Digitization Equipment in Cultural Heritage Imaging Labs

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Abstract: In anticipation of an increased need for digital access, the Digital Imaging Unit at the New York Public Library plans to expand library services by upgrading its lab equipment and building satellite photography bays. Since we had an opportunity to reimagine our digitization ecosystem, we were curious of how other imaging labs operate within the cultural heritage sector. By surveying professionals in the community, our report examines digitization equipment, workstation setups, and methods used in imaging labs across the globe. The success and challenges of specialized photography equipment are addressed, including camera systems, lighting, and imaging software.

Introduction

We are a group of four professionals from the New York Public Library's Digital Imaging Unit: three Collections Photographers (Rebecca Baldwin, Marietta Davis, and Sonny Smith) and a Special Projects and Services Coordinator (Jeanie Pai). Together we have more than 30 years of experience in digital imaging. In the Spring of 2021, our department had an opportunity to evaluate our digitization infrastructure and reimagine upgraded systems. Generally, cultural heritage digitization of high image quality consists of specialized equipment and components to build a workstation. A setup might include a table, column, camera (camera body, digital back, lens, shutter), lighting equipment, and a computer for processing files. Establishing a workstation can require in-depth knowledge of technical needs while adhering to imaging guidelines for archival integrity.

Our lab has had a long-term relationship with a single vendor. Because technology is ever-changing, we were curious about other brands and tools in the market. First, we contacted former colleagues to learn about their current digitization ecosystems and equipment recommendations. Next, we turned to ImageMuse, a highly active online forum for cultural heritage digitization professionals. This network consists of people working within the cultural heritage imaging, digital asset management (DAM), publishing, and digital projects space.[1] Oddly, there were not many discussions regarding comprehensive equipment procurement. We thought about what might cause this gap between equipment purchasing and consumer reviews—from the reluctance to publicly share institutional funding information to the presence of vendors in the forum. Therefore, it was unclear whether the ImageMuse community could be objective. With this in mind, we initiated an online survey inviting participants to share their setups, allowing anonymity to encourage honest feedback.

We, the Collections Photographers, first created and circulated the survey on ImageMuse, with questions designed to assess institutional foci, circulating material types, and equipment. To our astonishment, the response was overflowing. We received 70 individual responses and pages of data detailing equipment recommendations and complaints—a barrage of models and brands with many options for any size of cultural heritage project. The responses reflected setups in archives, museums, libraries (national, public, and academic), and commercial vendors across the globe. We were unprepared to digest this amount of

[1] "ImageMuse," https://imagemuse.groups.io

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information, as it was the first survey we had conducted. Jeanie Pai joined our team shortly after to help examine the responses and engage in our research.

Overwhelmed by and grateful for our network's professional knowledge, we wanted to share the results in the most helpful form. After spending months sorting through the responses and keeping up with our daily operations at work, we realized that the most valuable part of the survey was our community's voice. We hope that our findings can help anyone in their decision-making process towards digitization programs. The report is organized as follows: the survey question, a summary relating general challenges and how we digested the collected responses, accompanied by a chart of the resulting data. All charts are based on definitive answers.

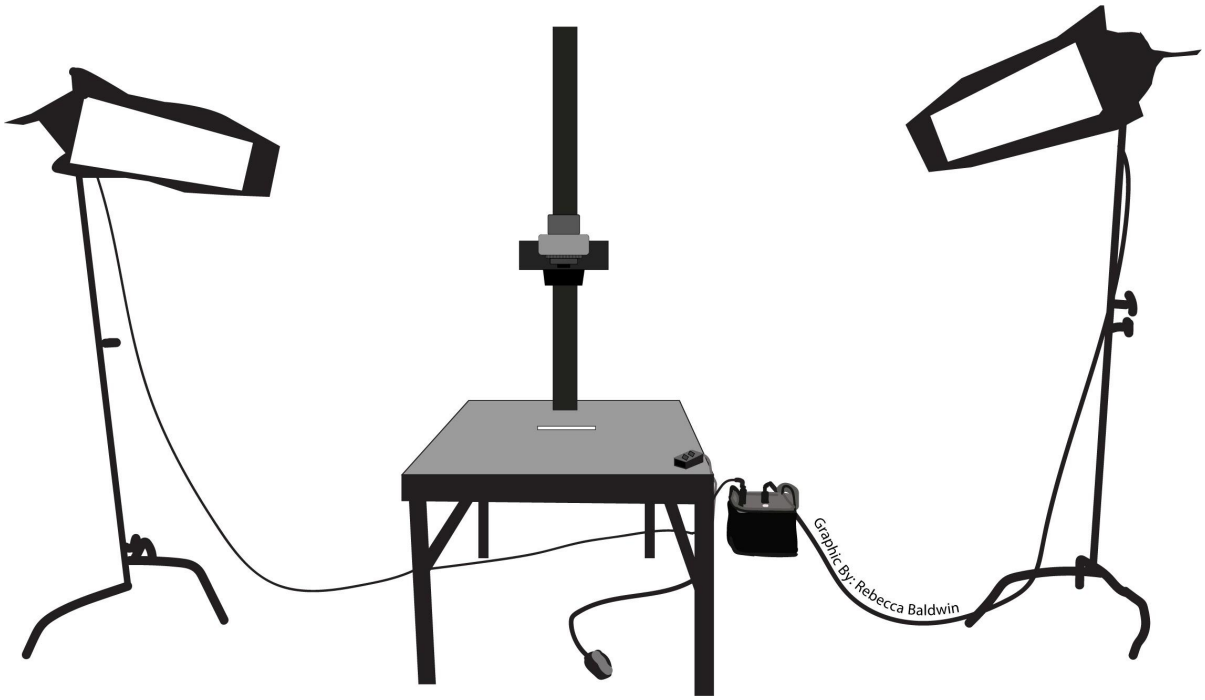
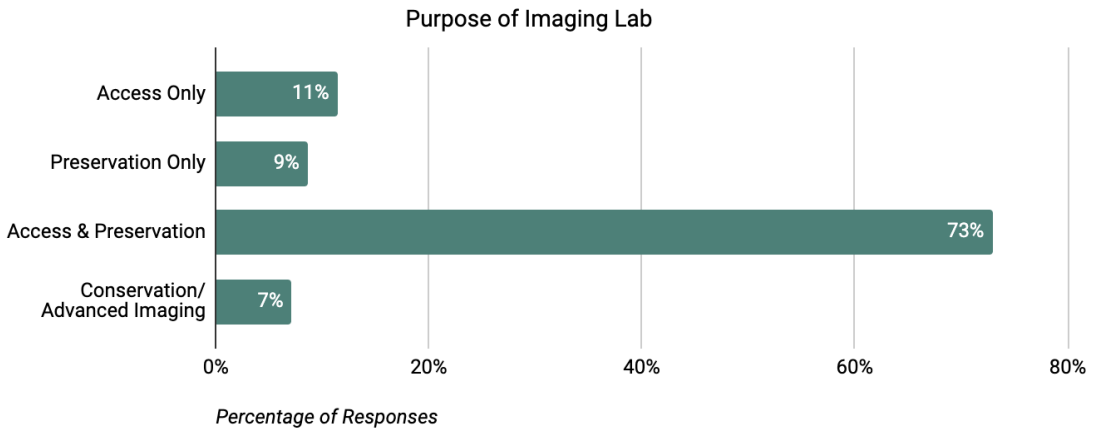


Figure 1. Digitization Workstation, illustration by Rebecca Baldwin.

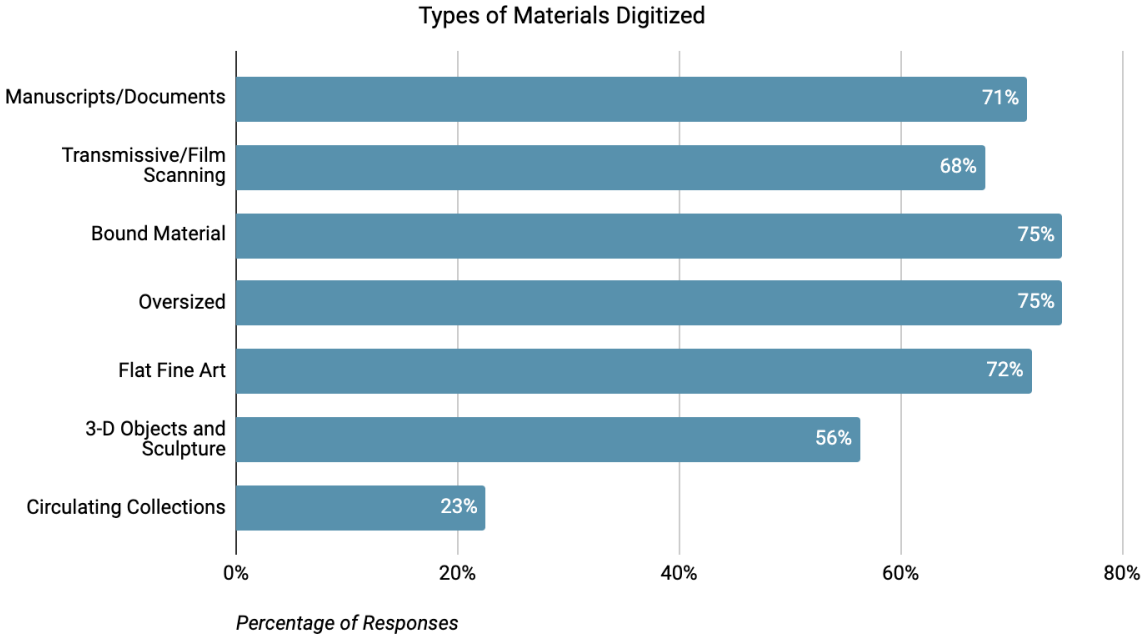
Q1. "What kind of digitization is your lab geared to?"

We began the survey by understanding where our lab's needs stood in relation to participating labs. The definitions of "access" and preservation" are separate yet intertwined, and continually evolving. Providing electronic files to patrons and researchers can be an act of both access and preservation, as digital access reduces the physical handling of archival collections (and the need for patrons to travel to see materials onsite). Not surprisingly, most respondents reported providing both access- and preservation-driven digitization. A final category, "Conservation/ Advanced Imaging," was added to include a significant number of fill-in answers.



Q2. "What kind of materials does your lab digitize?"

The question aimed to provide insight into the equipment and resources a lab might need to digitize specific materials successfully. Multiple choice answer options were based on standard classification of material types, as defined by the Federal Agencies Digital Guidelines Initiative (FADGI).[2] The majority of participants (93%) reported that their lab can digitize multiple material types, while the remaining reported that their lab is dedicated to a single material type. The latter was made up of commercial studios and independent photographers specializing in select service(s).



[2] Federal Agencies Digital Guidelines Initiatives. "Technical Guidelines for Digitizing Cultural Heritage Materials," 2016.

Q3. Current Digitization Equipment

Our curiosity in the diversity of digitization equipment was the catalyst for this research. Participants were asked to list their current setup of camera systems, copy stands, platforms, software, and quality control tools. Although the survey was designed to provide flexibility, the varying fill-in answers resulted in inconsistent and confusing vocabularies. Looking over the responses, we realized something striking throughout all categories: when asked to identify components in their imaging systems, many participants interchangeably used brand and product names to describe their workstations.

Managing broad and granular responses, with varying levels of detail, set an unclear division for analysis. It also reflected a mixed understanding of equipment names and definitions, causing us to wonder what qualifies a correct and complete answer. Indirect and incomplete answers may not be intentional, as its vernacular could pertain to one's specific workplace. In the future, we plan to provide a list of glossary terms for controlled vocabulary and/or ask for technical specification, i.e., brand, product, model, and year of manufacture, if applicable. Given this complexity, we did our best to pull valuable data from each subsection. However, we found that the answers to Quality Control, Copy Stands, and Platforms were too broad to analyze and ultimately omitted them in the report. Select responses are provided in Table 1, Table 2, and Table 3 in the Appendices.

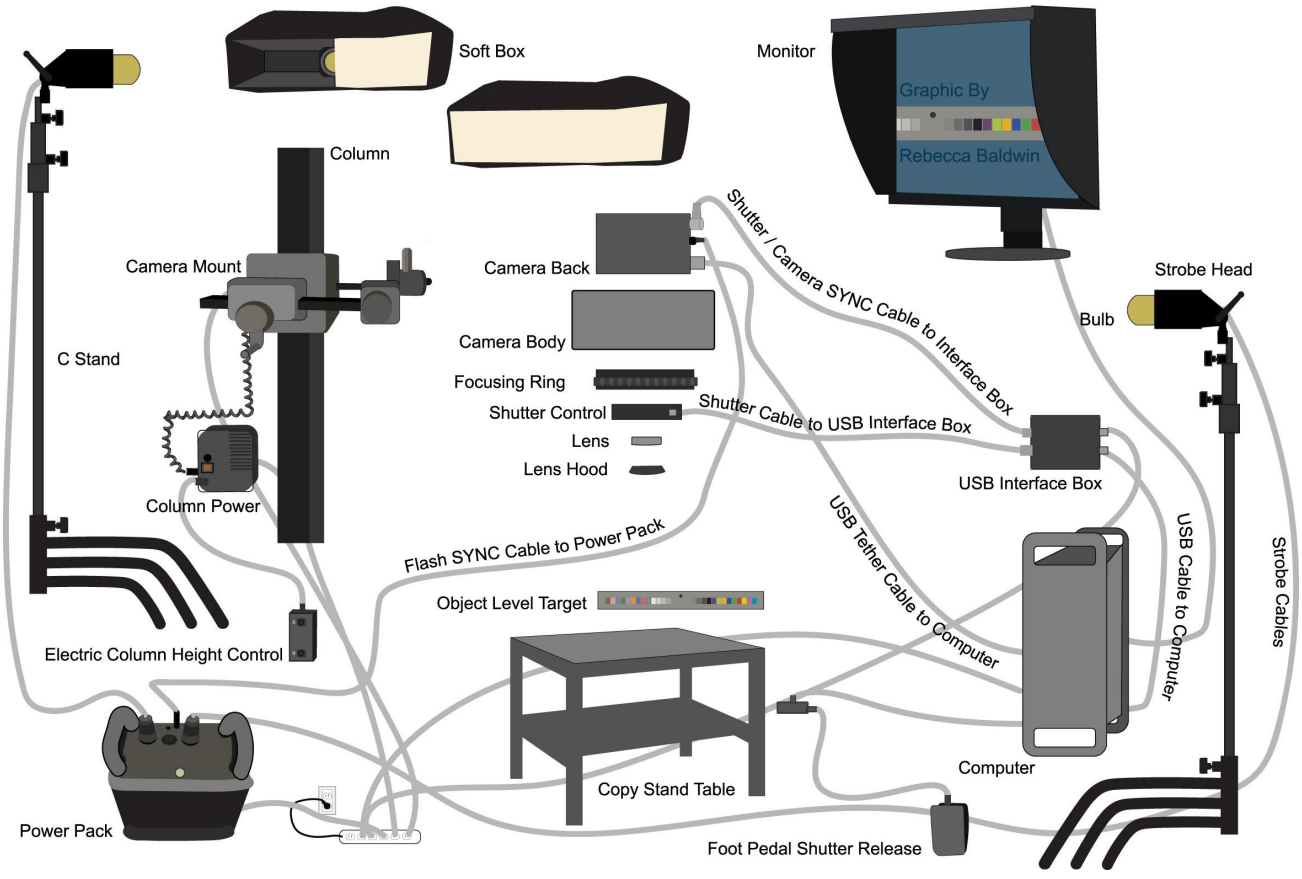
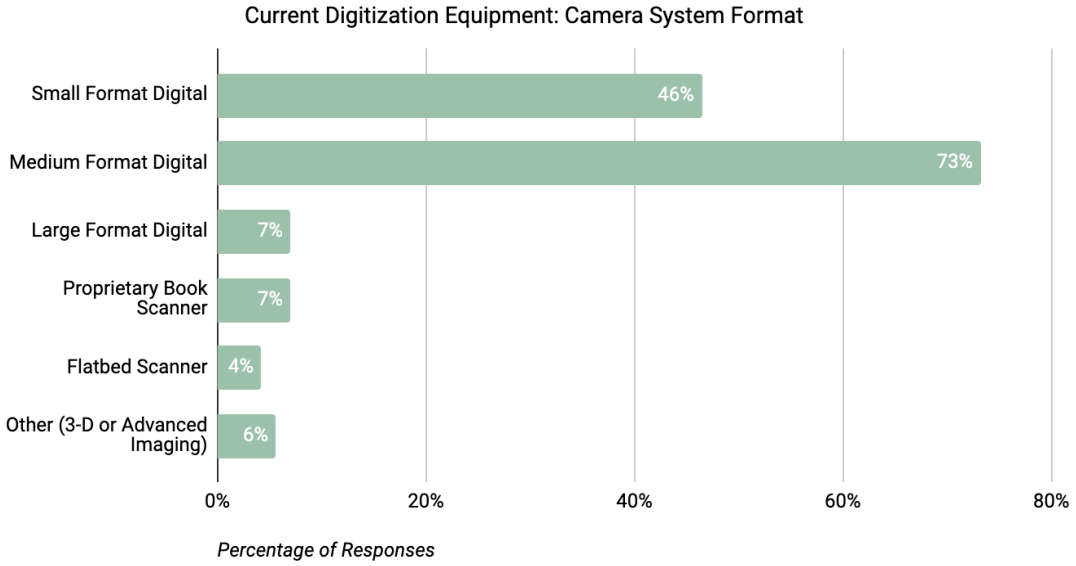


Figure 2. Detailed drawing of Digitization Workstation and Components, illustration by Rebecca Baldwin.

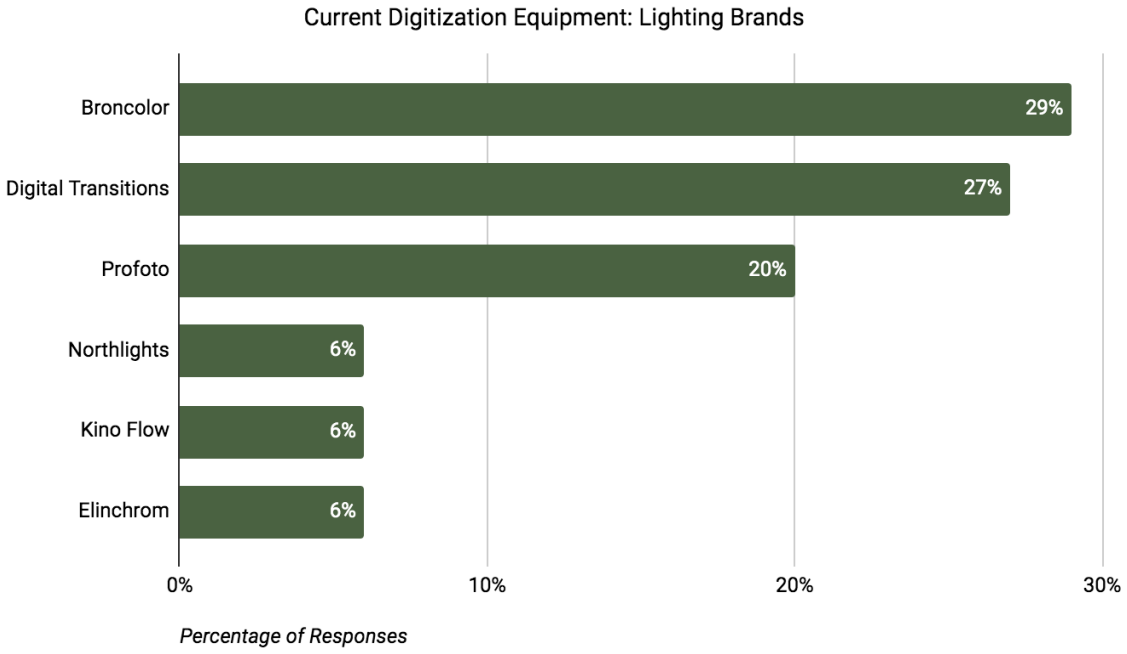
Q3a. Camera Systems

The conflation of language around camera supports and systems, as well as product names of camera/ digital backs, bodies, and lenses, were notable throughout the responses. For instance, one participant reported that their lab uses the "DT RCam (reprographic camera) and the Mamiya 645 AF camera body with a Phase One P65+ digital back." Although it is clear that the DT RCam is a type of camera body, what lens and digital back are being used in the system? What information should or shouldn't we assume, based on our own knowledge of camera systems? We still found the usage of different digital camera formats to be valuable. If a participant provided a specific model of equipment, we were able to categorize its appropriate format. In the absence of a model name, we only counted answers with brands that manufacture a single camera format.



Q3b. Lighting

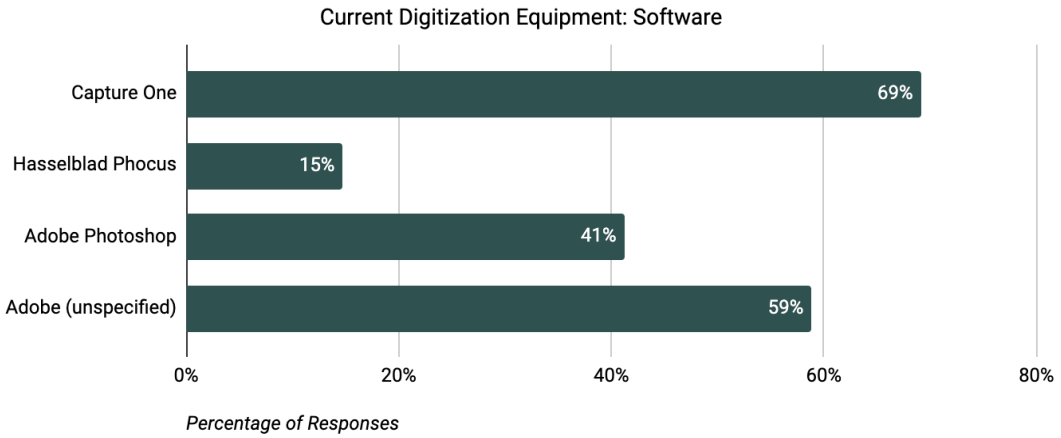
Our imaging lab is currently equipped with both strobe and continuous lighting. We primarily use strobe lighting unless working on equipment that is pre-installed with LED, such as Digital Transitions (DT) BC100 (book scanner) or the DT Atom (table-top platform). We were interested in the types of lighting other professionals use and to what success. The survey responses were initially categorized by delivery of light: "Continuous," "Strobe," "Other," and any combination of the three. However, many respondents only answered with brand names without specifying a model. This information was not enough to discern the lighting method, and unfortunately, we could not definitively report the data we hoped for. In lieu of lighting type, the chart below is organized by top reported brand names.



Q3c. Software

There was a similar pattern of conflation when participants listed imaging software used for digitization. Many participants listed the software company without identifying the product(s) deployed. For example, users from one institution may refer to any Adobe Creative Suite software program as "Adobe." If a participant reported that they use "Adobe" without specifying "Adobe Lightroom" or "Adobe Photoshop," their answer is incomplete due to the lack of details. Furthermore, some applications serve multiple functions, such as photo capturing and photo editing, and thus, it isn't always clear what a program may be used for.

Capture One, developed by Phase One, is the most reported program, as it has the ability to capture images using tethered photography. Along with Hasselblad Phocus and Adobe Lightroom, the programs allow raw files to automatically transfer from camera to computer, while offering raw editing capabilities. Users can immediately view the images on a larger monitor and adjust for quality control as they continue to shoot. Although Adobe Photoshop does not have tethering capabilities, the application gives users full control of advanced photo editing and retouching tools. In our lab, we use Capture One Cultural Heritage (CH) to capture and edit photos, and occasionally use Adobe Photoshop when further correction and/or compositing of multi-component originals are required. Since Phase One is in partnership with DT, the program has created a closed system so that users have a single stream capture system. Based on the survey, the responses have been organized by the top reported software suite, except where participants included individual application names.



Q4. Rose and Thorn: "What equipment in your current digitization setup do you recommend and why? What equipment in your current digitization setup do you not recommend and why?"
Q5. Wish List: "What equipment is in the digitization setup of your dreams?"

We asked participants to share the "rose and thorn" (success and challenges) of their digitization setup, as well as a hypothetical wish list. The survey responses reinforced the idea that a workstation does not simply refer to technical equipment only. Because the work is typically regarded as a "behind-the-scenes" process, factors such as adequate training, ergonomics, and environmental circumstances may not always be considered and/or prioritized by organizations (or even manufacturers).

We also recognize that institutional investment, available infrastructure, technical knowledge, and budgetary uncertainties are some of many limiting factors impacting the potential for optimal digitization. As imaging labor can be physically and mentally intensive, there is a general consensus that quality environments are just as important as having efficient equipment. Participants stated how ideal labs could offer, "enough space to work and skilled technicians who know how to use the equipment," as well as, "proper space with high ceilings and gray walls." Flexible workspaces should provide enough room to view and handle oversized materials, and the capacity to deploy large equipment, i.e., tables, copy stands with adjustable height, and/or casters for space re-configuration. Overall, it is impressive how participants overcome their challenges by adapting to new methods and exploring their creativity in the lab. See Table 4, Table 5, and Table 6 for detailed survey responses.

Conclusion

The results of the survey indicate that digitization infrastructures are diverse because there is no singular approach to successfully establishing an imaging lab. Every institution has its own bespoke needs, and the equipment to appropriately meet those needs will vary. What started as a small project led to the introduction of new vocabularies, vendors, and approaches, thus capturing a larger picture than originally anticipated. Our main takeaway is how vital an open dialogue that promotes and facilitates information sharing around digitization can be. We hope that this report begins a conversation as we strengthen and support digitization programs together as a community.

Appendices

Table 1: Select responses on camera systems with accompanying copy stands and platforms

Institution Type	Camera Systems	Copy Stands and Platforms
Academic Library	DT RCam • CopiBook OS XD	DT RG3040 • Generic boom for oversize materials
Art Gallery	Phase One IQ4 150MP • Nikon D2x • Epson 12000XL scanner	DT Titan with book cradle and film scanning lightbox/accessories
Art Museum	Phase One • Nikon • Betterlight	Bencher
Art Museum	Fuji GFX 100 • Canon 5DSR • Sony a7RII (full spectrum conversion) • Sensors Unlimited INGAAS IR camera • Sony RXR2 • iPhone 12 Pro Max	Old under-illuminated Bencher copy stand • Foba ASABA • Hughes Wall Easel • Gitzo tripods • Kaiser table
Consulting Organization	Hasselblad H6D-400ms • Canon R5 • Canon 5D MkIV	Kaiser • TTI
Municipal Archive	Sony a7R4	Kaiser RSX with RTX arm
National Library	Phase One 645df+ • Phase One IQ180 • Canon 5DS	Kaiser RSP rePRO • Kaiser columns bolted to walls • Linhof Studiomatic stand • Manfrotto super salon 230 stand
National Library	Phase One • Metis • DigiBook • Treventus ScanRobot • DL Mini	Kaiser • TTI
Vendor	4x5 Studio Camera • Betterlight Scanback • Nikon D850	N/A
Anonymous	DT RCam (reprographic camera) • Mamiya 645AF camera body + Phase One P65+ Digital Back	DT RGC180 copy stand (older version of their current DT Versa copy stand) • DT Atom copy stand with DT V-Cradle

Table 2: Select responses on digitization software with accompanying quality control tools

Institution Type	Digitization Software	Quality Control Tools
Academic Library	Capture One Pro • basICColor • Golden Thread	Eizo Monitors • X-Rite ColorChecker SG • Golden Thread
Academic Library	Capture One • Sinar CaptureFlow • Adobe Photoshop	X-Rite ColorChecker • Golden Thread Target sand OpenDICE • X-Rite i1Pro
Academic Library	Capture One Pro • Adobe Photoshop	Bespoke profiles created with basICColor input and/or Colorburst • Golden Thread/DICE

		Targets: Golden Thread suite • X-Rite ColorChecker SG • EIZO self calibrating
Art Museum	Capture One • Adobe • basICColor • Golden Thread	Don Williams • X-Rite ColorChecker
Art Museum	PC and Mac • Adobe suite • PTGUI Pro • Helicon Focus • Meshroom • Meshlab • AutoPano Giga • Platypus • Microsoft Office	X-Rite Passport and SG • Munsell linear grayscale • AIC color checkers • UV Innovations color checker
Art Museum	Capture One Pro • Adobe Photoshop • Adobe Bridge • Exiftool • Helicon Focus/Remote • RTI Builder/Viewer • Agisoft Metashape	X-Rite ColorChecker SG and 24 patch targets • Munsell Greyscale • basICColor Input 5 (for profile creation) • X-Rite i1 Display Pro for monitor and device profiling
Art Museum	Hasselblad Phocus • Capture One • Adobe Creative Cloud • CHROMix ColorThink • OpenDICE • Metashape • PTGui • basICColor • Lumariver • X-Rite i1Profiler	Golden Thread object level targets • FADGI19264 target • X-Rite ColorChecker and SG • Linear grayscale • QA-62 • Eizo CG279X monitors and some more basic Dell monitors • OpenDICE
Art Museum	Capture One 11 CH/Pro • Adobe Suite • Helicon Focus • Agisoft Metashape Pro	Eizo monitors with built in colorimeter • Capture One built in profiles with manual tone curve • Imaging Etc linear targets and Goldenthread object level targets • OpenDICE 2.4
Communications/ Media Organization	Capture One CH	Eizo monitor for QA/color correction • Custom reflective and transmissive ICC profiles • ISA reflective and film targets • Golden Thread software for target analysis • Laser parallel
National Library	Capture One • Adobe Photoshop • Adobe Bridge • Many others	FADGI • ISA Targets • Avian Targets, basICColor • Eizo
Science Museum	Primarily Adobe Camera Raw • Some Hasselblad Phocus	FADGI 19264 • ISA Object Level target set • ISA RezChecker Nano • X-Rite ColorChecker SG • ColorChecker Passport • LG 27BL65U (4K high res 27" decent color not wide gamut) • EIZO for color critical profiles made through X-Rite ColorChecker Camera Calibration (have also used basICColor Input)
Vendor	Hasselblad Phocus • Adobe Creative Suite • X-Rite Color Management	X-Rite Digital ColorChecker SG Card • X-Rite ColorChecker • Tiffen Gray Scale

Table 3: Select responses on material types with accompanying lighting equipment

Institution Type	Material Types	Lighting Equipment
Academic Library	Manuscripts/Documents • Transmissive/Film Scanning • Bound Material • Oversized • Flat Fine Art • 3-D Objects and Sculpture • Exhibitions	Copy stand setup is outfit with four Buhl Softcube lights • All other studios work using Profoto Acute 2 series strobe lighting with Chimera Softboxes, Grids, Beauty Dish with grid and a ring light.
Academic Library	Manuscripts/Documents • Transmissive/Film Scanning • Bound Material • Oversized • Flat Fine Art • Circulating Collection • Microfilm	Elinchrom D-Lite RX4 (very economical, good quality) • Profoto D2 monoblocks
Academic Library	Manuscripts/Documents • Transmissive/Film Scanning • Bound Material • Oversized • Flat Fine Art • 3-D Objects and Sculpture	Kino Flo LEDs • Profoto Strobes
Academic Library	Manuscripts/Documents • Transmissive/Film Scanning • Bound material • Oversized • Flat Fine Art • 3-D Objects and Sculpture	DT Photon XL LE • Profoto Strobes • Elinchrom Strobes
Art Museum	Manuscripts/Documents • Transmissive/Film Scanning • Bound Material • Oversized • Flat Fine Art • 3-D Objects and Sculpture	Various LED sources • ARRI Studio • Dedolight California • Wildfire UV
Art Museum	Transmissive/Film Scanning • Bound material • Flat Fine Art • 3-D Objects and Sculpture	Broncolor Xenon flash • LED lightbox
Art Museum	Bound material • Flat Fine Art • 3-D Objects and Sculpture	LED Photon without dimmer box for iXG • Dynalite flash units for all other workflows
National Library	Manuscripts/Documents • Transmissive/Film Scanning • Bound Material • Oversized • Flat Fine Art • 3-D Objects and Sculpture	Elinchrom 2400 rx Proheads • Assortment of Kaiser daylight fluorescent lamps
Vendor	Oversized • 3-D Objects and Sculpture • Wall Mural	Sometimes outdoors in ambient • Paul C. Buff Einsteins • Canon Speedlites for small subjects • We also use foam core V cards, and/or bounce off the ceiling when possible
Vendor	Flat Fine Art	North Light 900 watt Copy Lights • Ceramic Discharge Lamps

Table 4: Select Rose responses

What equipment in your current digitization setup do you recommend and why?
• "My goal was to use off-the-shelf solutions as much as possible to keep costs down. The Sony a7r4 may be a bit too much for [one's] purposes, but it gives us room to take on larger documents as needed but with lower overall expense." • "Hasselblad Multi-Shot cameras and Phocus software." • "[We use] adjustable tables and tripods over all very flexible workstations, it's a must for us since our materials are so diverse." • "iXG for copystands paired with [Capture One] helps us focus on capturing rather than fighting with focus. Allows more time to be spent on 3-D photography." • "Lightroom has really advanced and surpassed Capture One in many ways for art documentation purposes. [Capture One] is the standard most use but I'd encourage anyone to consider [Lightroom], especially if starting out." • "[...] Since we work in a historic site that depends on natural light, we will install two canopy tents to create a full blackout. In each tent we will have one of the new DT equipment, and additional table to support/work with items previous to digitization, a shelving on wheels for storage and a cart for transport." • "Photogrammetry setup for photorealistic digital twins of objects and environments." • "We digitize a wide variety [of] materials, therefore for us all of our equipment is essential."

Table 5: Select Thorn responses

What equipment in your current digitization set up do you not recommend and why?
• "They are no longer in our studio, but the Broncolor strobe equipment we purchased replaced Speedotron black line strobes, which I do not recommend for high volume, high precision imaging." • "Our lights stand on the floor on tripods, hard to adjust to 45 degrees - we are looking into buying a rig for the ceiling, in that way we would be able to use hanging lights instead of stands." • "The Dynalites are great for their value and portability but for true imaging a Profoto or Broncolor system would be preferred for color consistency and granular power adjustment." • "Our RG 3040 copy stand is an older table with a wooden top on a metal base, warping is a concern with age." • "Would like to update our copy stand lighting for manuscripts [and] rare books from [fluorescent] to LED." • "CopiBook OS XD - does not image at true 600ppi; initial setup and calibration was a nightmare; serious problem introduced with a software update last year that took months to fix." • "I would prefer better lights. The Dracast Kala LED 2000 fit our budget and provides just enough light for exposure, but just barely. I would prefer to lower the ISO, close the aperture and use a faster shutter speed." • "The random tables I'm using for the computer stations: none of them are the right size or height."

Table 6: Select Wist List responses

What equipment is in the digitization setup of your dreams?
• "Foba stands and Combi-tube system, computerized/motorized 3-D & photogrammetry table, RTI light dome, abundant C-stands, flags, arms, clamps, etc, overhead mount camera gantry on track capable of measured X-Y movements for photographing large flat items (textiles, maps, etc), large cyclorama wall, viewing lights that match output spectrum of strobes or continuous light." • "Good height adjustable tables with locking feet." • "The image quality of a 50mp multishot Hasselblad camera with the functionality and reliability of Capture One software for tethered capture and processing." • "DT's products are really great, so if we were to change anything, it would simply be to take advantage of some of the bells and whistles of their newer products. Having multiple systems set up so that multiple projects can move forward simultaneously [...]." • "Digital Transitions full multispectral setup, better and faster computers, motorized wall easel, Einscan 3-D HX Scanner, Large DR plate X-Ray system and mobile X-Ray source, Hirox digital microscope." • "An automated XY table for both oversized stitching and negative capture." • "I like an L- or U-shaped imaging setup that gives the imager adequate table space alongside the copy stand, or enough space next to the copy stand to bring in a cart for that purpose." • "... enough space to work; and skilled technicians who know how to use the equipment!"

References

Federal Agencies Digital Guidelines Initiatives. "Technical Guidelines for Digitizing Cultural Heritage Materials," 2016. http://www.digitizationguidelines.gov/guidelines/FADGI%20Federal%20%20Agencies%20Digital%20Guidelines%20Initiative-2016%20Final_rev1.pdf

"ImageMuse." https://imagemuse.groups.io/g/main