Blue Ribbon Panel Consensus Report on Better Practices of Personal Information Management

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Synopsis

Researchers have been studying personal information management (PIM) for many years, but little exists by way of practical advice for how individuals might better manage their own information. The work reported here employed the Delphi Method to engage PIM researchers in a five-round extended dialog concerning practices of PIM. Participants identified key everyday choices of PIM, suggested alternatives for each and identified pros and cons of each alternative as a practice of PIM. The results that emerged from this process are summarized along four dimensions: 1) Information capture and retention for later use, 2) Finding and organizing information across applications, 3) Reminding and managing attention, tasks, and to-dos, and 4) Managing versions, controlling clutter, and combatting fragmentation.

Practices are not specific to a given operating system or tools ecosystem but do reflect general affordances and limitations in the current base of tools generally available for PIM. Among the “most valuable practices”:

- Take a picture with smartphone (e.g., of paper notes or whiteboard)
- Email yourself notes, thoughts, tasks/to-dos’’
- Keep a notes or "thoughts" file (e.g., as .txt or Word doc) for each project or topic
- Organize information by project (one folder per project)
- Use standardized file and/or folder names
- Use calendar events to represent the future and to remind of tasks and aid in completion
- Store files in the cloud (e.g., Dropbox, OneDrive, Google Drive)
- Add characters or words to file names to add context (e.g., "v1" or "final" at the end of a file name)

The report contains recommendations (“recommended”, “not recommended”, “it depends”), consensus statements and pro/cons for 36 distinct practices of PIM. The report also summarizes panelist suggestions for “near-future” changes in tool support likely to have the biggest impact. Participant recommendations have immediate application and also point to “near-future” improvements in tool support.

For a description of the Delphi Method as it was used to generate the results of this report, and its relationship to other relevant uses of the Delphi Method in related research, see: Jones, W., Capra, R., Diekema, A., Teevan, J., Pérez-Quiñones, M., Dinneen, J.D., & Hemminger, B. (2015). “For Telling” the Present: Using the Delphi Method to Understand Personal Information Management Practices. To appear in *CHI’15: Proceedings of the 2015 Conference on Human Factors in Computing Systems.* Seoul, Korea: ACM.

Intended Audience of the Report

The report should have value to the following people:

- **Researchers**
    - In PIM and related areas interested in learning which consensus positions were achieved by a panel of noted PIM researchers.
    - Researchers and practitioners in other areas interested in applications of the Delphi Method and in assessing how variations of the method might be used in their field as a complement and catalyst to other methods of inquiry.
- **Teachers and those offering training and advice including…**
    - Those offering training in information literacy and information management (K-12, higher education, the workplace).
    - Librarians and information specialists advising diverse user groups.
- **All of us who of necessity must practice PIM.**
    - White-collar professionals looking for practical tips and techniques towards better practices of PIM. Panelists were told to target these people in particular.
    - Recommendations also apply to homemakers, retired people and nearly everyone else who must increasingly manage information in order not only to work more efficiently but also to live their lives as they would like to.
    - The recommendations apply with less force for those in a managerial position who are able to delegate at least some of their information management to the people they manage, most notably to an administrative assistant.
    - Recommendations apply with even greater force to those who are being delegated to since these people must manage not only their own information but also the information of their manager.

Motivation for the Report

"What should I be doing?" "When you get that figured out let me know!" Researchers involved in the study of personal information management or PIM often face questions such as these when they describe their work to people in social situations -- e.g., at the proverbial cocktail party. As good researchers lacking sufficient data the response is often to demur with responses like "well… it's hard to say" or "that depends….".

Alas, although there are many good *descriptive* studies on PIM (what are people doing now?) and also good *prototyping* work (how might future tools help?), there are relatively fewer studies from which *prescriptive* conclusions might be drawn about what might be done in the practical present towards better practices of PIM. It often depends – on the person, the job, the current configuration of tools, etc., and it can be tough to generalize when everyone is different.

Although generalization may be beyond our reach for the moment, that should not deter us from trying to identify better practices of PIM. This report describes the results of an effort to go beyond the current literature by drawing on experiences of PIM experts. That is, through both self-reflection and formal studies, researchers have acquired considerable practical knowledge concerning practices of PIM. What are common practices? Under what circumstances do they work? For whom do they work? And so on. Codifying this knowledge could have considerable practical value. Furthermore, it is hoped that the findings might offer a useful point of departure for more formal investigation, especially into areas where researchers have not achieved consensus.

This report reflects an effort, using the Delphi Method, to achieve a consensus among a selected panel of PIM researchers concerning, if not "best practices" of PIM then at least "better practices" of PIM. Which everyday practices of PIM are recommended? Which do researchers, based upon their direct experience and observations of participants in many studies, advise against? What considerations apply in the use of practices and subtle but important variations in their use? While researchers have certainly based their inputs on the tools they use or know, this report isn't focused towards any operating system or software application. Rather, it tries to address general-purpose practices that might help users regardless of the actual setup they use.

The Delphi Method (in several variations) forms the basis for the report and its conclusions. The Delphi Method is an alternate method of data collection and thus stands in complementary relation to more traditional methods of data collection (e.g., interviews, surveys, observations, focus groups, etc.). In a sense, the Delphi Method, as used in this report, is second order -- rather than focusing on individuals practicing PIM, it focuses on the researchers who observe, interview and survey individuals practicing PIM. In doing so, the intent is to paint, with broad strokes, a more complete picture of everyday practices of PIM.

Method Followed for the Recommendations of this Report

This report's study of PIM practices can properly be considered to have started at *PIM 2013* (http://pimworkshop.org/2013/, held Nov. 1, 2013), the sixth in a series of workshops designed to bring researchers around the world together to discuss issues and share information concerning personal information management. A dominant theme of *PIM 2013*, reflected in its call for participation, was the exploration of practical considerations both in the study of PIM and also in everyday practices of PIM.

In an afternoon breakout session participants took turns sharing details of their own practices of PIM. Participants – each of them a researcher in PIM – also shared their observations from formal studies of PIM behavior. As discussion proceeded, an informal consensus emerged concerning key challenges (or *choice points*) of PIM and notable alternatives (*choices*) for each. As one person presented, other workshop participants would frequently offer, "I do that too!" or, "That's a lot like something I've seen participants do in my studies." To formalize the discussion and involve members of the larger PIM community, it was decided to employ the Delphi Method.

Variations of the Delphi method were used in five rounds grouped into two distinct phases, taking place from March through September 2014. In Rounds 1 and 2 of Phase 1, an effort was made to include as many PIM researchers as possible in an open-ended effort to collect notable instances of PIM behavior. Rounds 3, 4 and 5 of Phase 2 involved a smaller, select panel of participants who made the commitment at the outset to invest at least a minimal amount of time required to complete all three rounds.

Phase 1: Outreach

People employ a large number of practices in their everyday personal information management. The goal of Phase I of the study was to identify a manageable number of key PIM practices for closer consideration. The approach can be characterized as an *outreach* in the recruitment of participants and in the structuring of Rounds 1 and 2.

Participants for Phase 1 were recruited through broad announcement (e.g., email announcements to a PIM research mailing list) and active, direct solicitation of key PIM researchers by the authors. Twenty-seven researchers participated in Phase 1. They were: Victoria Bellotti, Robert Capra, Mary Czerwinski, Anne R. Diekema, Jesse David Dinneen, Mike Eisenberg, Thomas Erickson, Ina Fourie, Robert Ferguson, Daniel Gonçalves, Heiko Haller, Andrea L. Hartzler (Civan), Bradley Hemminger, William Jones, Liadh Kelly, Matjaz Kljun, Gloria Mark, Cathy Marshall, Michael Muller, Manuel A. Pérez-Quiñones, Leo Sauermann, Jaime Teevan, Manas Tungare, Stephen Voida, Karl Voit, Barbara Kwasnik, and Hong Zhang.

In Round 1 (anonymous), the participants were asked to: "Please share a specific instance of a notable PIM behavior" and (optionally) to provide additional details such as benefits, rationale, context, and where they learned the behavior. Participants could repeatedly use a Google form provided to share additional instances of PIM. Participants were given 7 days to complete Round 1 with email reminders sent out twice during this period, as well as offers to extend the period of anyone requiring more time. (No Participant requested more time.) Participants documented 103 notable instances of PIM behavior. The following are examples:

- *Took picture of piece of paper with notes I scribbled for meeting on Tuesday. Tossed the paper.*
- *Open and leave open on PC files related to required short-term to-do items.*

- *Use sound recording in notetaking app (evernote) to record to-dos and notes on the go.*

In the interim between Rounds 1 and 2, facilitators independently categorized all notable instances according to general, PIM-related themes. In a collective Skype conference call, facilitators then compared themes provided by each facilitator. There was considerable agreement, made clear after variations in the name of a theme were replaced by a single theme name. Expressions for the final four themes to be the basis for Round 2 discussion reflected, not general activities/concerns of PIM (e.g., finding/re-finding or maintenance & organization) but rather the actions people could take "with their own hands" to manage their information:

1. ***Better organization*** *(for keeping, re-finding, making sense of and using our information)* ***through the artful use of file & folder naming****. Files and folders can be named to effect a sorting order ("zz"), to "tag" (i.e. by embedding keywords), to code for date ("2014-04-12), to represent versions, etc. Folders can represent projects, archival or a year's worth of photographs. But towards what end?*
2. ***Task management*** *– from capture of to-dos (as a special kind of "keeping" activity) to listings of tasks/to-dos by project or by "today". How to make sense of what needs to be done for a project? How to remember what needs to be done today or "now"? Some people keep a consolidated list of _everything_ they need to do or mean to accomplish. People sometimes mention use of a designated task management application but then usually in the past tense ("I tried but couldn't keep up…") or the future tense ("Someday …" or "I really should"), and rarely in the present tense ("I use the app every day…")? Reminding is done in various ways ad hoc ways including files/emails in open windows, tabs in the browser and "appointments" in a digital calendar (e.g., Outlook). How do methods best combine? What can we recommend?*
3. ***Finding/re-finding*** *– People appear to be using search ever more as a way to get back to their information – especially email messages. Still, recent studies indicate that navigation persists as a primary method for the return to files. How can search and navigation combine? When should people consider abandoning older ways of organizing (think use of email folders)? When do should people opt for big "everything bucket" folders with minimal organization. When do should people stick to organizations but use these in new ways (think search focused on file and folder names)?*
4. ***Fragmentation as the bane of our informational worlds!*** *How best to combat fragmentation? Dropbox? Google Drive? Conscious use of the same (or similar) organization (folders and naming) across devices? What if a person's own workflow is the cause of the fragmentation? What happens when project information is pulled into different, disparate folders according to different general stages in _any_ project (e.g. in academia stages might include grant proposal process, human subjects application, conference publication, etc.) When is fragmentation a _good_ thing – i.e. increasing the ease of access to personal information and supporting redundant, failsafe storage of important information?*

In addition, facilitators added the following areas for discussion based upon obvious general importance to PIM even though these were not well reflected in the notable instances of Round 1:

- ***Privacy****. We saw little in the way of instances of PIM behavior directed towards privacy per se. Does this say something about our "impotence" to directly impact? Regardless, privacy is an ongoing consideration. Consider, for example, the instance of a person subscribing for a*

premium service (via Dropbox) as way of combating fragmentation – all information, synced across devices and (selectively) shared with other people (friends and colleagues). But with one exception… financial information stays "local" on hard drive to be separately backed up. (Not ready to trust Dropbox for this).

- ***GIM and collaboration.*** *Again a constant consideration but co-opted by other activities such as use of storing application like Dropbox (for sharing) or use of simple file naming for version control.*
- ***Reflection (& reminiscing?).*** *We found only one instance (concerning editing of a calendar to accurately reflect what the person had actually done), but somewhat related was an instance describing the organization of photos by year (and then event). Is this a more common phenomenon worth of further discussion and study?*

In Round 2 (not-anonymous) participants were encouraged to freely contribute their thoughts to each of the four primary themes as listed above and also to the three additional themes (privacy, GIM, reflection). Participants discussed each area, outlined alternatives, listed pro and cons for each alternative, and in some cases noted which options were "best" (or "better") alternatives. Participants were given 7 days to complete Round 2 with email reminders sent out twice during this period, as well as offers to extend the period of anyone requiring more time. No one requested more time and the discussion fell off considerably in the final days, with no discussion on Day 7.

Phase 2: Focused Deliberation

The results of Phase 1 were analyzed by the facilitators and resulted in 36 unique everyday practices of PIM. These practices provided the nexus for focused deliberation by a select panel of PIM experts in Phase 2, which consisted of Rounds 3, 4, and 5.

Phase 2 participants (also referred to as "panelists") were recruited with more coordination and focus than in Phase 1. Facilitators nominated panelists for Phase 2 based upon their existing PIM research. All facilitators agreed on the final set of candidates to be invited. Candidates were then approached by one of the facilitators either in person or via email. The panelists agreed to participate with the understanding that they would complete all three rounds, Rounds 3, 4 and 5, of Phase 2 and that they would invest a minimal amount of time -- 15 minutes per round -- towards completion of these rounds. Most panelists elected to spend considerably more time than the specified minimum.

Altogether, Phase 2 had 22 panelists (Table 1), including the seven facilitators. Fourteen of these panelists had also participated in Phase 1. Other researchers were invited to participate as Phase 2 panelists but were unable to do so (including five researchers who had participated in Phase 1).

Panelist	Affiliation
Nicholas Belkin	Rutgers University
Harry Bruce	University of Washington
Robert Capra	University of North Carolina
Mary Czerwinski	Microsoft Research
Anne R. Diekema	Utah State University
Jesse David Dinneen	McGill University
Michael Eisenberg	University of Washington
Thomas Erickson	IBM T. J. Watson
Ina Fourie	University of Pretoria
Daniel Gonçalves	University of Lisbon
Jacek Gwizdka	University of Texas
Bradley Hemminger	University of North Carolina
William Jones	University of Washington
David R. Karger	MIT
Diane Kelly	University of North Carolina
Barbara H. Kwaśnik	Syracuse University
Gary Marchionini	University of North Carolina
Gloria Mark	University of California
Manuel A. Pérez-Quiñones	Virginia Tech
Jaime Teevan	Microsoft Research
Amy Voida	Indiana University
Steve Whittaker	University of California

Table 1. Phase 2 panel participants.

In Round 3 (anonymous), the panelists were asked to anonymously complete a Google form to recommend or advise against one or more of the 36 PIM practices resulting from Phase 1. Panelists were asked to make a recommendation (for, against, neutral) for at least 2 or 3 of the 36 practices identified but were encouraged to make recommendations for more (i.e., 8); some panelists elected to give recommendations (for, against, neutral) for all 36 practices. In addition to their recommendation for a given practice, Panelists were also invited to enter comments to explain their reasoning. Panelists were given 7 days to complete round 3. Panelists were told to target white-collar professionals of a kind they might meet at a cocktail party or other social situation.

In the interim between Rounds 3 and 4, the facilitators reviewed the responses for each practice and wrote brief summaries that included: a short description of the practice, a list of pros and cons, a statement to reflect points of agreement (emerging consensus) and points of disagreement, and a list of outstanding questions with regards to the practice. Facilitators each signed up for a share of the practices both to write the summaries for some practices and to review and modify the summaries of other practices. The summary for a given practice was reviewed by at least two facilitators (but frequently several). Finally, summaries were grouped into sections with headings that differed from the four main "theme" categories used for Round 2 but seemed better to group practices with respect to underlying PIM activity. These groupings were:

- Information capture and retention for later use
- Finding and Organizing Information Across Applications

- Reminding, Managing Attention, Tasks/To-Dos
- Managing Versions, Controlling Clutter & Combating Fragmentation (esp. across devices)

Groupings for sections were created using a process among facilitators similar to that described for the themes used in Round 2.

In Round 4 (anonymous), these summaries were put into an editable Google Drive document with space left underneath each practice for panelist discussion and contributions. Panelists were asked to review these summaries and then contribute to the discussion for at least two practices (but encouraged to discuss more). Panelists were given 7 days to discuss with an option to request more time if needed. No one did and discussion fell off precipitously towards day 6 (with no discussion on day 7).

In the interim between rounds 4 and 5, facilitators endeavored to condense the recommendations of Round 3 and the discussion of Round 4 into "consensus statements", one per practice so as to form the basis for this final report. As with the summaries produced for Round 4, responsibility for consensus statements was apportioned among facilitators and then statements were reviewed and modified by at least one (typically several) other facilitators.

Each statement was introduced by a color-coded provisional recommendation ("Recommended", "It Depends", or "Not Recommended") together with a tally of panelist votes "for" or "against" the practice). The statement itself consisted of:

1. An active-sentence expression of the practice (e.g., "Email yourself notes, thoughts, tasks/to-dos").
2. A longer description of the practice together with emerging consensus regarding considerations in the use of the practice (why/why not? And if recommended, then for whom and under what circumstances?).
3. A short list of "pros" and "cons" in the use of a given practice.

The listing of consensus statements formed a draft version of this "Better practices" report.

Finally, for Round 5 (non-anonymous), panelists were asked to read and edit the draft report and make sure the statements were complete, substantive, and concise. During this round two practices and their statements were split. In turn, two pairs of practices and their statements were merged, so that the total number of recommendations remained 36.

After editing the draft report, panelists were asked if they were willing to endorse the report, to highlight the practices they believed were particularly valuable, and to list up to five changes in PIM systems that they thought would be both impactful and reasonable to achieve in the near future. All 22 panelists endorsed the report.

Facilitators

Facilitators are essential to the Delphi Method, as they structure each round and provide the controlled feedback for iteration from one round to the next. The authors of this report <to remain anonymous here in this report pending review of a paper submitted in association with this report> fulfilled the facilitator role throughout the study. The facilitators, themselves each involved in PIM-related research,

also actively participated in each round of the study. Their participation was anonymous or not, according the general structure of a given round.

In any Delphi study, the facilitator must take care to insure that the controlled feedback is a balanced reflection of participant viewpoints. This is potentially a greater concern when facilitators are also participants. On the other hand, the seven facilitators represented a diverse set of viewpoints, drawn from very different organizations and backgrounds. It can be argued that this diversity promoted balance in the controlled feedback provided in the transition from one round to the next. It was concluded that it was better to support richer discussion by including the facilitators than to exclude the viewpoints of a number of PIM researchers.

Report Recommendations

First, some final caveats and considerations:

- The report does not provide, and doesn't intend to provide, a review (even partial) of the considerable literature on PIM in general and that specifically relates to each of the practices.
- Nor can the report or its Delphi Method approach take the place of traditional empirical work (involving the direct study of people practicing PIM).
- As traditional empirical work continues to fill in our picture for how people do PIM and how they might do it better, the report may ultimately prove to be wrong in some of its conclusions.
- Some of its conclusions will also surely be dated by improvements in tools and devices that support PIM.
- Even so, the report can do considerable good through its explicit, practical discussion of everyday practices of PIM. The report has value to people in general who face an avalanche of information – increasingly in digital form and accessible only through computer-based tools and services.

Format

Practices are grouped into sections consistent with those developed by facilitators for Phase 2 (and used by panelists in Rounds 4 and 5). Each category begins with a summarizing table. Each table features the abbreviated practice description, the number of votes the practice received from panelists as most valuable practice (MVP, as expressed in the sign-off form of Round 5), and the number of votes the practice received for and against its use (in Round 3). Exceptional practices are bolded, e.g., high importance or many votes for or against a practice.

Following the table are consensus statements for each of the practices grouped under a category. The format for each consensus statement is as follows:

- Recommendation (based upon the positions taken by panelists in Round 3 of Phase 2).
- One-sentence description of practice.
- One or two paragraphs of "consensus statement", leading as needed with a longer explanation and examples of the practice and then discussing various considerations (pros, cons, who? under what circumstances?) in the use of a practice.
- Two one-sentence summary listings of pros and cons for the practice.

Category 1: Information Capture and Retention for Later Use

Practice	Round 5 MVP	Round 3 For	Against
1. Take a picture with smartphone (e.g., of paper notes or whiteboard)	13	10	1
2. Email yourself notes, thoughts, tasks/to-dos	12	14	0
3. Keep a notes or "thoughts" file (e.g., as .txt or Word doc) for each project or topic	10	9	2
4. Use calendar events to represent the past and to support reflection of what has actually happened.	9	6	1
5. Email information to others not only to share it with them, but also to serve a keeping purpose (e.g. can later search sent email)	6	7	2
6. Use a special-purpose note-taking tool (e.g., MS OneNote or Evernote)	5	5	2
7. Bookmark webpages that contain interesting/personally important information into folders	4	5	4
8. Use a sound recording device/app to record to-dos or notes on the go	1	3	8

Table 2. Consensus statements for the Information Capture and Retention for Later Use category.

Recommended (10 for, 1 against):

1. Take a picture with smartphone (e.g., of paper notes or whiteboard)

Smartphone photos are a very useful way to capture non-textual information, whiteboard meeting notes, or paper notes prior to disposal. In some cases the image can be discarded after near-term use. However, such images may retain value for a much longer period of time, in which case it is necessary to ensure the image can be retrieved at a later date. This can be done by storing it within an organizational scheme, embedding the image in a document, email, or web page where the surrounding text supports search, or having the image “speak for itself” through OCR.

Pros: *Quick capture of information in contexts where alternatives may unavailable. Effective for quick digitization and distribution to a group.*

Cons: *Hard to search or re-find. Information may need to be manually extracted and transferred to other media, e.g., pictures with text must be annotated.*

Recommended (14 for, 0 against):

2. Email yourself notes, thoughts, tasks/to-dos

People widely email themselves personal notes, thoughts, and tasks. The practice is effective because email is ubiquitously available wherever information needs be captured and the content is likely to be viewed again as long as it stays at the top of the user's inbox. But the value of these notes is only as good as the user's overall ability to manage email. Emailing notes to oneself could exacerbate feelings of being overwhelmed by email and add to email management overhead. For longer-term, ongoing task management, emailed notes should only be used when the user makes a conscious effort to keep the content together (either in preparing the email by using consistent keywords in the subject line to make it easy to find notes on a particular project or topic, or afterwards by utilizing the ability of email applications to associate keywords, categories or rankings). For people who do not use email as their dominant mode of communication (and who may rely instead on Twitter or Facebook), this same approach can be applied to their dominant mode.

Pros: *Can be done from any location/device with access to the Internet. Emails serve as reminders as they are visible in the inbox.*

Cons: *Notes can be lost in email overload. Notes about various projects may add to fragmentation of information.*

Recommended (9 for, 2 against):

3. Keep a notes or "thoughts" file (e.g., as .txt or Word doc) for each project or topic

All of the notes associated with a project (e.g., thoughts, to-dos, and meeting notes) should be placed together, but there are many ways to do this. Some people can do this by creating "notes" document (e.g., using a word processing tool like Word) and placing in the folder for a project. Others might send email notes to self and others where the subject line includes the name of the project. (See recommendation #2). Special purpose note-taking tools such as Evernote, TiddlyWiki, or MS OneNote (or reference management applications) are recommended only for those whose note-taking needs are unusually high. (See recommendation #6). A more cross-project, consolidated approach to note-taking (possibly involving special-purpose note-taking tools) is advised when it is important to a more global or "big picture" understanding of projects and how these interrelate.

Pros: *Reduces re-finding effort for people with many projects with clear boundaries among them.*

Cons: *Fragmentation of notes in multiple projects. May not integrate well in group contexts.*

It depends... (6 for; 1 against):*

4. Use calendar events to represent the *past* and to support reflection of what has actually happened

Digital calendars can be a helpful representation of past events, but only partially so (except for the few people disciplined enough to make sure their "past" calendar is kept accurate). For most people, their calendar should be assumed to be incomplete (with significant events over time not being present in the calendar) and inaccurate (with events scheduled that were never attended). When completeness or accuracy is important, the information contained in a calendar should cross-checked with other archival sources, such as personal memories, email, and the calendars of others.

Pros: *Excellent support for recall and recollection. Can often be searched.*
Cons: *Past calendars are often not accurate representations of what happened. Limited to chronological information.*

** In Round 3, this was part of a larger item that included "Use calendar events to represent the future (#19)". The for/against votes shown are for the original item.*

It depends... (7 for, 2 against):

5. Email information to others not only to share it with them, but also to serve a keeping purpose (e.g. can later search sent email)

Email can be used not only to share information with other people, but also as a way to keep information for later retrieval. This approach should be used in team projects, collaborations, or instances when recipients value the information sent. However, it should be used with care. Spamming others just to be able to search for the sent email later increases the chances that other valuable emails will be ignored over the long run. The practice can still be used in cases where the email content only provides personal value; however, the email should be directed at oneself (see Recommendation #2 for more). When emailing content for keeping to another person, blind carbon-copy (bcc:) can be used so that the information will also appear in the sender's inbox. This provides reminding functionality and can facilitate retrieval.

Pros: *Supports re-finding by searching the sent box. Provides documentation to others. Serves as redundancy for important topics.*
Cons: *Pushes responsibility for keeping to others - some email may be seen as spam. Not all information is meant to be shared.*

It depends... (5 for, 2 against):

6. Use a special-purpose note-taking tool (e.g., MS OneNote or Evernote)

Special-purpose note taking tools like OneNote, Evernote, or TiddlyWiki are recommended for people whose note-taking needs are unusually high. Examples include students researching for a thesis, or managers with multiple weekly meetings. People with more limited note-taking needs should consider

repurposing existing tools and organizational structure, using, for example, word processing applications such as MS Word. (See recommendation #4) or even self-sent emails. (See recommendation #2). Successful note-taking tools must support at least two basic types of functionality: 1) capture across many devices, and 2) organization (including editing). While many users tend to focus on the capture, they must also be aware of organizational and maintenance costs.

Pros: *Good support for quick capture of text and pictures.*
Cons: *One more organization to maintain, one more tool to learn. Non-standard note formats may cause fragmentation across projects.*

It depends... (5 for; 4 against):

7. Bookmark webpages that contain interesting/personally important information into folders

Browser-supported bookmarking is being less frequently used. It is being replaced by alternative mechanisms including copying URLs into project notes, user's trust in being able to easily re-find in a new web search, better autocomplete capabilities of browsers, browser mini-page lists of frequently visited resources, and competing tools like Diigo and Evernote. However, bookmarking can be effective at providing faster access for users that have a large number of frequently visited webpages. Bookmarks also remain useful for people whose PIM practice already involves disciplined regular use of bookmarking with an organizational scheme. Maintaining and using bookmarks across multiple devices is best done by using browsers that include support for synchronization. While it can require some additional effort, a person's existing note-taking system or folder organization should also be considered as a viable repository for important links (e.g. by copying a link to into a note or by dragging a page's address into a folder).

Pros: *Facilitates re-finding. Handy for sites visited regularly.*
Cons: *List gets messy quickly. Maintaining organization is difficult. Information on pages may change, and pages may disappear.*

Not recommended (3 for, 8 against):

8. Use a sound recording device/app to record to-dos or notes on the go

Audio recording, whether of someone else (e.g. a lecture or meeting) or of oneself (speaking notes or to-dos) is fast, but most current systems do not have good support for indexing, searching, and retrieving information stored in audio form. Often this means that the ease of recording notes by voice is outweighed by the costs of retrieving the information at a later point. Voice input should only be used in cases where the user has a clear retrieval plan, such as when recording information about the current state of work just before an interruption, as part of workflows that include a larger discipline to listen to the notes again, or within the context of existing frameworks like Google Voice that convert speech to text. Finally, a recording cannot take the place of active participation in the event being recorded (e.g., lecture or meeting) and people are advised against a false sense of security that "I can always listen later". People may never find the time to do so. Moreover, context and the opportunity to interact (with the speaker or others in the meeting) are no longer present.

Pros: *Possible "hands free" way to record. Support for task recovery after interruption.*

Cons: *False sense of security (that information is "captured" when ability to access later or time to review may be very limited). Cannot take the place of active participation. Voice still cannot be easily, reliably indexed and retrieved in keyword search -- i.e., from transcription (though support for this is steadily improving).*

Category 2: Finding and organizing information across applications

Practice	Round 5 MVP	Round 3 For	Against
9. Organize information by project (one folder per project)	15	12	0
10. Use standardized file and/or folder names (also do this across devices)	12	8	2
11. Rely on search to find information	7	7	4
12. Store research papers in bibliographic management software	4	7	1
13. Structure subfolders according to standard sections of a document (e.g. academic folders match CV sections)	4	4	1
14. Organize information using a small number of large folders	3	7	4
15. Use tags to label files & folders in several different ways	3	5	1
16. Re-find by searching within the top level folder of a branch where a document is likely to be	3	5	2
17. Place keywords into file & folder names to aid later search-based retrieval	3	3	3
18. Let a "smart system" figure things out for me (e.g., "iPad hides structure, which works fine for me")	1	1	9

Table 3. Consensus statements for the Finding and Organizing Information Across Applications category.

Recommended (12 for, 0 against):

9. Organize information by project (one folder per project)

One folder per project makes it conceptually easy to identify projects and facilitates moving, deleting and sharing content associated with a project. Many panelists use the practice of organizing information by project although they are aware the practice poses some problems. Especially problematic are large multi-faceted or cross-cutting projects that potentially lead to bloated folder structures or the need to make connections between different parts projects. There is no consensus on how to resolve these issues. Creating links works for some but doesn't for others.

Pros: *Conceptually easy to identify project/folder. Ease of handling project (move folder, delete, backup, share, etc.)*

Cons: *Contents of projects might belong in multiple projects. Projects might grow from other projects.*

Recommended (8 for, 2 against):

10. Use standardized file and/or folder names (also do this across devices)

Developing and using standardized schemes for file and folder names is recommended and can make it easier to re-find items, especially for ones that are accessed infrequently. However, developing naming schemes that generalize can be difficult. For many people one scheme will not necessarily work in all situations, so it may be desirable to use a scheme flexibly, or for only certain types of files/folders. Specific recommendations include:

- Use schemes that help keep "active" files near the top (e.g., prepend international date "2014-09-22" to the name; sort by date)
- Use "old" or "archive" subdirectories for keeping folders from getting too large
- Use naming conventions that mirror real-world structure (e.g. course name, conference name+year)
- Choose names that will be useful in sorting, and that will be recognizable if shown in truncated forms since many interfaces show only the first and last chars of long names.

Pros: *Makes re-finding easier, especially when searching or navigating infrequently accessed files and folders.*

Cons: *Difficult to generalize for all situations, requires effort to implement and maintain.*

Standardizing file and folder names across *devices* is generally a good idea, as consistency in the names aids navigating and revisiting files and folders over time. In most cases it is easy to implement since file and folder names persist when copied across devices. However, in some cases identical names or folder structures may not be possible across different classes of devices. It may help in some cases to segregate information across devices (e.g. keep work-related information on a company laptop and non-work information on a personal laptop).

Consistent naming requires discipline but has big payoff for the ability to easily switch between devices. Once a scheme is developed and applied to one device it is easier to apply to other devices. Today, and increasingly more likely in the future, a recommended alternative is to utilize cloud-based storage so that the files exist in one place (in the cloud) under one name and folder structure but are available across all devices.

Pros: *Increases findabillity of folders and files and increases the ease of switching between devices.*

Cons: *It's difficult to standardize names on a single device (e.g. the local file system of a laptop) let alone across multiple devices. Sometimes it is not possible. File naming schemes evolve and might get out of sync between devices, hampering naming consistency.*

** After Round 5, this item was created by merging two similar practices: "Standardize file and/or folder names" (MVP=12, for=8, against=2) and "Standardize file and/or folder names across devices" (MVP=10, for=8, against=1).*

It depends... (7 for, 4 against):*

11. Rely on search to find information

Search can be very helpful when the location of the information is uncertain or if there are many files to consider. However, search tools typically present results in a list, without the same cues of the surrounding context of files and folder structure. This can limit serendipitous discovery of information. In addition, current search tools are not always well-integrated with applications and may not support the types of information that users may wish to search. Further, when information is old, poor memory of the information might make it difficult to come up with accurate search terms. When needing to re-find information, if the location is known, it is probably easiest to navigate through the folder structure. However, if navigation fails, or if the location is uncertain (e.g., older files), search can be very useful.

Pros: *Effective particularly when don't know where information is stored.*

Cons: *Depends on quality of meta-data captured. Might increase the number of false-positives. Depends on ability to remember name or non-location-based properties of the information.*

** In Round 3, this was part of a larger item that included "Organize information using a small number of large folders (#9)". The for/against votes shown are for the original item.*

It depends... (7 for, 1 against):

12. Store research papers in bibliographic management software

Whether research papers should be stored in specialized bibliographic management software depends on the type of functionality of the software. Typically bibliographic management software does two main things: 1) citation management, and 2) document storage. PIM panelists tend to agree that these

systems are very handy for formatting bibliographies etc. There is no consensus on storing documents using this type of software. While some respondents use bibliographic management software for citation and document management, other respondents rely on subscription-based bibliographic databases to find and re-find information, or store papers in designated folders. Newer tools like Zotero or Mendeley are making it easier to enter information as well as share with colleagues. Finally, this practice can really only be recommended to those handling scholarly citations regularly in academia or business, e.g.: students, researchers, analysts.

Pros: *Support generation of bibliographies. Share info via export/import. Improve re-finding of citations.*

Cons: *Generally more effort required to put papers in. No consensus on the right tool for collaborative work.*

It depends... (4 for; 1 against):

13. Structure subfolders according to standard sections of a document (e.g. academic folders match CV sections)

There is no consensus as to whether people should structure subfolders according to standard sections of a document. There is not even consensus about the interpretation of the practice of structuring subfolders according to standard sections of a document (e.g. academic folders match CV sections). If this practice is interpreted literally, the folder structure is informed by an important document (CV, tenure and promotion letter) so that information that goes into creating these documents can easily be found. Some panelists use this practice, others do not.

Pros: *Helps re-finding if structure is commonly used.*

Cons: *Hard to figure out what common structure to use. Some files and folders, especially temporary ones, may not match standard documents.*

It depends... (7 for, 4 against):*

14. Organize information using a small number of large folders

The idea behind this approach is to save information into only a few folders, as opposed to a more traditional folder hierarchy that may include many folders. As a result, each folder tends to acquire larger numbers of files. Benefits of the approach are that it can require less effort to save information due to the simpler organizational scheme. However, since folders contain more items, this approach can increase reliance on search tools for retrieval. In addition, many panelists saw value in having a logically structured file system that is not limited to just a small number of large folders; organizing information into folders allows easy visualization of the structure and can help users to understand their work. Personal preferences and the availability of powerful search tools play an important role in choosing this approach.

Pros: *Requires less effort to save info due to simpler organizational scheme.*

Cons: *Might increase the number of items per folder, making some re-finding tasks harder.*

** In Round 3, this was part of a larger item that included "Rely on search to find information (#11)". The for/against votes shown are for the original item.*

It depends... (5 for; 1 against):

15. Use tags to label files & folders in several different ways

Notwithstanding numbers for and against, there was considerable ambivalence among PIM panelists regarding tagging and even those who recommended the practice did so only with caveats such as "90% of the time I don't use tags" or "only if you can be systematic". No panelist indicated making widespread use of tags. The one "advise against" position noted that tags can be a "time sink". But similar sentiment was voiced by ten other panelists who took a neutral position with comments such as "doesn't work for me", "tricky" or takes "effort". Some respondents use tags within certain applications but nobody spoke in favor of adding tags to file names in general. Several noted that, though the basic semantics of files and folders are supported across operating systems and cloud storage services, the same is not true of tags.

Pros: *Allows placing multiple tags per item leading to richer representations in support of search and use.*

Cons: *Tags take effort to use consistently and can be a "time sink". Work invested in one system or service may not "translate" if information is moved to another.*

It depends... (5 for; 2 against):

16. Re-find by searching within the top level folder of a branch where a document is likely to be

The decades-old debate over "browsing" (e.g. navigation by folder structure) vs. search as the "best" way to return to personal information has been usefully restated: How best to use search (e.g. type a few "key" words, hit return, select from results list) in combination with folder structure. The answer depends in part on how confident the individual is that the information is "where" (in the folder) they think it is in. But partly the answer also depends upon tool support. Some people may still prefer navigation as a primary means of return with search used only as a second (or even "last") resort and then with broad scope (e.g. top-level or "Documents"). (see also Recommendation #11).

But with better tool support comes more artful combinations of search and navigation. Searching within a folder can be a useful way to establish scope and so restrict the number of results to be sifted through. If the scoped search fails, it can be broadened (or made "top-level"). However, some tools (e.g. Spotlight) now support a best of both: Global search but with results organized by folders so people can quickly narrow to the folders where their information is likely to be.

Pros: *Simple to implement, and reduces the number of results to read through.*

Cons: *Knowing a general file location increases the chance of finding the file by browsing, occasionally precluding the need to search. Can't count on remembering location, however.*

It depends... (3 for; 3 against):

17. Place keywords into file & folder names to aid later search-based retrieval

The insertion of keywords into file and folder names to aid later search-based retrieval might work in selected instances (for example as a way to "tag" article PDF files by author, date, topic, etc.). But in general the approach appears to be more trouble than it's worth, and it is not commonly used. The primary alternative is utilizing full-text search across the file contents if folder navigation is not sufficient.

Pros: *As with tags, allows multiple keywords to be used in one item.*

Cons: *Hard to maintain and consistency is difficult to ensure. Difficult to recognize file with name as keywords.*

Not recommended (1 for, 9 against):

18. Let a "smart system" figure things out for me (e.g., "iPad hides structure, which works fine for me").

"Smart" systems for information organization can be of two kinds: 1. continued support of the location-based folder model only "smarter" (e.g., through suggestions concerning filing and organization). 2. eliminate (or hide) the folder model altogether (e.g., iTunes). PIM panelists do not trust either approach. Guessing the right folder organization is extremely difficult and mistakes can be very annoying to the user. Systems that eliminate or hide folders only work in special circumstances (e.g. for music) or when information is "low stakes" (i.e. the costs of mistakes in organization are not so bad). But a kind of information such as photos or music may be "low stakes" to one person and very "high-stakes" another. Panelists comments overall make it clear that they do not trust and or like "smart systems" for organizing personal information. They do not believe systems are smart enough to be reliable nor do benefits compensate for the loss of user control.

Pros: *Potentially reduces the tedium, time and cognitive work of filing. May work well in cases where number of items is small (hundreds or low thousands) or when all items are well-described by a small common set of attributes (e.g., "artist", "album", "song").*

Cons: *File location is lost as attribute for retrieval. Frustrating to users not know location of information. Loss of control. No system is currently smart enough to be worthwhile.*

Category 3: Reminding, managing attention, tasks/to-dos

Practice	Round 5 MVP	Round 3 For	Against
19. Use calendar events to represent the future and to remind of tasks and aid in completion	13	6	1
20. Use email inbox as to-do list (including use of flags and unread status as reminders, or maintaining a single "to-do" email)	9	10	1
21. Maintain a single, 'master' list of all tasks/to-dos	9	7	1
22. Keep windows and tabs open as a reminder to do something (i.e. they require attention before being closed).	9	6	2
23. Use leading characters in file and folder names to bring important information to the top or to send old / inactive information to the bottom (e.g., "aaa-", "zzz-").	7	9	2
24. Keep a simple to-do list in a generic application such as word processor (e.g. Word) or spreadsheet (e.g. Excel)	7	6	2
25. Keep a simple paper-based to-do list (e.g., in a notebook or in note cards).	5	8	3
26. Duplicate critical task information across applications and devices (e.g., to-do as both email and calendar item)	5	4	3
27. Multi-task (e.g., do simple tasks while watching TV)	4	7	3
28. Use a special-purpose task management system (e.g.,Wunderlist, Things)	3	3	2
29. Use a desktop feature (e.g., Finder's 'sidebar') to organize currently active work items	3	2	1

Table 4. Consensus statements for the Finding, Managing Attention, Tasks/To-Dos category.

Recommended (6 for; 1 against):*

19. Use calendar events to represent the future and to remind of tasks and aid in completion

For future intentions, a person's calendar can provide a simple kind of task management, not only for scheduled meetings and appointments, but also to set aside time for task completion (e.g., "finish report"). People should consider setting aside blocks of time for personal tasks, and can often include in the calendar event description (i.e. as text, links or attachments) much of the information needed to complete the task. However, it should be noted that "meetings of intention" may be more easily missed or re-scheduled than meetings that involve others. To better ensure task completion, therefore, this approach should be used as a supplement to other approaches for task management. Also, while effective for deadline type scheduling, people who must manage a larger number of tasks or tasks with no fixed deadline might instead consider a more formal task management. (see recommendations #28 & #21).

Pros: *Mark intentions, temporary meetings, and alternative possibilities. Remind of critical events. Can often be searched.*

Cons: *Limited to chronological information. Must be maintained to be of use.*

** In Round 3, "Use calendar events to represent the future" was part of a larger item that included "and use calendar events to represent the past (#4)". It was split to allow commenting on the different component practices. The for/against votes shown are for the original item. After Round 5, this item was created by merging two similar practices: "Use calendar events to represent the future" (MVP=13, for=6, against=1) and "Use calendar events to remind of tasks and aid in completion" (MVP=8, for=13, against=2).*

Recommended (10 for; 1 against):

20. Use email inbox as to-do list (including use of flags and unread status as reminders, or maintaining a single "to-do" email)

Using email messages to keep track of "things to do" is a common and recommended practice, especially when "to-do" messages are consistently marked as unread or with a flag. However, many people's email inboxes are already overloaded and there are limited ways to prioritize, organize, and set reminders with those to-do messages. In addition, messages can get lost in the constant shuffle of email. People with a great many to-dos might consider a separate solution such as a single document or outline listing to-dos or possibly a special-purpose task management system (see recommendation #25).

Pros: *Easy to implement and learn. Is in an accessible location.*

Cons: *Contributes to overload of email inbox. Can get lost in one's flood of email. Fragmentation may occur as not all to-do tasks are in email form, and multiple email accounts produce multiple inboxes.*

Recommended (7 for; 1 against):

21. Maintain a single, 'master' list of all tasks/to-dos

Some people, especially in managerial positions, may be able to rely upon those around them (possibly even including an administrative assistant) for reminders concerning tasks that need to be completed. But most other individuals will benefit from the ability to view all (or most) of their key tasks and to-dos items into a single place. This allows them to see all of their commitments and prioritize across tasks. To minimize the overhead of maintaining the list, it should be accessible across devices and locations so it can be updated or accessed from anywhere. Systems that may work for this include: an online note taking tool (such as Evernote or OneNote), a file synced in the cloud, a draft email, or a paper notebook that is carried everywhere. People may also find it useful to limit the scope of their master list, including only key items and controlling the list's length rather than trying to create a complete, comprehensive list that includes fine-grained daily activities and that may prove to be overwhelming. Items on the master list might also serve as a basic reminder and a reference to other project-specific documents with more detailed task breakdowns.

Pros: *Provides overview of all tasks and allows user to get big picture view of task space.*

Cons: *List takes time to maintain and update. Sharing with others is a problem. Can be especially difficult to keep in sync with a calendar (also commonly used as a way to remind and carve out time for tasks to be done).*

Recommended (6 for; 2 against):

22. Keep windows and tabs open as a reminder to do something (i.e. they require attention before being closed)

There is a common agreement that the practice of keeping windows and tabs open as a reminder to do something is useful but fragile with the lack of support in the OS, particularly when there are multiple tasks or when the tasks span multiple sessions. The problem is that although some browsers or OSs restore systems to a previous state, this feature doesn't always work perfectly nor does it work well when the system crashes. One respondent admitted that (s)he was unclear how to save a window of tabs making relying on the system to reinstate them risky. It is therefore suggested that this practice is most useful for the short term. Another problem is that the project context of the tabs is lost and one has to cycle through all tabs to see what is there, which is inefficient. Some respondents resolve this by using one desktop per project (on Mac OS) to preserve context, or using the *grouptab* feature, which allows users to bundle related tabs together and hide them so as to not clutter the desktop. Some browsers *(e.g. Chrome)* have performance issues when too many windows are open.

Pros: *Easy to get back to task after being reminded of it.*

Cons: *Not all browsers restore windows properly across sessions, and using many windows and tabs may clutter workspace and degrade performance.*

Recommended (9 for; 2 against):

23. Use leading characters in file and folder names to bring important information to the top or to send old / inactive information to the bottom (e.g., "aaa-", "zzz-")

The use of leading characters in file and folder names is good technique for controlling the position of a small number of files or folders in a directory display. Adding “aaa” to a file name will put the file at the top in a file folder structure organized by name. Similarly adding “zzz” to a file name will sort the file at the bottom of the list. However, this approach is not recommended as a strategy for organizing or sorting a large set of files or folders (e.g., all the files in a directory) because changing the ordering at a later time could require changing many items.

Pros: *Quick way to move important files to the top and archived files to the bottom of file list. Works well with default alphabetical sorting.*

Cons: *Changing this organization scheme in large file sets could be labor intensive.*

It depends... (6 for; 2 against):

24. Keep a simple to-do list in a generic application such as word processor (e.g. Word) or spreadsheet (e.g. Excel)

Keeping a simple to-do list in a generic application (as opposed to a dedicated to-do or reminder application) is effective in many situations, especially when the application is easily accessible or is already part of a routine PIM activity. Generic applications allow flexibility and simplicity, and panelists noted that they work well for recording work assignments after meetings or sharing work tasks among a small group of collaborators. Whether or not the to-do list will be shared plays a role in what generic application may be best suited (e.g., email, word processing document, spreadsheet, Google doc). In contrast, some panelists recommended using dedicated applications such as Wunderlist because they help to keep to-dos organized in one place, have support for sharing, and support cross-device synchronization. Other panelists recommend the old fashioned paper to-do list (see #25) or email (see #20).

Pros: *Centralized location is easily referenced, can be made accessible (e.g., in cloud). Easy to send document to others.*

Cons: *Does not support reminding as list might be hidden in application. Requires integrating the list into one’s PIM routine.*

It depends... (8 for; 3 against):

25. Keep a simple paper-based to-do list (e.g., in a notebook or in note cards)

Keeping a paper based to-do list (e.g. in notebook or as a stack of notecards) is useful for many situations, such as short term to-dos, attaching to-dos and reminders to locations, capturing notes while being away from technology, and to focus attention on priority to-dos. A paper sheet of to-dos for people working on-site can also be an effective way to share what has been done (crossed off on the list but still visible) and what remains to be done. Paper notes do not require electricity or Internet

connectivity. Nevertheless, paper can be lost, can be bulky, and is less easily backed up and not easily shared across distances. (See also #19 for the electronic to-do list, and email to-do list #20).

Pros: *Complements other task management. Easy to carry and manage. Easy to discard. Is flexible--can be placed in visible locations.*

Cons: *Difficult to update (change). Can be easily lost. Does not integrate well with digital information. Requires updating complementary system.*

It depends... (4 for; 3 against):

26. Duplicate critical task information across applications and devices (e.g., to-do as both email and calendar item)

Duplication is often unavoidable across email, calendars, spreadsheets, and notes (whether in a special-purpose app like Evernote or simply in a text or Word document) and reflects a lack of integration among current tools. Duplication is recommended in particular for critical tasks as a way to build in fail-safe redundancy. However, duplication can take different forms. Best is either if copies can be properly synced or, absent this, if duplicates can take the form of a link (or simple text reminder) that points back to the correct/current information needed to complete the task.

Pros: *Duplication provides extra reminder of critical tasks.*

Cons: *Extra work and opportunity for error to creep in.*

It depends... (7 for; 3 against):

27. Multi-task (e.g., do simple tasks while watching TV)

Multi-tasking is a common practice. But instances where two tasks requiring attention can truly occur in parallel are rare. In many other instances, multi-tasking means task switching. People may, for example, read email during a meeting or while watching TV. People may hope to get more done in the same period of time but run the risk of doing one or both tasks more poorly e.g., an important comment in the meeting is missed and the email response is poorly written as well. People may also do a kind of multi-tasking as a way of initiating a difficult, unpleasant or boring task as, for example, when people initiate the task while music or the TV is playing in the background. Some panelists expressed the thought that multi-tasking got more difficult with age and that they were more inclined now to do one task at a time. A key to effective multi-tasking is to combine tasks fruitfully. Ideally, background tasks would not require much active attention and leave most attention and concentration for the primary task. There are some concerns about people having too many tasks, or too many interruptions, and not being able to focus in depth on tasks requiring concentration and focus.

Pros: *Possibly a way of getting more done in a period of time.* A pleasant background task may make it easier to initiate a big, unpleasant main task.

Cons: *Fragmented attention can mean both tasks take longer and are done more poorly. One can get drawn into the secondary task to the detriment of the primary task. For some, multi-tasking (task switching) may become more difficult with age.*

It depends... (3 for; 2 against):

28. Use a special-purpose task management system (e.g., Wunderlist, Things)

Most respondents were neutral or abstained commenting on this practice. Generally respondents did not use this type of system. Special applications are likely to require more effort to learn, maintain and use consistently over time than they return in benefits. Also, there are as yet no dominant players and no assurance an application used today will still be available or useful in the future. Another thing to consider is whether the task management tools are integrated with other applications, which would be useful, or are completely stand-alone. This practice is recommended only for exceptional cases, such as event planners or personal assistants needing to track a great many, time-critical tasks.

Pros: *System specifically tailored to managing tasks (with tracking and task sharing features) and allows tasks to be collected in a single place. Takes task management load off other applications such as the calendar or email.*

Cons: *Cost of learning to use system (while it might be easy) and no guarantee that the tool will be around for an extended period of time. Consistent tool use requires discipline and time.*

It depends... (2 for; 1 against):

29. Use a desktop feature (e.g., Finder's 'sidebar') to organize currently active work items

Few people use desktop features such as Mac OS's Finder's sidebar or MS Windows recent items folder to organize active work items. Those that do say that it combines a visual reminder with instant access to the content and it is easy to add/remove. While the sidebar requires action on part of the user to put the work items there, the "recent items/folders" can be used without the need of management. Not all respondents trust the smart system approach to determining what should be in the "recent items."

Pros: *Desktop provides visual reminder of current important folders and files and provides direct access to these items*

Cons: *Active work items that are automatically gathered in "recent items" might disappear automatically (e.g. if a certain threshold of recent items has been met).*

Category 4: Managing Versions, Controlling Clutter & Combating Fragmentation

Practice	Round 5 MVP	Round 3 For	Against
30. Store files in the cloud (e.g., Dropbox, OneDrive, Google Drive)	17	13	0
31. Add characters or words to file names – usually trailing – to represent the “who”, “when” or recency of a document (e.g., "v1" or "final" at the end of a file name)	10	14	1
32. Archive old/inactive information into designated subfolder (e.g. "archive")	8	10	0
33. Store persona information (e.g., username and log-in details) in a single file	5	5	5
34. Use email as a file system (i.e., to store and access files across devices)	3	2	1
35. Avoid multiple devices; use a single device (e.g., laptop) no matter what	1	4	8
36. Use a dedicated version control system (e.g., Subversion, Git)	1	1	4

Table 5. Consensus statements for the Managing Versions, Controlling Clutter & Combating Fragmentation category.

Recommended (13 for, 0 against):

30. Store files in the cloud (e.g., Dropbox, OneDrive, Google Drive)

Cloud storage services are a great method for accessing files from multiple locations/devices and for collaboration. Cloud storage services are also very useful for backing up files. There can be issues however with collaboratively managing the files stored in the shared space. Also, users must be aware of security and privacy risks and make decisions about what types of information they are willing to store in cloud services (there may be regulatory and institutional policies and restrictions as well). Some panelists recommended against storing confidential files in the cloud. As with any system, users are advised to make separate and regular backups of data stored in cloud storage. Use of cloud storage

services can also create challenges related to fragmentation of individuals' digital identity, and how these identities are linked to specific cloud services.

Pros: Great for collaboration. Good for backup and accessing files from multiple locations/devices.

Cons: Issues with collaboratively managing the files stored in the shared space. Concerns about privacy and security of storing information in the cloud. Still have to make up your own backups just in case.

Recommended (14 for, 1 against):

31. Add characters or words to file names – usually trailing – to represent the "who", "when" or recency of a document (e.g., "v1" or "final" at the end of a file name)

Use of file names (especially by adding suffixes such as v1) is a simple way to keep track of versions for those who aren't prepared to invest the time and effort to use a more formal version control system. Standardizing naming conventions is helpful, particularly for those working in collaboration with others. Alternative practices including emailing a copy of the file with additional information or keeping copies elsewhere. More formal version control systems provide better, more consistent support for versioning but require training and ongoing effort. Consequently, formal systems are not currently recommended. Successful version control systems exist for software repositories (GitHub), and in the near future version control systems for file storage applications may increasingly be supported in applications such as Dropbox, Google Drive and One Drive. (See also #36).

Pros: A simple effective way to track versions (v1, v2, v3….) and, in group work, who was the person to last work on a document (e.g., through person's initials)

Cons: Conventions are often jumbled and people in collaboration rarely discuss and agree to conventions ahead of time. File names may "lie" as in "-Final" and "-ReallyFinal".

Recommended (10 for, 0 against):

32. Archive old/inactive information into designated subfolder (e.g. "archive")

Archival of old/inactive information into a subfolder of the project folder is a practical way to reduce clutter and is a recommended practice for the majority of people who have an abundance of digital storage. For those who archive not only to reduce clutter but also to reduce the use of storage (e.g., readily accessible storage) alternate archival plans should be considered -- e.g., designate a parallel archival storage (cheaper, less accessible) for all old information but maintain a parallel organization to that used to for active information. Alternatively, archive not only within projects but also archive whole projects -- these when completed might be placed in cheaper, less accessible storage.

Pros: Simple way to get old information out of the way but still nearby and "available" just in case (though a case for its need may rarely arise).

Cons: *Information archived is harder to find. Archival takes (at little) time and trouble.*

It depends... (5 for; 5 against; the remainder neutral or abstaining):

33. Store persona information (e.g., username and log-in details) in a single file

Security experts recommend using strong passwords and to use a different password for each account. Managing such personal information (e.g. usernames and passwords) presents challenges for many users. While it is important to have some type of secure method for storing personal information, the panel did not reach a clear consensus about how to do so. Some felt that it was more secure to keep a written list in a secure location as compared to an electronic list that could be hacked. Even in case of an electronic list it is considered useful to have a paper backup of this list. Others relied on password managers such as LastPass and KeyPass that store passwords in encrypted formats. One panelist suggested storing password "hints" rather than the passwords themselves. Another suggested using certain "rules" to generate passwords so that they are remembered more easily. One respondent relies on filling out the "forgot your password?" forms for accounts that are hardly used. When one does need to use these accounts you get your password reset or sent to you by email. Panelists also noted tradeoffs in security, convenience, and accessibility, and that the type of account (e.g., financial account versus journal reviewer site) plays a role in their strategy for managing personal information.

Pros: *Convenience of having all personal information in a single place (the file should still be protected/encrypted in some way).*

Cons: *A single file could become lost or corrupted, and any singular source may be susceptible to hacking.*

It depends... (2 for; 1 against; the remainder neutral or abstaining):

34. Use email as a file system (i.e., to store and access files across devices)

Services like Dropbox and OneDrive have eliminated the need to use email for file system functionality (such as storing and accessing files), and files should generally be managed through one of these systems rather than an email client. However, because many users have email easily accessible at all times and across all devices, it can serve as a quick-and-dirty way to transfer, share, or archive files. Email may be particularly useful in this way for emerging projects where the files do not yet have a place in the individual's file system.

Pros: *Simple way to exchange documents across devices; emails -- in sender, date and message body can provide metadata for an attached document. Short-term backup.*

Cons: *Missing many features of file systems; outdated practice given web services such as Dropbox, Google Drive, OneNote, etc.*

Not recommended (4 for, 8 against):

35. Avoid multiple devices; use a single device (e.g., laptop) no matter what

It is not recommended that users limit themselves to a single device. Almost everyone uses multiple devices and that is unlikely to change in the near future. Rather, it seems likely that the number of devices people manage will *increase* with the proliferation of mobile, wearable and special purpose devices. Utilizing cloud-based storage for personal information can help reduce the confusion and clutter of interacting with many different devices. It will become increasingly important for device makers to provide a consistent user experience in accessing cloud based information from different types of devices, so that users do not have to become expert in many different interfaces. In some cases, users may find partial specialization among devices to be helpful (e.g. only do work on a work-issued laptop, only listen to music on the smartphone).

Pros: *Using one main device (e.g. laptop) for extended computing work can help to "maintain mental health" (i.e. we're not tempted to do work in social situations). Everything is in one place and you only have to bring along one device, one charger etc.*

Cons: *Limiting ourselves to a single device seriously limits our options and access to information in different settings. Some devices are better for certain situations than others.*

Not recommended (1 for, 4 against):

36. Use a dedicated version control system (e.g., Subversion, Git)

A dedicated version control system like Git or Subversion might work for programmers who are already familiar with such systems and the discipline involved in their use (and working with information primarily in textual form). But such complex systems are not ready for widespread use in PIM. However, simpler, easier to use forms of version control are supported in services such as Dropbox and Google docs, which automatically save versions of files (up to a point) and allow users to access older versions if needed. (See also #30).

Pros: *More formal way to manage and establish (through log information) who did what when and which version is the most up-to-date.*

Cons: *Difficult to learn and to use. Doesn't do well with non-textual information (i.e. pictures, songs and other binary files).*

Near Future Recommendations

The final part of Phase 2 asked each panelist to list recommendations for changes to PIM systems that would be impactful and reasonable to achieve in the next five years. As part of the conclusion to Round 5, 44 recommendations were collected and these were grouped by the four categories used to organize recommendations. The count shown in parenthesis next to each title represents the number practices recommended by panelist and summarized here.

Finding and Organizing Information (19 near future practices recommended)

In this group, several recommendations focused on improving file systems. A common request was that file systems should better support users (and tools) in associating meta-data as part of files and folders to help in organizing the information. This meta-data could also be used for cross-linking purposes, possibly bringing together local and cloud-based files. There were also suggestions to revamp file explorers (i.e., Finder in OS X, Explorer in Windows). File systems/explorers should allow users to explicitly promote or demote items, and support not only extensionally defined folders, but also intentional ones (e.g., folders based on "queries" that logically group items created on a given date or by a particular person), thus helping automate the organization of folder contents. Another common request was for better search support in file systems, for example, by providing users more control over the searches (e.g., limit to particular folders).

> ***Common themes:*** *enhanced file systems, better support for organization, better use of meta-data*

Managing Versions, Clutter, and Fragmentation (8 near future practices recommended)

This group of near future recommendations focused on needs for improved synchronization of files across devices, version control, and cross-linking of information. The suggestions underscore problems users face in managing information stored in different locations and devices. Panelists described needs not just for personal files, but also for sharing files with others. Panelists suggested developing versioning systems to help users maintain awareness of current file versions, and noted that a key aspect is the need for more usable version control systems. In cases where turn-taking is still the preferred means of collaborative authoring, for example, systems might more directly support the creation of "snapshot" versions (e.g. identified by the who, when and what was done) prior to transfer from one author to the next.

> ***Common themes:*** *cross-application data exchange, file sharing, file system synchronization*

Reminding, Managing Attention, Tasks, and To-Dos (8 near future practices recommended)

Common suggestions in this category included easier capture of tasks, the ability to more effectively record and use notes via speech, and features to help in annotating folders. Panelists

highlighted the need to integrate or cross-link to-dos with other information items. To accomplish tasks, panelists described needs to associate resources with to-do items. Desired associations included email and calendar, notes and projects, and the flexibility to integrate any other resources needed to carry out a task. One participant requested an easier way to break down larger tasks into smaller ones in order to get more work done.

Common themes: *information integration, information linking*

Information Capture and Retention for Later Use (2 near future practices recommended)

The few recommendations in this category complemented other categories. For example, participants requested flexibility in application schemas so that users can add extra information to any application or document. This would in turn allow for more focused search and filter options. An interesting request was for increased support for features that support reflection in task management and calendar applications. A person could learn about their own practices through reflection on their prior activities.

Common themes: *information schema, task management*

Other (7 near future practices recommended)

Several interesting recommendations did not fit neatly into our existing four categories. These included: adding PIM to K-12 education, improving security and privacy for data in the cloud, and integrating voice input and analysis into more applications.

Conclusion

This report describes an application of the iterative Delphi Method [12,18,19,21,25] to fill a "prescriptive" gap in more formal research. Rather than studying people's PIM behavior, the report describes a study that involved a different kind of participant: the researchers themselves, who study people in their daily practices of PIM. Drawing upon direct experience and observation across many studies, report participants considered:

1. Which of the many everyday practices of PIM had sufficient usage to warrant closer examination,
2. What considerations, costs, and benefits apply to each practice, and
3. Which practices should be recommended or discouraged given reasonable assumptions about current tool support and given a targeted user population of white-collar professionals[i]

The report makes several specific contributions:

- The report presents details of an application of the Delphi Method and show how it can be used as a tool for human-computer interaction (HCI) research. The report shows how the method can be used to identify common user behaviors and practices in a domain (e.g., PIM). Where there is an achievable consensus among domain experts (e.g., PIM researchers), the Delphi Method provides an effective means to reach this consensus. And where not, the method makes explicit the reasons why not.
- The report presents a set of 36 PIM practices identified via the Delphi Method, along with pros and cons and recommendations (for/against) for each practice. These practices and recommendations have immediate practical use for individuals and organizations to inform their day-to-day information management needs.
- Further, the report's use of the Delphi method guides towards future research and development in two ways: 1. Recommendations based on expert consensus often relate to PIM practices that are not designed for in current tools and point to "low hanging fruit" for tool improvement. 2. Practices where consensus is not achieved or "it depends", point to areas where limited resource available for empirical research might be most fruitfully applied.

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Appendix: Background and Literature Review

In many human endeavors practice proceeds of necessity, only occasionally to be informed and improved by principles elucidated from formal study. Such is true for personal information management (PIM), which is defined to be "the practice and the study of the activities people perform to acquire, organize, maintain, retrieve, use, and control the distribution of information items such as documents (paper-based and digital), Web pages, and email messages for everyday use…" [14:1].

The phrase itself was coined less than 30 years ago [17]. But phrase or no, people have been practicing PIM of necessity since ancient times. Logs, journals, ledgers, marginalia – even the proverbial string tied around the finger – are all, more generally, examples of PIM activity.

Though the practice of PIM is ancient, its importance has dramatically increased in modern times as, ever more so, the content of our perceptions and actions is mediated by information in one form or another. Discussions of information overload, personal storage in the "cloud", time and task management, privacy, security, etc. are testament to the practical importance of PIM in our daily lives.

Research has increased considerably our understanding for how people manage information and the problems they encounter as they do so. But studies are necessarily limited in scope and can only assess and evaluate a few of the many situations of PIM activity and tool use that occur "in the wild." As a result, few specific guidelines for the everyday practice of PIM have emerged from formal study.

A selective review will help to illustrate the nature of the questions addressed and partially answered by formal research. People differ dramatically in their tendencies to organize [9,24]. Studies over the years report a strong preference for navigation vs. search as the primary method for the return to personal files that endures notwithstanding the improvements in desktop search [1,5]. On the other hand, people are increasingly disinclined to invest in the organization of emails into folders for use in navigation [23] opting instead to use search as a primary method of return to email [15].

People keep information in a wide variety of ways and according to best guesses of later use [10,13,16]. People tend to organize information – especially digital files – by project [9]. Notwithstanding organizational efforts however, fragmentation of information, by tool and device, is a major concern [4]. People often eschew the expressive freedom and flexibility of tags in favor of the familiarity and, it might be said, the *universality* of folders [6,11]. Similarly, people often prefer to manage tasks and to-dos in an ad hoc manner using another universal form of information in our digital age -- email [2,3].

Some studies carry practical implications for everyday PIM suggesting, for example, that for faster retrieval, people might limit the number of items in a folder to less than 22 [7] and might well use the icon view rather than the details view[8]. However, formal research addresses only a fraction of the choices people face in everyday PIM.

The work presented in this report complements traditional research by bringing together many of the PIM researchers involved in these studies with the intent of being *prescriptive* concerning a broad range of everyday PIM practices. Through both self-reflection and formal studies, researchers have acquired

considerable practical knowledge concerning practices of PIM. What are these practices? Which seem to work? For whom, and under what circumstances? Which practices should be avoided?

Codifying this knowledge could have considerable practical value. Furthermore, it is hoped that the findings might offer a useful point of departure for more formal investigation, especially into areas where researchers have not achieved consensus. Moreover, practices that work *in spite* of current tool support, may carry implications for "low hanging" fruit to be addressed in prototyping efforts.

The Delphi Method

Efforts to achieve consensus among PIM researchers are based upon the *Delphi Method* [12,18,19,21,25], a widely-used process for achieving consensus. Noting its potential application to the study of human-computer interaction (HCI), Mankoff *et al*. describe the method as a means of "collecting the views of people (typically, experts) through iterative dialog" [20:1634]. The Delphi method is a way "to allow access to the positive attributes of interacting groups (knowledge from a variety of sources, creative synthesis, etc.) while pre-empting their negative aspects" [21:354] such as, for example, might emerge in the group dynamics of a conventional focus group.

The Delphi method is perhaps more accurately regarded as an approach rather than a well-defined procedure. Indeed, though Linstone & Turoff have written extensively on the method over the years [18,19], they avoid giving a detailed definition for the method, observing in one edited book that "... if we were to attempt this, the reader would no doubt encounter at least one contribution to this collection which would violate our definition." [18:3]. Though consensus among experts is often an objective of its use, Turoff argues for utility in the method even when consensus is not achieved noting that the goal may be "to establish all the differing positions advocated and the principal pro and con arguments for those positions"[22:153].

Across the many variations in its application, four features characterize the Delphi Method: *statistical aggregation, anonymity*, *iteration*, and *controlled feedback* [21]. Statistical aggregation may be quite elaborate in studies involving a large number of participants. But the number of participants (often called "panelists") can be quite small (e.g., 20 or fewer). In these cases, statistical aggregation may be a simple mean or median of participant responses or a tally of those "for" and "against" a position. Similarly, though anonymity can be critical in certain rounds of the Delphi process it is sometimes waived in other rounds to, for example, improve participation and compliance [25].

More essential for the Delphi method are the features of iteration and controlled feedback. The Delphi method involves at least one but often several iterations in which a *facilitator(s)* initiates the current round of discussion with a summary of results from the previous round. Consensus or an understanding of the differing positions is then given an opportunity to emerge.

[i] Per instructions, participants were told to imagine meeting someone at a cocktail party or some other social event who then asks for practical advice on how do PIM better.