

# **SUPPORTING DIGITAL SCHOLARSHIP AND INDIVIDUAL CURATION BASED ON A MEME-AND-CLOUD-BASED PERSONAL KNOWLEDGE MANAGEMENT CONCEPT**

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Recent papers argue for advancing autonomous Personal Knowledge Management Systems (PKMS) which also enable their users to engage in cloud-based creative conversations. This shift from centralized organizational systems to networked decentralized individual devices is accompanied by substituting traditional document-centric repositories with meme-based knowledge bases allowing for information-rich, multi-dimensional information structures and trails as well as for more elaborate dissemination concepts and knowledge tracking systems. The novel approach - supported by a prototype system - incorporates a number of appealing opportunities in the educational and professional context of publishing, digital scholarship, curation, and mentorship.

**Keywords:** Personal Knowledge Management (PKM), Digital scholarship, Personal curation, Memes, knowcations.

## **In Need of Personal Knowledge Management Systems**

After contemplating knowledge acquisition's past and present, Gaines (2013) draws attention to the rivalry between the two dominating paradigms of human knowledge processes, "the accumulation and dissemination of relatively unstructured knowledge and skills through experience, education, and access to literature, as supported by the web in general, and the principled encoding of that material in a logico-mathematical inferential framework as supported by the semantic web" and predicts "that bridging between them will become an increasingly significant area of research and development, and one with major surprises beyond any that we might reasonably expect at this stage."

Although the novel meme-based concept and cloud-based realization of the Personal Knowledge Management (PKM) concept to be introduced fit the bridging metaphor well, the very need for such a solution was already expressed seven decades ago. Vannevar Bush (then President Truman's Director of Scientific Research) imagined the 'Memex', a hypothetical sort of mechanized private file/desk/library-device. It is supposed to act as an enlarged intimate supplement to one's memory, and enables an individual to store, recall, study, and share the "inherited knowledge of the ages". It facilitates the addition of personal records, communications, annotations, contributions as well as non-fading trails of one's individual interest through the maze of materials available - all easily accessible and sharable with

the ‘Memexes’ of acquaintances (Bush, 1945). Unfortunately, Bush’s vision of the Memex, so far, has remained unfulfilled (Davies, 2012; Osis, 2011; Kahle, 2009).

The ‘personal’ feature of the PKM concept – as a recent paper details – does not only trail Bush’s notion but also addresses more recent concerns regarding attention management (Simon, 1971), personal autonomy (Nonaka et al., 2000), and creative conversations (Levy, 2011). As a result, an overarching PKM meta-concept has been presented (Schmitt, 2014m); based on an assimilation of over forty renowned knowledge management models and theories (Schmitt, 2015b), it serves as a blueprint for the PKM system’s design as well as for the parallel development of a comprehensive educational concept<sup>1</sup>, not at the expense of Organizational KM Systems, but rather as the means to foster a fruitful co-evolution.

A corresponding paper (Schmitt, 2014l) introduces the ‘meme-based’<sup>2</sup> grass-roots feature and the concept of memetics. What the user captures in his/her knowledge base and what is subsequently referred to, is smaller and more distinct than a whole document; it is rather a basic building block of knowledge in the eyes of the beholder (a meme). Captured ideally in a quasi-atomic state, this information-structure should be perfectly understandable alone by itself but be able to be used at any later time in combination with other building blocks stored without piggybacking irrelevant or potentially redundant information (Schmitt, 2014c).

By digitally capturing, referencing, and visualizing these memes, the PKM system allows the user to recall, sequence and combine stored units with his/her own new meme creations for integration in any type of authoring and sharing activity he/she would like to pursue. As a result, the user obtains the means to retain and build upon knowledge acquired in order to sustain personal growth and facilitate productive contributions and collaborations between fellow learners and/or professional acquaintances.

A prior paper has added a hands-on perspective to demonstrate this PKMS authorship capability by utilizing the prototype for its creation and by describing the iterative process steps involved (Schmitt, 2014d). The resulting printed or pdf copy (like this paper) shares its features with the traditional format of a book (see next section), while its internal virtual structure in the knowledge base remains multi-dimensional and information-rich.

Due to these ‘personal’ and ‘meme-based’ features, networked PKMS devices provide an overdue technology for supporting knowledge workers’ life-long-learning, resourcefulness, creativity, and teamwork throughout their academic and professional life, with particular benefits in the context of publishing, scholarship, curation, and mentorship. This paper will explore the underlying predicaments further and argue that meme-based PKMS devices are able to provide a way out of the multiple dilemmas.

What, one might ask, has prevented such a technology from becoming available earlier? The investigation points to the current paradigm, logics and logistics of centralized institutional systems thinking (Schmitt, 2014f) and the barriers and remedies identified have been condensed into five provisions for the PKMS development:

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<sup>1</sup> Levy paints a possible scenario, where Knowledge Management will – similar to the personal computer revolution – “experience a decentralizing revolution that gives more power and autonomy to individuals and self-organized groups” and stresses the need for education “to encourage in students the sustainable growth of autonomous capacities in Personal Knowledge Management” and the “need for a personal discipline for collection, filtering and creative connection (among data, among people, and between people and data flows)” (Levy, 2011).

<sup>2</sup> Memes, originally described by Dawkins (1975) as units of cultural transmission or imitation, are (cognitive) information-structures (Bjarneskans, Grønnevik & Sandberg, 1999) that evolve over time through a Darwinian process of variation, selection and transmission (Collis, 2003).

- Digital personal and personalized knowledge is always in possession and at the personal disposal of its owner or eligible co-worker, residing on personal hardware and/or personalized cloud-databases.
- Contents are kept in a standardized, consistent, transparent, flexible, and secure format for easy retrieval, expansion, sharing, pooling, re-use and authoring, or migration.
- Information and functionalities can continually be used without disruption independent of changing one's social, educational, professional, or technological environment.
- Collaboration capabilities have to be mutually beneficial to facilitate consolidated team and enterprise actions that convert individual into organizational or societal performances.
- The PKMS design and its complex operations are based on a concept, functionalities, and interventions which are clearly understood and are painlessly applied in practice.

The respective prototype supporting the concept proposed has been continuously expanded over the years and has been used personally for career support as a management consultant, scholar, professor, and academic manager. Recent advances in development and hosting platforms have now provided an opportunity for innovation and its conversion and advancement into a marketable application to be trademarked 'Knowcations'. In parallel to the ongoing migration process, a series of papers have been presented and published on various aspects over the last two year to be referred to in the appropriate context.

### **The World of Paper and PDFs versus the Web**

The traditional book format has proven “great for packaging information, convenient to thumb through, comfortable to curl up with, superb for storage, and remarkably resistant to damage. It does not need to be upgraded or downloaded, accessed or booted, plugged into circuits or extracted from webs. Its design makes it a delight to the eye. Its shape makes it a pleasure to hold in the hand. And its handiness has made it the basic tool of learning for thousands of years, [but] movable type can't move fast enough to keep up with events [any longer]” (Darnton, 1999).

“Books are [also] designed to contain all the information required to stop inquiries within the book's topic. But now that our [digital] medium can handle far more ideas and information, and now that it is a connective medium (ideas to ideas, people to ideas, people to people), our strategy is changing” (Weinberger, 2012). In contemplating the attraction of an e-book, Darnton, for example, suggests opening up “new ways of making sense of the evidence, new possibilities of making available the raw material embedded in the story, [and] a new consciousness of the complexities involved in construing the past” and to structure contents “in layers arranged like a pyramid<sup>1</sup>” (Darnton, 1999). Today's “Internet's abundant capacity has removed the old artificial constraints on publishing - including getting our content

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<sup>1</sup> A “concise account” (top layer) would be based on “expanded versions of different aspects of the argument” as “self-contained units” (second), both supported by documentations “set off by interpretative essays” (third) and “selections from previous scholarship and discussions of them” (fourth), followed by pedagogic “suggestions for classroom discussion and a model syllabus” (fifth) and “a growing corpus of commentary as the book made its way through different groups of readers” (Darnton, 1999).

checked and verified. The new strategy of publishing everything we find out, thus, results in an immense cloud of data, free of theory, published before verified, and available to anyone with an Internet connection.” As the traditional physical filters and authorities lose their grip, “we can now see every idiotic idea put forward seriously and every serious idea treated idiotically” (Weinberger, 2012).

Moreover, “our information technologies are precisely the same as our communication technologies, so learning a fact can be precisely the same as publishing a fact to the world” (Weinberger, 2012). Accordingly, any contents (or fractions of it) allow for redundant, fragmented, distorted, or incorrect copies adding to the trivial chatter populating the search engine listings and consuming our attention<sup>1</sup>. Besides, a fact or idea - once stated - does not necessarily stay unchanged any more (as previously ensured by the physics of paper).

To accommodate the traditional book format distinguished by one-dimensionality and finality, the memes captured in the PKMS’s knowledge base can, of course, be combined to result in a printed or pdf copy, just like this paper (figure 1, based on Armour, 2009):

- It is made up entirely of repurposed or newly created pieces of information (memes) being put in a sequence and assigned to particular sections. In regard to connectivity, any given meme has a predecessor and a successor<sup>2</sup>.
- Any meme might be linked to external references in order to cite other past publications, and/or might point to internal footnotes in order to reiterate or rephrase essential memes from own or other sources to achieve a physical proximity among the ideas they contain.
- Any meme might also explain other memes like charts or tables, and some of the terms used might also be included in the keywords section or, potentially, in an index or glossary.
- In an electronic paper version (pdf or web page), embedded hypertext links<sup>3</sup> can be used to ‘join’ concepts together that are physically separated in the document<sup>1</sup>.

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<sup>1</sup> In ‘Designing Organizations in an Information-rich World’, Simon pointed out already over 40 years ago that it is not enough any longer just “to know how much it costs to produce and transmit information; we must also know how much it costs, in terms of scarce attention, to receive it. [...] In a knowledge-rich world, progress does not lie in the direction of reading information faster, writing it faster, and storing more of it. Progress lies in the direction of extracting and exploiting the patterns of the world – its redundancy – so that far less information needs to be read, written, or stored” (Simon, 1971).

<sup>2</sup> “Different flavors of next-prior at different levels of abstraction [distinguish] approximate different types of connections. We group sets of concepts into sentences and then into paragraphs and into chapters. We assign different purposes to different chapters to use the physical proximity to model the logical relationship. We indent paragraphs to show decomposition or ownership and there is usually some implicit relationship of knowledge elements at the same indentation level. If we want to reinforce a sequential relationship [infer equivalence] we may assign numbers [bullets] to the paragraphs” (Armour, 2009).

<sup>3</sup> In his autobiography, Ted Nelson, widely credited with the invention of the hypertext word and its definition (Pimentel, 2012), clarifies that the current practice of “hypertext (only one-way links, invisible and not allowed to overlap) is entirely different from mine (visible, unbreaking n-way links by any parties, all content legally reweavable by anyone into new documents with paths back to the originals, and transclusions as well as links - as in Vannevar Bush's original vision)” (Nelson, 2011).

Before elaborating on the advanced richness of the meme-based PKMS structures, related scholarship and curation issues will be investigated.

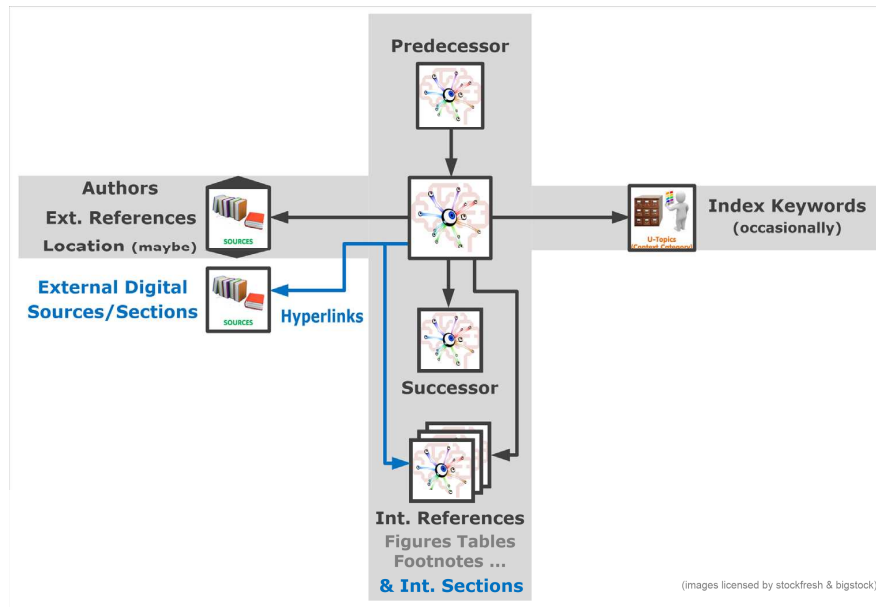


Figure 1: Traditional Book Format enhanced by one-directional Hyperlinks (Schmitt, 2014j)

### Scholarship: Giants' Shoulders and Social Endeavors

“Scholarship is a cumulative process, and its success depends on wide and rapid dissemination of new knowledge so that findings can be discarded if they are unreliable or built on if they are confirmed” (Borgman, 2007). Since the 17<sup>th</sup> century, the academic-paper-based citation system supports this endeavor and cultivates a reputation economy. It “allows scientists to build on the earlier work without having to repeat that work. The citation both credits the original discoverer, and provides a link in a chain of evidence” (Nielsen, 2011).

To take advantage of today’s online realities, Nielsen (2011) urges removing barriers that prevent potential contributors from engaging in a wider sharing and faster diffusion of their ideas, sources, data, work-in-progress, preprints, and/or code for the benefit of more rapid iterative improvement<sup>2</sup>. “If

<sup>1</sup> “But while the hyperlink allows physical connection of ideas and quicker transition between them, it doesn’t clearly show proximity of the knowledge. On paper, the physical proximity of ideas is still the strongest mechanism for associating knowledge” (Armour, 2009).

<sup>2</sup> The suggested overhaul would not only benefit the contributors of the many citizen science projects Nielsen refers to, but also address the digital and innovation divides. While the ‘digital divide’ describes “the uneven distribution

scientists are to take seriously contributions outside the old paper-based forms, then we should extend the citation system. [...] All that's needed for open science<sup>1</sup> to succeed is for the sharing of scientific knowledge in new media to carry the same kind of cachet that papers do today. At that point the reputational reward of sharing knowledge in new ways will exceed the benefits of keeping that knowledge hidden”.

But, lagging the pace, scope, and openness of online scholarship is not the only inefficiency encountered. In the current citation system, “any correct reference indicates a discrete source (e.g. book, article, web site) with a page number or access date added only sometimes. It represents a granularity which might have been adequate in the stable context of paper-based worlds, but is far from sufficient in a volatile digital world where contents referenced are constantly altered or erased” (Schmitt, 2014f). The problem is exaggerated by a tendency reported by Arbesman: “Too often a popular paper is not actually read by a scientist and then cited in her own work. Sometimes scientists just look at the bibliographies of other papers and copy the citation to the paper instead. This somewhat lazy approach is unfortunately all too common, and if one scientist types it incorrectly, then suddenly there is a mutated version of the citation out in the wild.” To back up this claim, he cites a study which concluded that only about twenty percent of scientists who cite an article have actually read that paper (Arbesman, 2012).

Hidden knowledge presents a further obstacle. “At its most basic level hidden knowledge can consist of pieces of information that are unknown, or are known only to a few, and, for all practical purposes, still need to be revealed. Other times hidden knowledge includes facts that are part of undiscovered public knowledge, when bits of knowledge need to be connected to other pieces of information in order to yield new facts. Knowledge can be hidden in all sorts of ways, and new facts can only be created if this knowledge is recognized and exploited” (Arbesman, 2012).

As a consequence, “individual erroneous beliefs, assumptions, and judgments as well as outdated know-how can represent a formidable barrier to personal and collective progress and achievement. This type of ignorance does not only stem from inadequate teachings and role models, but also from a lack of constant maintenance of our intellectual, social, and emotional capitals” which can push misconceptions up to unacceptable levels (Schmitt, 2013e). In ‘The Half-Life of Facts’, Arbesman has singled out the underlying causes, naming them preferential attachments, phase transitions (tipping points), decline effects, publication and taxonomic bias, shifting baseline syndromes, factual inertia, and change blindness (Arbesman, 2012).

The time frames for knowledge to become obsolete or out-of-date also matter and have been analyzed by measuring “how long it takes for the citation of an average paper in a field to end. Whether it is no longer interesting, no longer relevant, or has been contradicted by new research, this paper is no longer a part of the living scientific literature”. In 2008, Tang looked at scholarly books in different fields;

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of ICT across society, distinguishing between ‘digerati’ and ‘have-nots’”, the ‘innovation divide’ labels “the gap in technology creation [between technology innovators and non-innovators] and thus in ownership of the related intellectual property” (Drori, 2010).

<sup>1</sup> Society overall benefits from an open and flawless exchange of ideas within the scholarly community. Hence, ‘Open Science’ is “based on the premise that scholarly information is a ‘public good’” and “the emphasis in e-Research on enhancing scholarship by improving access to information is an implicit endorsement”. But, ‘Open Science’ “has come under threat in recent years due to changes in intellectual property regimes, an increasing emphasis on data as scientific capital, and new models of electronic publishing. Emerging models of scholarship such as open access publishing and knowledge commons reflect efforts to reinstate the fundamental principles of ‘Open Science’” (Borgman, 2007).

the resulting half-life (in years) ranged from History (7.1) to Physics (13.0), with Economics in a mid-position (Arbesman, 2012, Tang, 2008).

Also, “scholarship is an inherently social activity, involving a wide range of public and private interactions within a research community. Publication, as the public report of research, is part of a continuous cycle of reading, writing, discussing, searching, investigating, presenting, submitting, and reviewing. No scholarly publication stands alone” (Borgman, 2007). But, “selecting, collecting, organizing, and providing access to information, whether in physical or digital form, requires considerable skill [as well as discipline and motivation]” and is a “prerequisite for constructing a rich and useful content layer. Building this human capacity to provide permanent access to scholarly content [and ensure its longevity] is among the great challenges for an e-Infrastructure” (Borgman, 2007).

Prior papers have taken account of several correlated aspects in the context of personal, social, and organizational learning curves and development:

- To make interdependencies and benefits for individuals and society transparent, twelve ‘PKM for Development (PKM4D)’ criteria have been introduced which are closely aligned to Maslow’s Extended Hierarchy of Needs. They illustrate how individuals can be enabled advancing their intellectual, social, and emotional capital and e-skills as well as their status as contributors and beneficiaries of organizational and societal performance (Schmitt, 2014k).

- To assess the PKMS design, its processes have been validated against established concepts and methodologies (Schmitt, 2013c, 2013g, 2014a, 2014e, 2015a) including ‘Mapping of the Agent and the World’ (Boisot, 2004), ‘Intelligence versus Extelligence Concept’ (Stewart & Cohen, 1999), ‘Notional Model of the Sensemaking Loop for Intelligence Analysis’ (Pirolli & Card, 2005), ‘SECI-Spiral’ (Nonaka & Takeuchi, 1995), ‘Eight Building Blocks of KM’ (Probst, 1998), ‘Creative Space’ and ‘Seven Waterfall Model’ (Wierzbicki & Nakamori, 2006, 2007).

- To add to the transparency further and to contribute to the educational contents of the PKMS concept, design elements, learning cycles, and methodologies have been pictured and included as figures in papers or as A0-size conference posters (Schmitt, 2013b, 2013d, 2014h). Of particular utility has been the visualization of the PKMS’s conceptual elements within the three-dimensional matrix of Boisot’s Information-Space Model (Boisot, 2004).

### **Curation: Adding Value to and Preserving Resources**

“Curation usually refers to the methods or systems that add value to and preserve resources”. However, the “goal is not only to describe individual resources, but to position them in the larger collection in which they reside.” It is “most necessary and explicit in institutional organizing systems where the large number of resources or their heterogeneity requires choices to be made about which ones should be most accessible, how they should be organized to ensure their access, and which ones need most to be preserved to ensure continued accessibility over time” (Glushko, 2013) to facilitate future consumption.

In academia, “access, preservation, and curation can be viewed as one composite function of scholarly communication, reflecting the continuous availability of the scholarly record” (Borgman, 2007). Personal digital libraries (PDL) are seen in this context as “integrating tools that let us manage our creative resources with less overhead than the tools of today” presenting the “potential to leverage the substantial economic resources being invested in building large repositories of digital content”. Synergies can be realized by enabling “the same content to be used by multiple users for multiple purposes” and by making “large DLs and PDLs interoperable, such that individuals can download data for local manipulation, and can upload tagged data to share both content and metadata” (Borgman, 2003). Yet,

individual scholars focus their attention primarily on their research, on seeking funding and publishing rather than investing effort for fostering access and longevity. By the same token, “the rates of contribution to document repositories remain low in most fields” (Borgman, 2007).

In the business environment, a technology-centric first generation of knowledge management (KM) initiatives were about viewing knowledge as a foremost strategic asset, measuring it, capturing it, storing it, and protecting it. (Pasher & Ronen, 2011). Due to too many of these KM efforts not delivering on their promises (Wilson, 2002; Schuett, 2003; Malhotra, 2004; Pollard, 2008; Frost, 2013), a more practice-based and community-centered approach has emerged as a second KM phase in the last decade characterized by social media and the cloud and an emphasis on shared tacit knowledge and collaboration in digital habitats. To champion currently still neglected concerns<sup>1</sup>, Pasher and Ronen (2011) argue for a future focus on creating new knowledge and innovation, an iterative creative process which starts with the “reuse or new use of existing knowledge, adding an invention, and then creating a new product or service that exploits this invention.”

At the personal level, “we still take copies and store them in diverse arrays of devices or make mental notes only. Over time, copies deteriorate, memories fade and with it the ability to recall the locations and contents of our fragmented personal knowledge inventories and archives. Nevertheless, we are unable to part with our accumulated hard and soft copies which slowly but steadily lapse from potential value towards dead ballast” (Schmitt, 2012).



Figure 2: A Brief PKM Survey in Flickr Images (Schmitt, 2014f; see acknowledgements<sup>2</sup>)

<sup>1</sup> Kahle fittingly observes: “While today we have many powerful applications for locating vast amounts of digital information, we lack effective tools for selecting, structuring, personalizing, and making sense of the digital resources available to us” (Kahle, 2009).

<sup>2</sup> Acknowledgements: All eleven pictures in Figure 2 are resourced from Flickr, the online photo management and sharing application web site, according to the creative commons license provided by the authors (CC by 2.0, CC



The curation principles chosen by an individual largely reflect his/her specific preferences and objectives (figure 2). However, as evidence suggests (Whittacker, 2011), the volume of personal repositories that people keep and try to manage for future exploitation is continuously increasing, promoted by new technologies which ease the capturing as well as the storing of more and more extelligence<sup>1</sup>.

Accordingly, the need of individuals for “a ‘place’ or a ‘space’ in which to assemble and manipulate information resources for their own purposes, with flexible tools that they can adapt to their practices, skills, habits, and artistry” (Borgman, 2003) will become increasingly vital. Knowledge workers, in particular, have to be furnished with these overdue career tools (Schmitt, 2013f, 2014c) to promote the notion that knowledge and skills are portable and mobile, and that professionals - moving from one project or responsibility to another – ought to take their PKM version with them. Accordingly, Whittacker (2011) stresses the “need for new theories, tools and practices for Information Curation to help support these pervasive activities”.

### **The Meme-based PKMS versus Bush’s ‘Memex’**

The fifth provision of the PKMS development stated earlier expects the system design and operations to be based on a concept, functionalities, and interventions which can be clearly understood and painlessly applied in practice. The root of this premise is provided by the internal virtual representation of the meme-based authorship approach to be exemplified (figure 3, red section) as an extension to the traditional structuring depicted earlier (figure 1).

- The pure referencing of the external sources or sections is replaced by direct links to the contents of particular referenced memes, captured and conserved with their relevant frames of references (e.g. origins, titles, formats, licenses).
- Referenced memes can be relevant prior work (‘standing on the shoulders of giants’), questionnaires or recommended practices (e.g. accreditation standards or business plan templates), evidence and testimonials (to back up any claims made in a meme), or meme-specific feedbacks in peer-review or mentorship processes.
- Confidential memes (plans, reflections, or echoes) or draft memes generated during an authoring project can be kept but set silent to prevent wider sharing or publication.

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BY-SA 2.0). The URLs from top left to bottom right are: [www.flickr.com/photos/schnaars](http://www.flickr.com/photos/schnaars)  
[www.flickr.com/photos/dullhunk](http://www.flickr.com/photos/dullhunk)      [www.flickr.com/photos/juhansonin](http://www.flickr.com/photos/juhansonin)      [www.flickr.com/photos/dylanramos](http://www.flickr.com/photos/dylanramos)  
[www.flickr.com/photos/sfllaw](http://www.flickr.com/photos/sfllaw)      [www.flickr.com/photos/themastersshakesignal](http://www.flickr.com/photos/themastersshakesignal)  
[www.flickr.com/photos/35188692@N00](http://www.flickr.com/photos/35188692@N00)      [www.flickr.com/photos/spine](http://www.flickr.com/photos/spine)      [www.flickr.com/photos/fw](http://www.flickr.com/photos/fw)  
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<sup>1</sup> Stewart and Cohen introduced the term ‘Extelligence’ for externally stored information; it represents the cumulative archive of human cultural experience and know-how accessible and augmentable by any individual who knows how. In their concept, Extelligence forms the external counterpart to the intelligence of the human brain/mind and deals in information whereas intelligence deals in understanding; together they are driving each other in a complicit process of accelerating interactive co-evolution (Stewart & Cohen, 1999). Parts of any agents’ extelligence is private and not shared publicly although it might be stored and maintained on devices of external parties.

- Any reference made to hosts and their roles (e.g. authors, editors, suppliers, organizations) presents associated background links as assembled by own or shared data in a Profiles base.
- Additionally, links to one own or others' memes (if access and sharing rights permit) are possible (incl. meme-related progress reporting and to do's) and people's roles or profiles.

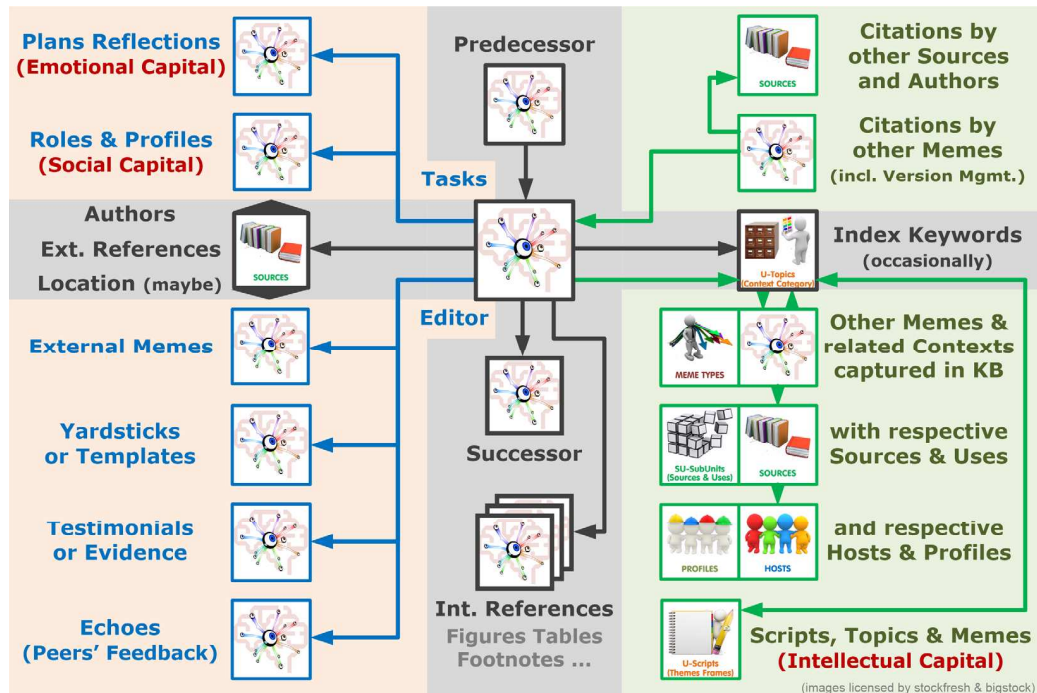


Figure 3: Traditional Document-centric vs. Meme-based PKM Repositories (Schmitt, 2014)

Further advantages of the memes' functionalities are shown in the green section (figure 3):

- The bi-directional relationships between memes (rather than the one-directional links in pdf files or web pages) allow for forward and backward feeding and, thus, enable the integration of subsequently created memes and documents citing a meme-in-focus (exemplified by the icon in the center of figure 3) by oneself or other users with access to their respective hosts, roles, and profiles as mentioned before<sup>1</sup>.
- Also, memes captured are not only qualified by their source but it is also encouraged to embed them in a more-dimensional classification system for subsequent easy retrieval, and as a pure, pre-edited, re-purposed, and/or already re-combined version according to individuals' preferences and objectives (topics and script knowledge bases).

<sup>1</sup> The functionality is similar to Google Scholar citation and referencing system which only operates at the level of documents. If the 'Related Articles' (or 'Cited by x') references of a document-in-focus happen to be provided by Google, one is able to feedback (or feed forward in time) to the referenced source document (if accessible).

- Accordingly, by accessing the related topics and scripts of a meme-in-focus one is able to access and examine potentially relevant other memes (due to their sharing of category or context) for possible inclusion in any authorship project.

Thus, while one output of the PKMS can be a paper or pdf-version or web page representing an ordered sequence of memes resulting in a book-like linear format potentially supported by one-way hypertext links (as shown in figure 1), its internal virtual structure in the knowledge base remains information-rich and multi-dimensional (as exemplified in figure 3) with all its memes ready to be re-used, rephrased, re-purposed, combined, and shared and with two-way trails in place to be visited, revised, and further grown. By moving along any trail<sup>1</sup>, the newly accessed meme-in-focus will be displayed with links to its own specific meme neighborhood.

As the ‘Memex’ envisioned seven decades ago, the PKMS Knowledge Bases act as enlarged intimate supplements to a user’s memory and enable us to transform captured extelligence into memplexes<sup>2</sup> or knowledge assets<sup>3</sup>. By creating the respective meme relationships, the user’s perspective establishes the trails through the maze of the memes’ contents available; all to be easily accessible and shareable with the PKMSs of acquaintances. As anticipated by Bush, “the inheritances from the master become, not only his additions to the world’s record, but include for his disciples the entire scaffolding by which they were erected” (Bush, 1945).

In contrast to its organizational KMS counterpart, a PKMS’s objective is to enable self-reflecting user monologues “over life-long-learning periods of educational, professional, social and private activity and experience. In these conversations with self, the knowledge under review is biographically self-determined and always presents itself as a former state of personal extelligence captured” (Schmitt, 2014f). The fully-fledged incorporation of personal records, communications, annotations, ideas, intentions, and reflections (further detailed in table 1) complements this aim and facilitates the curation and growth of one’s intellectual, social, and emotional capital as well as one’s e-skills and competencies (Schmitt, 2014k).

Personal digital libraries were imagined to “be much more than repositories; they can facilitate malleability, mutability, and mobility of information resources” (Borgman, 2003). A PKMS device fits this role by ensuring personal autonomy in developing one’s expertise and in deciding how, where, when, with and for whom to exploit it.

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<sup>1</sup> This feature, as the ‘Memex’, makes intellectual excursions more enjoyable by “reacquiring the privilege of forgetting the manifold things [one] does not need to have immediately at hand, with some assurance that [one] can find them again if they prove important” (Bush, 1945).

<sup>2</sup> To gain an advantage in competing for attention and survival, memes can combine to form symbiotic relationships (memplexes) to mutually support each other’s fitness and to replicate together (Grant, 1999).

<sup>3</sup> Knowledge Assets are defined “as a nonphysical claim to future value or benefits” (Dalkir, 2005) to include, for example, distributable articles, presentations, or reports.

## Promoting Scholarship, Curation, Authorship, Mentoring

In summary: Meme-based PKMS devices are able to provide crucial support for knowledge workers by focusing on the relevant textual, visual, audio, or video memes a message or document contains, conserving them with their relevant frames of references (e.g. origins, titles, formats, licenses), embedded in a more-dimensional classification system for subsequent easy retrieval, and as an either pure, pre-edited, re-purposed, or already re-combined version according to the user's individual preferences and objectives. By digitally capturing, referencing, and visualizing these basic information structures via an intuitive interface, the system allows the user to recall, sequence and combine stored memes with own new meme creations for integration in any type of authoring and sharing activity he/she would like to pursue.

In this process, the knowledge bases capture a variety of entities (table 1) and their diverse relationships and support individuals in keeping their accumulated intellectual, social and emotional capitals in compatible recorded formats and in continuous modes of maintenance and learning. This way, a user can systematically retain and build upon knowledge acquired in order to sustain personal growth and productive development. Stacks of time and attention currently lost due to redundant findings, mundane tasks, and rework can be mobilized for concentrating - instead - on the creative or innovative targets set and for facilitating consolidated actions that convert individual into organizational or societal performances.

The PKMSs are geared towards continuous life-cycle support from trainee, student, novice, or mentee to professional, expert, mentor, or leader. Immense synergies occur (contributing to Levy's 'decentralizing revolution' scenario referred to earlier) when the users of these distributed autonomous PKMS capacities engage in 'Creative Conversations' and their personal devices facilitate the emergence of distributed processes of collective extelligence and intelligence, which in turn feed them (Levy, 2011). To illustrate the point, Levy's notion of 'Creative Conversations' has been sketched as an 'Exemplary Scope' depicted in figure 4.

Table 1. Main Entity Types in the meme-based PKMS Knowledge Bases (Schmitt, 2014I)

| Hosts                              | Sources (sub-sources)            | Uses (sub-uses)             |
|------------------------------------|----------------------------------|-----------------------------|
| Actors, Agents, Users              | Testimonials (Proof Evidence)    | Memes (Information Units)   |
| Communities, Networks              | Yardsticks (Rules Standards)     | Authorship (Drafts Notions) |
| Teams, Groups                      | Periodicals (Articles Papers)    | New Memes (Takes Ideas)     |
| Organizations, Institutions        | Events (Reports Papers)          | Intentions (Tasks Diaries)  |
| Research Areas (Classifications)   | Books (Chapters Papers)          | Forethoughts (Plans)        |
| Industry Sectors (Classifications) | Artefacts (Assets Components)    | Evaluations (Reflections)   |
| Spaces (Location Classifications)  | Repositories (Sites Files Items) | Scripts (Themes Frames)     |
| Meta-Topics (e.g. RFCD, TOA)       | Shoe Boxes (Records Notes)       | Topics (Context Category)   |

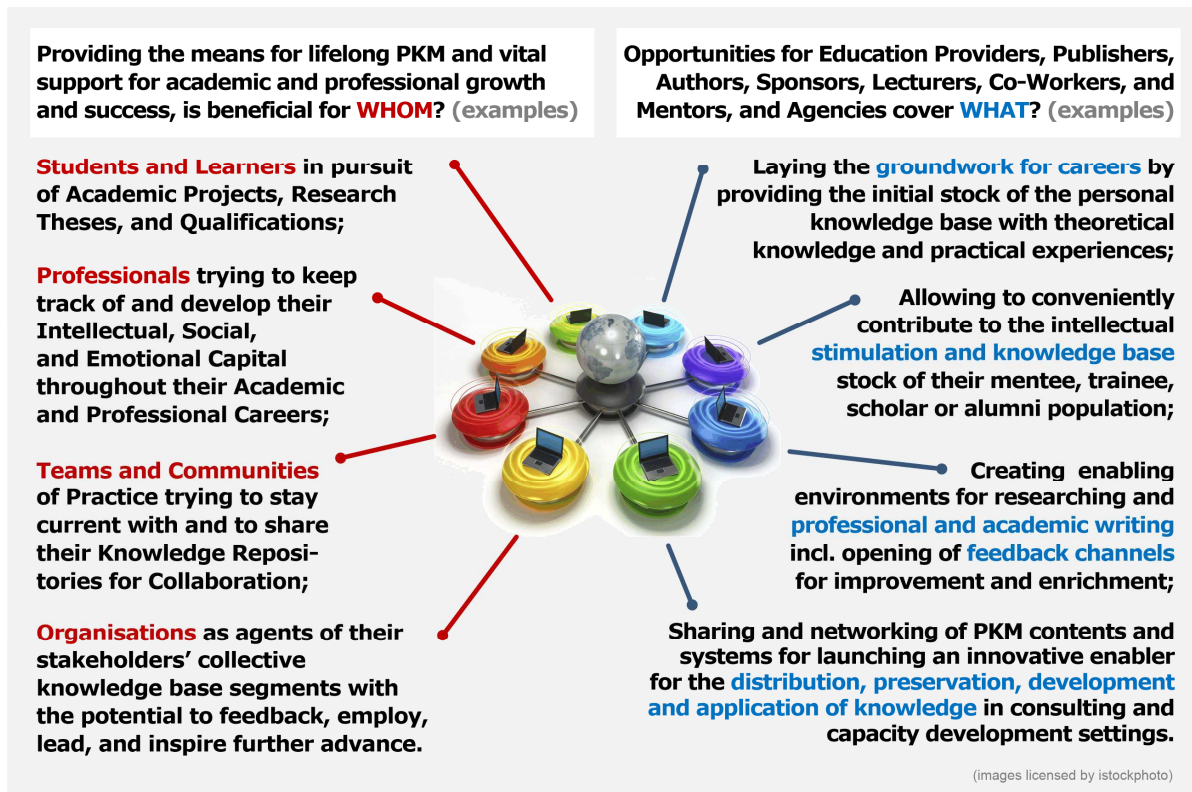


Figure 4 – Exemplary Scope of PKMS Creative Conversation Clusters (Schmitt, 2013e)

Although the PKMS offers life-long career support, the first point-of-engagement with a user should ideally be the Higher Education environment, because (Schmitt & Butchart, 2014g):

- The process of researching and writing academic project papers, theses, and dissertations to meet academic qualification requirements can substantially benefit from the application and be a potent trigger for further on-going practice.
- The groundwork for the subsequent professional career is laid with the theoretical knowledge and practical experiences acquired at university; consequently, the respective contents should add to the initial stock of the personal knowledge base.
- Since entries to the knowledge base can also be provided by external parties, lecturers, authors, publishers, sponsors, and academic institutions are encouraged to conveniently contribute to the intellectual stock and stimulation of their scholar and alumni population.
- The networked academic world paired with the web oriented context of a meme-based PKM technology provides a perfect environment for launching an innovative enabler for distributing, preserving, developing, and applying knowledge.

- Scholars who are already familiar with bringing together friends and colleagues on their social network sites, would very likely welcome the opportunity of accumulating and reconfiguring memes and the benefits it serves in regard to their academic and professional development and collaborations.

With this scope of utilities, the novel PKMS concept offers appealing opportunities for stakeholders in the educational (Schmitt & Butchart, 2014g), professional (Schmitt, 2013f), and developmental context (Schmitt, 2014a) alike. By enabling meme-specific feedbacks and reflections, it provides effective means for supporting mentee-mentor/coach relationships. And, it might as well qualify as one of the ‘new media’, Nielsen referred to when he suggested the wider sharing and faster diffusion of knowledge<sup>1</sup> “to carry the same kind of cachet that papers do today” (Nielsen, 2011).

### The Road ahead

Judging from two recent research papers originating in the developed (Benitez, Pauleen, Hooper, 2013) as well as the developing world (Jain, 2011), a PKMS-like approach is nowhere to be seen, nor are students or faculty aware of it. However, the need for a new generation of more accommodating knowledge management systems has been strongly articulated, although mainly in form of anticipated general features rather than clear-cut designs and solutions (Schmitt, 2015b).

The semantic web paradigm mentioned by Gaines (2013), might provide an alternative solution. Some PKM activities based on this technology have already been undertaken. A more technical paper-in-work will compare the meme-based PKMS prototype to the semantic and ontology-based developments and will assess the bridging potential of the PKMS to also publish the memes and relationships in its knowledge bases in the format of formal knowledge representation languages.

A further paper-in-progress following up on the issues discussed in this paper will look into the common technical aspects between Enterprise Resource Management Systems and the meme-based PKMS approach, focusing especially on traceability and configuration issues as well as the chances of transforming citation systems to contribute to the “New Era of Networked Science” as advocated by Nielsen (2011).

While the prototype is in the process of being converted, the respective Training and Service Concept for Personal Knowledge Management aimed at Higher Education and Professional Training will be finalized, and it is planned to publish suggestions for a KM course structure in support of the PKM concept and to offer respective conference tutorials as well as further demonstrations of the PKMS (in following up on the recent one (Schmitt, 2014i).

The paper started with a prediction by Gaines and is about to be concluded with two further appropriate points of view:

- “Ideally, creative conversations should be able to collaboratively categorize, evaluate and filter the storehouse of data of the Web according to their own criteria. In addition, if data are organized in different ways, so that creative conversations are separated by walls, the potential usefulness of a global

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<sup>1</sup> Like Nielsen sixty-six years later, Bush also based his notion of the ‘Memex’ on observing a steadily “growing mountain of research” and an “increased evidence that we are being bogged down” as specialization extends further in the name of progress. He regarded our methods of transmitting and reviewing the results of research “to be generations old” and “totally inadequate for their purpose” (Bush, 1945).

memory is not optimized. Let us recall the well-known silos created by the incompatible formats of the “clouds” controlled by the big companies of the Web or the “semantic silos” of ontologies” (Levy, 2011).

- “The challenge now facing all of the industrialized countries is to invent new institutions that encourage a higher level of applied, commercially relevant research and development in the private sector. [...] There are two safe predictions. First, the country that takes the lead in the twenty-first century will be the one that implements an innovation that more effectively supports the production of new ideas in the private sector. Second, new meta-ideas of this kind will be found” (Romer, 2008).

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