Knowcations - Conceptualizing a Meme and Cloud-based Personal 2nd Generation Knowledge Management System

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Abstract. The first generation of Organizational Knowledge Management (OKM) focused on the capturing, storing, and reusing of existing knowledge. To be classed as second generation, systems need to facilitate the creation of new knowledge and innovation which requires creativity and the awareness that old knowledge becomes obsolete.

Recent suggestions also urged to advance Personal Knowledge Management (PKM) as an overdue support tool for knowledge workers in the rising Creative Class and Knowledge Societies. Based on the assumption of creative conversations between many individuals’ PKM devices, the autonomous systems are supposed to enable the emergence of the distributed processes of collective ex-telligence and intelligence, which in turn feed them.

With a PKM prototype system pursuing these qualities, the paper illustrates the interaction between a user and external information-bearing hosts and vehicles. The resulting feedback loop incorporates Boisot’s I-Space Model, Dawkins’ Memes, Probst’s KM Building Blocks and Pirolli’s Sensemaking Model for Intelligence Analysis.


1 First versus Second Generation Knowledge Management

In the “Complete Guide to Knowledge Management”, Pasher and Ronen describe the focus of the first generation of Knowledge Management (KM) as the capturing, storing, and reusing of existing knowledge including “systems of managing knowledge like company yellow pages, experts outlining processes they are involved in, creating learning communities where employees/customers share their knowledge, creating information systems for documenting and storing knowledge, and so on. These first-generation KM initiatives were about viewing knowledge as the foremost strategic asset, measuring it, capturing it, storing it, and protecting it. They were about treating
knowledge as an asset, recognizing how it influences strategy, and wanting to make the most of it by managing it properly” [1].

The second generation of KM needs to focus, they argue, on creating new knowledge and innovation, a 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.” This process requires creativity and the awareness that old knowledge becomes obsolete. For reaping the appropriate rewards, it is essential to systematically exploit the knowledge captured and created [1].

In meme1 theory, this innovative process is attributed to two factors: recombination and mutation. As Distin points out in "The Selfish Meme": "In recombination, existing memes are appropriately recombined in new situations, creating new ways of thought and novel effects, perhaps as the result of previously recessive memes' 'effects' being revealed in the reshuffle". As a result of mutations, "copies will not always be exact, and the idea or skill in question may change in some way en route”. In science, for example, "existing theses are reshuffled perhaps in the light of new evidence - and this may lead to unforeseen consequences, or even to a fresh hypothesis” [5].

The distinction between the first and second KM generation is by no means trivial, in particular, since the lack of an established KM definition as well as the lack of an agreed scope of KM is blamed for the failure of too many Knowledge Management initiatives [6].

Hence, this paper takes account of how the concept of the system-in-progress accommodates the features of the first as well as the second KM generation. The second KM generation capabilities are closely related to the memetic context and the meme life cycle steps presented and referenced in the information-space model.

2 Organizational versus Personal Knowledge Management

In comparison to Organizational KM (OKM), Personal KM (PKM) has been positioned historically in a narrow individualistic confinement [7]. In limiting its scope, it has been labelled as sophisticated career and life management with a core focus on personal enquiry [8] or as a means to improve some skills or capabilities of individuals, negating its importance relating to group member performance, new technologies or business processes [9].

Wiig’s view differs and considerably amplifies its status: “The root objective of PKM is the desire to make citizens highly knowledgeable. They should function com-

1 Memes are (cognitive) information-structures that evolve over time through a Darwinian process of variation, selection and transmission. They are able to self-replicate utilizing mental storage in human hosts and to influence their hosts’ behavior to promote further replication. Memes are virtual, and have no intentions of their own, they are merely pieces of information in a feedback loop which are encoded in vehicles for transmission between human hosts; this loop facilitates their continued replication as mental copies with their longevity being determined by their environment. [2, 3, 4].
petently and effectively in their daily lives, as part of the workforce and as public citizens. In a society with broad personal competences, decision-making everywhere will maximize personal goals, provide effective public agencies and governance, make commerce and industry competitive, and ensure that personal and family decisions and actions will improve societal functions and Quality of Life. […] Competence of the individual is particularly important in small-to-medium-sized enterprises (SMEs) where variability of work requires workers to be more agile than in larger enterprises” [10].

Levy’s vision puts PKM even at the center stage of Knowledge Management: “Without denying the importance of collective strategies and the shared visions that support them, I believe that social knowledge management should be thought of as an emergent level based on the creative conversation of many individuals’ Personal Knowledge Management. One of the most important functions of teaching, from elementary school to the different levels of university, will therefore be to encourage in students the sustainable growth of autonomous capacities in PKM. And this personal management should be conceived from the outset as the elementary process that makes possible the emergence of the distributed processes of collective intelligence, which in turn feed it” [11].

Since Levy’s notion has to enable continuous feedback loops between individuals and communities or institutions, PKM and OKM systems have to share compatible models and structures. In ‘Practical Knowledge Management: A Model That Works’ [12], Probst introduces eight building blocks of OKM2 which form a logical sequence of activities to be carried out continuously. Since a Personal KMS has to facilitate the creation of new documents (e.g. thesis, article, report, presentation) with subsequent release to audiences, this model is also fully applicable to PKM (see paper section 5), although the motivation, emphasis, scope and scale of Organizational KM Systems differ3,4.

Wiig’s and Levy’s views support the notion that “knowledge and skills of a knowledge worker are portable and mobile. Unlike manual workers, they have numerous options on where, how, and for whom they will put their knowledge to work. As Drucker so often noted, this is a fairly recent phenomenon, and many people have not yet come to grips with its implications for the present or the future.” [13].

Both views are also at the heart of a concept and system-in-progress to aid teamwork, life-long-learning, resourcefulness, and creativity of individuals throughout their academic and professional life and as contributors and beneficiaries of organizational performance.

2 Probst’s eight building blocks of OKM: Knowledge Goals, Knowledge Identification, Knowledge Acquistion, Knowledge Development, Knowledge Distribution, Knowledge Use, Knowledge Preservation, and Knowledge Measurement.

3 “The Goal of [Organizational] KM is a practical one: To improve organizational capabilities through better use of the organization’s individual and collective knowledge resources. These resources include skills, capabilities, experience, routines, and norms, as well as technologies.” [12]

4 Organizational KM’s “overall objective is to maximize the enterprise’s Intellectual-Capital-related effectiveness and returns in all its forms.” [10]
3 Knowcations - A Personal KM System-in-Progress

The idea originated during the author’s PhD studies in the early 90s and the resulting prototype has been continuously expanded to integrate additional uses and functionalities. Due to advances in standards-based rapid database development platforms as well as cloud/hosting services, the transformation into a marketable application across multiple platforms and environments has become a viable opportunity for capacity development and innovation. Recent papers published, accepted or currently under review have concentrated on the underlying relevant concepts and features.

Attending to the general troubles of individuals managing their knowledge, four distinctive challenges at acquisition/preservation, collaborative, capacity development, and conceptual level (referred to in paper section 7) have been discussed [14]. It was shown that they can be constructively addressed by assimilating recognized models and approaches from other disciplines, e.g. Probst’s eight building blocks of KM [12], Gratton’s changing pattern of work [15], Andrew’s four components of a strategy [16], and Kerwin’s domains of ignorance [17-19]. Taking the ignorance matrix as a point of departure (given prominence by Rumsfeld’s knowns and unknowns [20]), its Personal Learning Cycles were analyzed by identifying seven wastes to be minimized with the assistance of the proposed PKM [21].

A further presentation and paper [22-23] assessed the envisaged scope of the PKMS concept proposed by positively comparing it to a set of applied competences (the philosophical underpinning of a Higher Education Qualifications Framework [24]) as well as to Pirolli’s and Card’s Notional Model of the Sensemaking Loop for Intelligence Analysis [25].

To put Levy’s notion into action, an integrated view of Boisot’s ‘Agent and the World’ [26] and Stewart’s and Cohen’s ‘Extelligence’ [27] assisted in identifying seven present-day obstacles [28] which novel PKM approaches have to overcome by catering for five vital provisions [29].

The latter publication [29], a short paper/poster, also visualized the general knowledge formation process to be supported by a PKMS by presenting it within Boisot’s Information-Space Model [26]. This paper considerably advances this approach by positioning the PKM system itself and by demonstrating how its design elements are interacting with the user and the outside world.

5 1. 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.
2. Contents are kept in a standardized, consistent, transparent, flexible, and secure format for easy retrieval, expansion, sharing, pooling, re-use and authoring, or migration.
3. Information and functionalities can continually be used without disruption independent of changing one’s social, educational, professional, or technological environment.
4. Collaboration capabilities have to be mutually beneficial to facilitate consolidated team and enterprise actions that convert individual into organizational performances.
5. 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.
4 The Visualization of a PKM System in Information-Space

The ‘Information Space’ or ‘I-Space’ model [26] entails a three-dimensional matrix formed by the axes of codification, abstraction, and diffusion. Whereas the original model depicts the dynamic flow of knowledge assets following a ‘Social Learning Cycle’ through six phases, the figure 1’s matrix visualizes the PKMS’s key constituents and their process pathways which consists of Pirolli’s and Card’s [30] foraging loop (steps 1-2) and sensemaking loop (steps 3-7) as well as added PKMS support functions (steps a to i). The Information-Space has been divided up into three layers:

1. The bottom layer represents the part of the meme pool6 which is inhabiting hosts as uncodified and tacit knowledge. A host must be able to possess at least the potential capacity to elaborate on a meme and to perform those cognitive tasks connected to the meme that we normally refer to as "understanding" [31].

2. The middle layer is occupied by memes and memeplexes7 codified in vectors forming part of the private, shared, and public world extelligence8. A vector is anything that transports the meme between hosts without the capacity to reflect on the meme, e.g. books, spoken message, observed behavior, CD, pictures, directories, or artefacts [31].

3. The top layer symbolizes the individual intelligence and personal extelligence of the PKMS user including the respective knowledge bases and repositories. A link to other compatible autonomous PKM systems via a Cloud Interface is shown on the top right to indicate shared repositories and collaborative opportunities (as exemplified in the figure 2).

Section 2 mentioned the need to bridge the gap between OKM and PKM by sharing compatible models and structures and Probst’s eight building blocks were cited as an example. These blocks correspond to the following steps (figure 1): Knowledge Identification {1}, Acquisition {2}, Preservation {3}, Goals {4}, Development {5}, Distribution {6}, Knowledge Use {7 and 8}, and Knowledge Measurement {1-8}. Knowledge measurement takes place on a meta-level, when users and peers engage in feedback or when outstanding 'work to be carried out' (meme gaps to be filled) is evaluated against progress by using dedicated comment fields.

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6 “Meme Pool: The full diversity of memes accessible to a culture or individual. Learning languages and traveling are methods of expanding one’s meme pool” [31].

7 Mememeplexes are groups of memes mutually supporting each other and replicating together to benefit from competitive advantage [3].

8 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 [27].
Figure 1: Flow of Memes within a PKM System depicted in I-Space [26 30 33]
4.1 The PKMS Foraging Support in the Information-Space

(For the ensuing deliberations and references to the icons in the figure 1 [as indicated by square brackets] the following applies: in any link referred to between constituents of the individual’s PKMS, either the creating or the receiving counterpart can be - in a shared and collaborative environment - substituted by the compatible constituent(s) of other cooperating autonomous PKMSs [i]. Furthermore, since the PKMS concept introduced incorporates Pirolli’s Sensemaking Model for Intelligence Analysis [25, 30] the associated terms are co-used whenever applicable.)

To succeed in becoming part of the body of socially transmitted information, a meme has to be encoded in an information-carrying medium and can then be passed between peers from brain to brain via learning and imitation [level I and II]. In the meme world, information ‘consumes’ the attention of its recipient/host and is either multiplied or lost in the process (but not consumed like physical goods).

A knowledge worker, referred to in the following as user (of the PKMS), foraging for data and information collects relevant material via field research [1u] or desk research [1c] from sources accessible to him/her and stores it in a Case File or Shoe Box [UA]. The outcome will resemble a disorganized pile of memeplexes which are packaged or absorbed in complex ways inside larger vectors [level II] and recorded conversations or observations [level I]. The user is acting like any host with a limited attention span and memory, but with the potential cognitive capacity to single out and understand a meme, to elaborate on it, and to create groups of memes from diverse sources, mutually supporting each other for further replication. However, this activity does not only take place mentally but is supported by the PKMS functionalities and the more reliable storage and retrieval facilities of the underlying knowledge base and engine.

So, based on his/her interests, knowledge and editorial literacy, the user consciously selects suitable materials gathered, captures their memes’ intended original ‘messages’ [2] and stores them in a Memes or Evidence Base [UM]. To ease re-usability any meme captured and codified should be - ideally - in an atomic state of an information-structure, perfectly understandable alone by itself but being able to be used at any later time in combination with other memes without piggybacking irrelevant or potentially redundant information. The latter requires the variation and replication of an original meme in a creative manner. As Koch reminds us, not the physical script matters but the ideas it contains; "It must be valued, either for its own intrinsic appeal or because it can help to deliver other things that people want, or help to deliver them at a higher quality level or using fewer resources" [32]. In an iterative process, emerging gaps in an authoring project mean that further suitable memes to be found or already captured have to be added or, alternatively, new memes have to be self-authored [a] or re-purposed from personal repositories [b]. Depending on the required context, the contents, purpose, and format (text, sound, visual, message) of memes might have to be adjusted, resulting in copying and variation.

The references of memes (e.g. origins, authors, publishers, contact details, titles, formats, licenses) are also stored [d] in the knowledge base [P*]. This part is not further detailed in the figure 1, but it links meme-relevant hosts (individuals, teams,
communities, and organizations as actors in research/project-related, industrial, service-oriented, and geographic settings) to the meme-accommodating vectors (knowledge sources and uses). The capturing of host-to-host/sources/uses relationships assures the comprehensive recording of intellectual capital, but also provides suitable 'scaffoldings' for social (bullets 1 & 2) and emotional capital, in particular, regarding reflection and confidence building (bullets 4 & 5). These assets are key targets of an organizational KMS, but equally relevant to a Personal KMS.

1. Structural Relations and Networks Bases depict interdependencies of an actor in regard to any other actor (e.g. memberships, relatives, superior, or advisor).
2. Formal Education and Professional Experience Bases capture past and current organizational ties (e.g. employers or universities) typically chronologically ordered in a CV, supported usually by qualifications and references.
3. Exploration Base lists the access to existing Sources and the particular role (e.g. author, publisher, or owner) and Innovation Base references the occupation with Uses which includes work-in-progress and planned activities.
4. Research Activities and Leadership/Achievements Bases describe past and current ties with a more task/project-specific orientation, evidenced usually by publications, project proposals or reports, and peer assessments.
5. Outcomes/Results Bases consider the wider benefits of activities for society (e.g. Environment or Development Agenda) evidenced by impact studies/testimonials.

Supporting evidence of any of these relationships is stored separately and attached to the user’s output at the end for dissemination to back up any statements or claims made.

Codified information to any of the entities (e.g. directories, lists of ingredients) can be uploaded and integrated for convenience. Current datasets used include: World’s Countries, Regions, and Cities; International Universities; ERA Journals and Conferences; Standard Research as well as Industrial Classification Codes; Higher Education Standards and Audit Criteria; Food, Cocktail, and Genealogical Datasets.

4.2 The PKMS Sensemaking Support and Knowledge Diffusion

In order to facilitate future recovery, replication, and repurposing, the searchability of the memes is assured via the references to the source of origin. To further enhance their accessibility, the user qualifies a meme by linking it to a multi-dimensional classification system, made up of pre- or user-defined abstract Meme Types (e.g. area, concept, process, tool) or already created topics and memeplexes (e.g. decision methods, logistics, ecology) to be stored in a Topics and Schema Base. Thus, memes and/or sub-topics are only a few clicks away and can be more easily and speedily retrieved and repurposed. Because any entity with a focus is displayed on a user’s screen with its immediate entity neighborhood, the more qualified memes stock impart constant mental refreshers about their usage and are better memorized.

During the authoring process, the accumulated meme pool is scanned to activate appropriate candidates for composing a desired Script (e.g. article, lecture, or presentation) to be stored in a Scripts and Hypotheses Base. Any gaps will be
filled with a provisional 'known-unknown' meme as a reminder for work to be carried out in order to direct the iterative processes alluded to {5}. Additionally, dedicated fields allow for comments and to-do-lists regarding any entity in the knowledge base, and silent memes linked to particular memeplexes can be added which do not show up during publication, but contain, for example, annotations, further ideas, feedbacks from colleagues or supervisors. The significance of recombination and mutation, as emphasized by Distin, has already been pointed out in section 1.

Any finalized script can be converted into a presentation, pdf or paper version for publication and wider diffusion {6} and stored in a Report or Presentation Base {U*} in order to become part of the publically shared world extelligence {Level I/II}.

Any finalized script can also be left in the knowledge base and shared with other compatible external PKMS. It provides a knowledge asset with all reference links kept intact and instant access to the underlying information-rich contributing memes. This type of digital document – if the content is appropriate for the purpose – is ideal for storage in a Benchmarking and Standards Base {UB} whose contents is feeding back {g & h} to related later projects and activities by providing, for example, templates, samples, best-practice methods, proven heuristics, regulations, tutorials, evaluation criteria, or trial assessments. Unfortunately, in a pdf or paper copy these information-rich causative references have to be given up due to its one-dimensionality.

After publication and diffusion, the novel insights are shared by oral presentation from person-to-person {7u} or via newly codified vectors {7c} and lead to shared new learning experiences and behaviors. As a consequence, knowledge and memes are absorbed by the human brain and can become 'intangible', 'uncodified', or 'tacit' knowledge {level I} as well as personal or organizational extelligence {level II}. Eventually, the abstract knowledge absorbed makes an impact by becoming embedded in concrete practices, either in codified formats such as documents or products {8c} or uncodified formats such as unwritten rules or patterns of behavior {8u}.

This knowledge diffusion process is vital for today's knowledge economies and societies and has attracted widespread academic and professional attention. Embedded in the figure 1, as an example, is Nonaka's SECI Loop Model [33] which addresses a major objective of Organizational KM. Its aim is to make the tacit knowledge (gained only experientially and difficult to articulate, explain, share; as opposed to formal or explicit knowledge) of knowledge workers explicit, so it can be measured, captured, stored, protected, and further utilized in a 'spiral' of knowledge creation for the benefit of the organization and its stakeholders and independent of the availability of the persons concerned.

Its four knowledge conversion modes correspond to the following steps: Socialization {tacit-to-tacit: level I from undiffused to diffused; 1u sharing, 8u}, Externalization {tacit-to-explicit: from level I to level II; 1u recording}, Combination {explicit-to-explicit: within Level II and III; all steps with the exception of a, 1u, 7u, and 8u}, and Internalization {explicit-to-tacit: from level II to level I; 7u}. 
5 Human Capital Development – The Impact of PKM Solutions

To build personal capacities for career progress in the propagated Knowledge Economies and their increasingly complex multi-disciplinary problem spaces, PKM systems for knowledge workers and their diverse roles and career portfolios are critical. Existing solutions address PKM needs only partially; they concentrate on more specialized as well as wider unrelated tasks and, accordingly, are usually grouped into categories such as Office Suites, Document and Bibliographic Management, Contact and Relationship Management, Group and Collaboration Software, Web Databases, and the Organizational Knowledge Management Systems referred to.

With dedicated PKM systems, stacks of time and attention currently lost due to redundant findings, mundane tasks, and rework could be mobilized for concentrating instead on the creative or innovative targets set and for facilitating consolidated actions that convert individual into organizational performances. Novel PKM approaches catering for the five provisions made (footnote in section 3) are geared towards continuous life-cycle support from trainee, student, novice, or mentee to professional, expert, coach or leader. They empower individuals to keep their accumulated intellectual, social and emotional capitals in compatible recorded formats to benefit continuous modes of maintenance and learning and to uphold a basis for sustainable development, innovative authorship, and mutually beneficial collaborations (figure 2). They also imply a departure from the current heavyweight, prohibitive, centralized, top-down, institutional developments with preference given to grass roots, bottom-up, lightweight, affordable, and personal applications across a multitude of information and communication platforms.

Figure 2: PKMS Conversation Clusters exemplifying Beneficiaries and Benefits [21]
6 The Road ahead

In “Creative Environments” [34], Wierzbicki and Nakamori affirm: “In the new knowledge civilisation era, given the systemic methods and tools of intercultural and interdisciplinary integration of knowledge, we shall also need computerised creativity support”, but they also maintain: “Before we think of constructing systems of tools to support creativity, we should reflect upon what prescriptive conclusions can be derived from descriptive theoretical considerations”. The system-in-progress introduced agrees with this notion; it provides a pragmatic novel solution based on established concepts and theories, some of which have already been alluded to.

In follow-up papers-to-be-submitted the prescriptive character of the system is further verified against the notion of the ‘Ideosphere’ [Sandberg, Kimura], Nonaka’s concept of ‘ba’ as well as the integrated JAIST Nanatsudaki Model of knowledge creation. After reflecting on the potent co-evolutions which shaped human innovativeness, the more recent organizational, commercial, and social changes with their profound impacts on the way we work and live are explored together with the diverse shortcomings experienced by societal stakeholders. With Gurteen’s interpretation of the knowledge worker and Florida’s concept of the rising creative class gaining currency, the paper further looks at Vannevar Bush’s still unfulfilled vision of the ‘Me-mex’ and the wider role of PKM in the context of ICT for Development (ICT4D) and a new era of networked open science.

It is planned to transform the prototype to a commercially viable PKM software application within two years. In parallel, a system training seminar will be set up as well as a curriculum and study guide for the wider multi-disciplinary Personal Knowledge Management contexts and methodologies. Further papers in progress or planned will feature the meta-entities of the system-in-progress (Sources, Actors, Profiles, Uses, and Projects) and their interdependencies as well as a case study. The latter will integrate the papers published with all their memes and references to demonstrate the knowledge management and authoring capabilities of the system.

References
