSS from multiple countries. For the United States, the website that first appeared in Google's search results was chosen. The content of five websites was analyzed to find out the functions, support areas and service types of DSS.

Stage 3: The study continued to analyze the content of the remaining websites of United States' universities. Those which appeared first in the search results were selected. Websites were analyzed continuously until the point of saturation reached, that is, no new information about functions, types and support areas of DSS emerged (Connaway and Powell 214). As a result, nine academic library websites were used as the final sample for this study, comprising University of Melbourne (Australia), University of Toronto (Canada), University of Hong Kong (China), Nan yang Technological University (Singapore), University of Pittsburgh, New York University, University of Oregon, University of South Florida, Northeastern University (United States).

Data analysis

Identifying content for analysis: The study carefully reviewed the library website homepages, subpages and associated pages to identify content related to functions, service types and support areas of DSS. The related text from the websites was copied into a Word (Microsoft Office) document to generate a data set describing the DSS system of each library.

Analyzing data: The three categories for content analysis were identified prior to the analysis, comprising functions, service types and support areas of DSS. The study then performed a thematic content analysis of the qualitative data following the process suggested by Bryman (578).

Identifying the functions of DSS: The data, which was mainly extracted from the DSS introductions of the websites, was read carefully at first. The study then performed the coding of the data reflecting the functions of DSS. The functions of DSS were defined based on the aggregation of nine libraries' data.

Identifying the service types and support areas of DSS: The functions of DSS that emerged from the analysis were used to establish the main themes of the service types and support areas of DSS. Data collected from academic library websites to describe each digital scholarship service was carefully read, followed by generating codes that reflected the specific types and areas of each supporting activity. The service types corresponding to the support areas were identified by grouping together data analysis results of nine libraries.

Results and Discussion

Functions of digital scholarship services

The results of the nine academic libraries' websites analysis show that supporting the full lifecycle of digital scholarship is an overarching function of DSS. A range of services have been built to meet the diverse needs of the academic community in the digital scholarship landscape. Based on the content analysis of the DSS homepages' service introduction and description,

Five particular functions of DSS are identified: (1) support digital project management, (2) support digital data, (3) support digital methods and tools, (4) support digital sharing and publishing, and (5) support digital scholarship connections (Table 2).

Table 2: Functions of Digital Scholarship Services

Functions	Examples of statements in DSS homepages
Overarching function	<ol style="list-style-type: none"> 1. Support the full life-cycle of digital scholarship, from initial planning to long-term curation (Northeastern University). 2. Help researchers move their work through the various stages of the research lifecycle (University of South Florida).
1.Support digital project management	<ol style="list-style-type: none"> 1. Support from designing a digital humanities project to making a data management plan for a grant application (University of Pittsburgh). 2. From designing a digital humanities project to making a data management plan for a grant application (University of South Florida).
2.Support digital data	<ol style="list-style-type: none"> 1. DSS is a front-end to the library's resources, expertise, and services in support of a broad range of digital and data-intensive scholarly activities (University of Pittsburgh). 2. Aims to modernize scholarly practice <i>via</i> digital techniques and by maximizing the value of research data (University of Melbourne). 3. DSS provides digital asset management, digital preservation, training, consultations, instructional design, and tools for digital scholarship, teaching, and learning (University of Oregon).
3.Support digital methods and tools	<ol style="list-style-type: none"> 1. Help faculty and students incorporate digital scholarship tools and methods into their research and teaching (New York University). 2. Support the University faculty and researchers to incorporate digital scholarship tools and methodology into their research (University of Hong Kong). 3. Supports faculty members and students in transforming research and teaching using new media and digital technologies (University of Oregon).
4.Support digital sharing and publishing	<ol style="list-style-type: none"> 1. Share your work with New York University and the world (New York University). 2. DSS will advocate for author rights and promote scholarly publishing literacy. Partner with faculty to present their research online and preserve their work through our repository systems. (University of South Florida).
5.Support digital scholarship connections	<ol style="list-style-type: none"> 1. Find collaborators, services, and software (New York University). 2. Data Champions are connected to central support and infrastructure for research data management, and are supported in building their own local communities of practice (University of Melbourne).

In the DSS introduction of all surveyed library websites, supporting digital data and supporting digital methods and tools are specified as the functions of DSS. The most obvious difference between the traditional and the digital scholarship is in the use of digital methods and tools during the process of working with data; therefore, in the digital context, the libraries have designed DSS to enhance their support to the academic community. In terms of research sharing and publishing, academic libraries have provided various forms of supports to users, especially when digital materials have become ubiquitous. The rapid development of digital technology has led to the emergence and increasing use of new ways of presenting and disseminating, sharing and publishing, organizing and storing information in digital scholarship. For that reason, publishing and sharing by digital means is underlined as an important function of DSS.

Supporting connections is also considered a prominent function of DSS. One of the library's inherent services is connecting users with each other and building cooperative relationships with potential internal and external partners. In the context of digital scholarship, this function is particularly taken to the next level by expanding the scope (object and value) of the connection. These results strengthen the view that DSS is more comprehensively developed and more systematically meets user needs than traditional research support services (Zhou et al. 109). It

can be seen that the functions of the DSS system at the surveyed libraries are closely linked with the research process. This reinforces the finding from Zhou et al.'s study (114) of DSS in China's academic libraries, which indicates that modern academic libraries are increasingly focused on providing a service system that supports all activities in each stage of the research process.

Service types and support areas of digital scholarship services

Supporting digital project management: With regard to supporting digital project management, research results find that DSS primarily assists the academic community in (1) dealing with a variety of project management issues including project management methods for planning and implementing digital projects, (2) dealing with grant seeking and grant proposal development, (3) dealing with copyright, licensing and intellectual property issues. These are also the main support areas of DSS with a range of service types such as consulting services, teaching and training services, digital scholarship connections and implementation assistance.

In terms of project management, DSS provides consultancy and guidance on how to manage and execute digital research projects. This service allows libraries to equip users with knowledge of project management methods for planning and implementing digital projects. For example, some of the University of Oregon library's consulting topics are digital project lifecycle management, defining team member roles and responsibilities, budgeting, timelines, project communication planning, outreach and marketing. In training courses or seminars, libraries also discuss some of the issues surrounding project management based on a predefined plan or participant requests. This is evidenced by the list of training topics and schedules found on the websites of the nine libraries. The libraries regularly offer training or workshops in every academic term and on request by users. Some libraries even deliver training at researchers' department or unit upon request as indicated on the website of the University of Hong Kong library and the University of Pittsburgh library. In addition, librarians can connect researchers with experts to gain more in-depth supports on needed issues. In some libraries, librarians can also accompany researchers in performing their tasks, such as help develop project plans, monitor project progress (University of Hong Kong).

For research grant, librarians provide consultancy and guidance on seeking, writing proposal and applying for grant (University of Oregon library), as well as facilitate research process and comply with funding requirements (Northeastern University).

For copyright and licensing support, all the surveyed libraries provide consultancy, guidance and workshops with implications for research, teaching and learning activities. For instance, libraries offer copyright consultancy services in relation to using information resources, publishing and teaching (University of Toronto), using copyrighted materials in thesis (University of South Florida).

Research results show that the digital project management support services currently deployed at the observed libraries are compatible with three groups of services: finding partners for research, writing research proposals and conducting research projects, as described in the study background. This result strengthens the findings of previous studies, such as Lippincott & Goldenberg-Hart (1), Craft (71) and Zhou et al. (119), that academic libraries play an increasingly important role and actively participate in the implementation of digital research projects.

Supporting digital data: As for the function of digital data support, DSS assists researchers in two aspects: data management and data curation. Regarding data management, by consulting, teaching and training, digital scholarship connections and implementation assistance, the nine libraries provide a variety of support, such as on data management plans, standards, documents

and organizations to promote preservation and reuse (Northeastern University); metadata, citation management, file formats for long-term access, file management, data repositories (University of Toronto); data policy, tools, resources, effective process and grant applications (University of Melbourne).

For example, in terms of consulting services, the New York University library provides advice on the entire research data lifecycle, from accessing, analyzing, and developing collections to managing and preserving data. For teaching and training services, the University of Hong Kong library delivers one-hour training sessions on data management planning or data management plan writing with DMTTool. To implementation assistance, the University of South Florida's librarians can work with researchers to write a data management plan, generate appropriate metadata, or perform data validation checks. The University of Melbourne library can assist researchers in collecting and visualizing data from one or more storage sources as well as investigating and examining research information.

Regarding data curation, support services cover virtually all stages of data lifecycle, from collecting, preparing, analyzing and presenting data to preserving and sharing data. There are many similarities between service types of data management and data curation. For example, the University of Toronto library offers advice on a multitude of topics, such as understanding and applying data visualization best practices, editing and cleaning data for visualization, selecting appropriate data for visualization. In terms of teaching and training services, the New York University library offers a wide range of instructional supports on data curation, for example, data visualization with Table, big data, and accessing US census data. The Nan yang Technological University library provides a series of training sessions to assist in the use of presentation tools and sources, such as "Jazzing up your presentation with Prezi", "Picture perfect: Finding and using images for your projects", and designing info graphics with Canva and Piktochart. To assist with data cleaning, the University of Pittsburgh library offers training courses on Open Refine-a powerful tool for cleaning messy tabular data. The University of Hong Kong library helps users create websites and develop platforms for the dissemination of research works and long-term maintenance of their projects. Meanwhile, the University of Toronto library assists users in selecting appropriate statistical methods, interpreting results, and using statistical software.

It should be noted that the libraries have increasingly focused on collaborating with experts, including faculty and researchers in order to strengthen their capacity to support users in managing digital data. Take the University of Oregon library as an example, the library intersects with Digital Scholarship Center through services, resources and experts in serving users; it is in partnership with faculty advisors and multiple stakeholders including the Center of Digital Humanities and New Media and Culture Certificate (a hub for new media scholarship and activities across campus).

In previous researches, the results show that data management is focused from the proposal writing stage until the implementation of the research (Craft 68; Hannah et al. 713; Lippincott & Goldenberg-Hart 9; Wang Z. & Wang X. 7; Zhou et al. 116). The results of this study once again show that digital data management service has received much attention from the surveyed libraries.

Supporting digital methods and tools: With the function of supporting digital methods and tools, the issues concerned with assisting academic community to use and benefit from digital scholarship IT infrastructure are the support areas of DSS. The libraries administer several types of services: consulting, teaching and training, providing digital scholarship IT infrastructure with

equipment, tools and storages as well as information resources, technology assistance or implementation assistance, and connection assistance.

Hannah et al. (713) suggested that, in the process of conducting research, libraries need to develop or provide software and digital tools to support the research process. Drawing from his research, Mehtonen (Section Conclusion) emphasized that a multidimensional library space is absolutely necessary to academic activities.

The data shows that the libraries not only provide physical and virtual spaces, digital scholarship IT infrastructure but also assist researchers in incorporating digital scholarship tools and methods into their research and teaching (as stated in the New York University library's DSS homepage), transforming research and teaching using new media and digital technologies (as indicated in the University of Oregon library's DSS homepage), and modernizing scholarly practice *via* digital techniques and by maximizing the value of research data (as specified in the University of Melbourne library's DSS homepage).

The nine libraries provide venues for digital scholarship practices under different names: Data Forensics Lab (University of Melbourne), Information Commons, Reference Area Computer, MAD lab and UX lab (University of Toronto), Digital Scholarship Lab (University of Hong Kong), Workstation (Nan yang Technological University), Digital Stewardship Lab and Digital Scholarship Computer Lab (University of Pittsburgh), Research Workspace (New York University), Digital Scholarship Common (Northeastern University), Digital Scholarship Spaces and Labs (University of Oregon), and Digital Media Commons (University of South Florida). The naming of the venues seems to reflect that the libraries arrange a place for the academic community to work with data during their research process, not just a place they visit when having a need for information or for particular support. In these venues, the academic community can use the facilities, including specialized information systems, geographic information systems (GIS), specialized equipment, hardware, software or tools to work with research data. The libraries also provide digital and spatial archives and repositories. For instance, the New York University library provides centrally-housed storage that can be mounted locally, enabling users to access and share large data sets from desktops and lab workstations. In addition, providing information resources is a traditional function and is implicitly considered the core type of library services. In terms of DSS, the libraries provide different types of information resources on digital scholarship issues, for example, Nan yang Technological University library's Lib Guides on a variety of topics relating digital scholarship, books and blogs.

In regard to technology assistance or implementation assistance, librarians help with equipment and tools or other technical assistance when required. The libraries also connect users to relevant departments or experts for further support, for example, the University of Pittsburgh library can connect users with other services, such as The Center for Research Computing, The Qualitative Data Analysis Program or the Western Pennsylvania Regional Data Center at The Center for Social & Urban Research; or suggest more appropriate and effective software and tools, for example the University of New York library's consulting services can provide guidance on selecting an appropriate tool for users' task as well as locate further resources.

Supporting digital sharing and publishing: To support digital sharing and publishing, the investigation notes that the issues relating with digital and open publishing, such as Open Educational Resources (OER), online journals and institutional repositories, are the support areas of DSS. The libraries use consulting services, teaching and training services, and

implementation assistance to facilitate researchers to disseminate their research by various digital means.

The libraries offer consulting help on diversity issues concerning copyright, licensing, publishing procedures and platforms in order to assist the process of sharing and publishing. For example, some of the consultant topics provided by the University of Toronto library and New York University library are publishing policies, copyright and intellectual property, open data commons and creative commons license or publishing agreements. The University of Oregon library's digital consulting services can help researchers in creating a peer-reviewed open access journal, a digital non-peer reviewed publication, digital books.

In addition to consulting services, the nine libraries offer training and workshops on diverse issues, such as using digital publishing platforms and tools, creating websites or digital exhibitions and building personalized digital libraries.

DSS takes advantage of using institutional repositories, open access sources or platforms to assist academic communities in disseminating and sharing their digital research. For instance, the Northeastern University library's digital repository services facilitate users to store, access and share digital materials. As for the University of Hong Kong library, technology support services can help researchers in creating websites and developing platforms for the dissemination of research works and long-term maintenance of their projects.

The libraries also assist researchers in publishing their works in academic journals. For example, the Nan yang Technological University library provides advisory on scholarly publishing, such as which journals to publish in, content hosting, DOI minting for papers, ISSN registration for journal and peer review.

The above supports can be seen as how the libraries fulfill the mission of DSS, as indicated on the website homepage, that DSS helps the academic community to share their work with the academic community around the world, accordingly enhancing the value of their research. The results of this study are firmly supported by previous research. Prior studies have shown the involvement of academic libraries in supporting the publication of research results, starting from publisher selection stage to research impact evaluation stage (Craft, 68; Zhou et al. 118).

Supporting digital scholarship connections: The need for collaboration in the academic community is increasing due to the interdisciplinary and multidisciplinary nature of much research. Lynch & Carleton (230) indicate that "there is no scholarship without scholarly communication". Libraries therefore have been involved in building a network of partnerships for research projects (Lippincott and Goldenberg-Hart 2) as well as providing collaborative research services (Wang Z. & Wang X. 10; Zhou et al. 115). The surveyed libraries have also implemented these services in practice.

All nine libraries have paid great attention to helping users connect with other stakeholders through different approaches. By providing a digital scholarship space, the libraries facilitate academic communities to meet and interact with each other, thereby having the opportunity to receive advice and to share experiences in the use of digital scholarship methods and tools. This is stated clearly on the websites of some surveyed libraries, for example: "Digital scholarship common ... is a space ... to support members of the Pitt community who are learning and experimenting with digital and data-intensive research and teaching" (University of Pittsburgh). For the same purpose, arranging promotion events and activities, including public talks, seminars, conferences and digital exhibitions, is also a proactive way to support

connections. For example, the Nan yang Technological University library administers Digital Scholarship Tuesday to provide a series of workshops and seminars that take place on Tuesday afternoons during the semester. There are libraries had organized national or international conferences relating to digital scholarship, such as Digital Scholarship Symposium 2017 held by the University of Hong Kong library, or GIS Day 2020 held by the University of Pittsburgh library. Library supports for dissemination and sharing, as mentioned earlier, also help in connecting the academic community.

In order to help user’s access services from any terminal in any place, the libraries become a sort of bridge connecting users with other scholarly centers or networks, experts or units that can provide a higher-level service when needed. Each library has its own approach to support digital scholarship connections. Take the University of Oregon library as an example, the library connects users to resources of Digital Humanities and New Media and Culture Certificate (a Trans disciplinary program focuses on blending scholarly research on new media topics with hands-on experience in creating new media content and using digital research tools). Thus, digital and physical spaces, promotion events and digital scholarship connections are considered service types to support connections. Types of services to dissemination and sharing also contribute to digital scholarship connections. Derived from the findings, this study suggests grouping DSS based on the services’ functions as indicated in Figure 1.

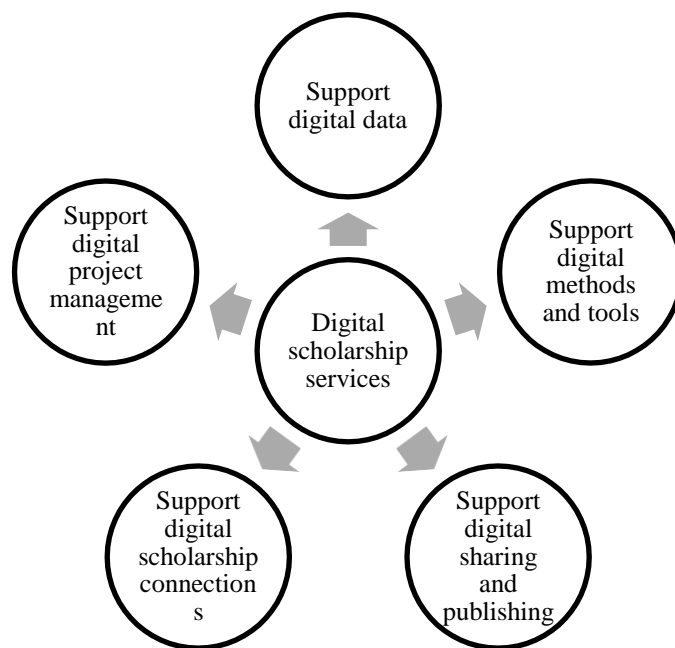


Figure-1: Digital Scholarship Service Groups Based On Their Functions

Conclusion

Through website content analysis, this study demonstrates that academic libraries in many parts of the world are strongly supporting the academic community in the use of digital technology in teaching, learning and research. This shows that academic libraries can take on one of the key roles in the digital transformation.

This study also identifies eight main support areas of DSS: (1) project management, (2) research grant, (3) copyright and licensing, (4) data management, (5) data curation, (6) digital scholarship information technology infrastructure, (7) digital and open publishing, (8) digital scholarship connections.

In addition, the research identifies the following main types of services: (1) consulting; (2) teaching and training; (3) resources provisions including digital scholarship IT infrastructure, digital and physical spaces, information resources; (4) promotion event services; (5) connection assistance; (6) technology assistance; (7) implementation assistance.

This study has both theoretical and practical contributions. The study provides a model that reflects the DSS system according to specific functions and their respective support areas and service types. The functional-specific service model reflects how the library organizes resources in providing DSS while still showing that DSS supports users through various stages of the research lifecycle as suggested by Zhou et al. (113). This helps guide libraries, especially those that do not have or have an incomplete DSS system, in organizing resources during the development of DSS.

As mentioned in the introduction, this study is part of the theoretical framework for the larger research project aiming at developing DSS at VNU-HCMC. Findings from this study were used to design tools to collect data on needs and preferences for DSS support areas and service types, as well as to guide the organization of resources for the DSS system at VNU-HCMC.

Although the findings obtained from a small sample group of academic libraries' websites cannot be generalized to the entire academic libraries worldwide, this work is a step toward broadening the understanding of the practice of providing DSS at a number of academic libraries around the world, and additional research is necessary using the same approach with a larger sample size.

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