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Making Sense of e-Skills at the Dawn of a New Personal Knowledge Management Paradigm

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Abstract

Recent suggestions urge advancing Personal Knowledge Management (PKM) to provide over-due support to knowledge workers for mastering the ever-increasing information abundance, the changing spheres of work, and the needs for self-development and e-collaboration. Based on assumptions of autonomous capacities engaged in creative conversation, these personal devices are supposed to enable the emergence of the distributed processes of collective intelligence and extelligence, which in turn feed them.

Currently, a prototype pursuing this concept and used personally for professional support is about to be converted into a viable 'next generation' PKM system. The paper follows up on a series of recent publications which concentrated on the novel concept as well as the numerous renowned Knowledge Management (KM) methodologies and practices integrated in the system design. As an application aiming 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, e-literacy and e-skills are both, a requirement for and an outcome of using a PKM device.

To make these interdependencies and the benefits for individuals and society transparent, the paper introduces twelve 'PKM for Development' criteria which are closely aligned to Maslow's Extended Hierarchy of Needs. As enablers of personal development and people empowerment, decentralized autonomous PKM system capacities will give individuals a better chance of advancing their intellectual, social, and emotional capital, but also offer appealing and viable opportunities for their acquaintances in the educational, professional, societal, and developmental context.

Keywords: Personal Knowledge Management (PKM), Organizational Knowledge Management, ICT for Development (ICT4D), PKM for Development (PKM4D), Human Capital, Applied Competences, Capacity Development, Lifelong learning, e-Collaboration, Memes, Knowcations.

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Introduction

How can the emerging knowledge societies and the growing creative class of knowledge workers be better served mastering the ever-increasing information abundance, the changing spheres of work, and the needs for self-development and e-collaboration?

Recent suggestions urge advancing Personal Knowledge Management (PKM) to provide overdue support for aiding lifelong learning, resourcefulness, creativity, and team-work throughout an individual's academic and professional life and as contributors and beneficiaries of organizational and societal performance. Based on assumptions of autonomous capacities engaged in creative conversation, these personal devices are supposed to enable the emergence of the distributed processes of collective intelligence and extelligence, which in turn feed them.

The applied research paper and project report builds upon a series of recent publications and exemplifies such a novel approach in the context of twelve criteria (shown in brackets) for ICT/PKM-related capacity development. Based on a PKM prototype-in-progress about to be converted into a viable application across cloud-based platforms, the solution to be portrayed:

1. Gives preference to grass roots, bottom-up, lightweight, affordable, 'Personal Devices' which offer effective low-cost applications (Accessibility Easiness),
2. Endorses 'Five Vital Provisions' 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 (Operable Autonomy),
3. Enables the 'Creative Authorship' of own ideas based on one's background, know-how, and experiences (Expressive Creativity),
4. Facilitates developing one's 'Emotional Capital' as a source of self-understanding, self-reflection, and self-determination (Collaborative Choice),
5. Allows for the nurturing of 'Social Capital' as the sum and quality of one's relationships in collaborative environments (Relational Interactivity),
6. Supports learning and fruitful endeavors either alone or with other users/owners in order to promote creativity, innovation, and the next 'KM Generation' (Creative Conversation),
7. Provides the opportunity for employing and furthering one's 'Applied Competencies' to add productively to the 'World Extelligence' (Ecological Reciprocity),
8. Assists in maintaining and developing one's 'Intellectual Capital' for career advancement and self-actualization (Personal Mastery),
9. Offers the means for 'Assisting and Mentoring' others in the context of the PKM4D criteria and their self-actualization (Encouraging Empowerment),
10. Helps 'Converting Individual into Organizational Performances' to foster a productive co-evolutions between Personal and Organizational KM Systems for mutual benefit (Institutional Performance),
11. Eases the 'Wider Sharing and Faster Diffusion' of ideas, sources, data, work-in-progress, etc. for the benefit of more rapid iterative improvement (For the Common Good),
12. Makes a crucial difference by 'Providing the Overdue Support Tools' and an enabling environment for the creative conversations needed (Technological Progress).

The paper aligns the twelve PKM4D features to Maslow's Extended Hierarchy of Needs, a structure which will also be employed as a Personal Knowledge Management course outline. The concept portrayed strives to give impetus to a scenario put forward by Levy: "Just as computer science underwent a revolution in the 1980s with the wide-spread use of personal computers, it is possible that Knowledge Management (KM) will in the twenty-first century experience a decentralizing revolution that gives more power and autonomy to individuals and self-organized groups."

Background

Since Simon (1971) noted that the "wealth of information is creating a poverty of attention and with it a need to allocate that attention efficiently among the overabundance of information sources that might consume it", over forty years have passed. In the interim, we have experienced profound changes in the way of our working and living and significant organizational, commercial, social and legal innovations triggered by the accelerating progress and the widespread diffusion of Information and Communication Technologies (ICT).

On the one hand, work has undergone a process of fragmentation, which will continue to accelerate (Gratton, 2011). With the growth in specializations and the evolving clusters of domain-specific knowledge, the identification of people has shifted from their company to their occupation and profession, and "the vertical hierarchy and traditional career ladder have been replaced by sideways career moves between companies, [a more horizontal division of labor], and a horizontal labor market" (Florida, 2012). With competitive pressures on organizations continue to grow, so does their need for greater flexibility and skill sets. But, "responsibility for self-development and lifelong learning is now in the hands of the individual, who increasingly controls the development of his/her career and destiny. […] In the world of the modern knowledge worker, it has become necessary for individuals to maintain, develop and market their skills to give them any chance of competitive advantage in the job market in both the short and long term" (Gorman & Pauleen, 2011).

On the other hand, an uneven diffusion of digital technologies and their unequal effects have caused detrimental opportunity divides across societies worldwide. While the 'digital divide' describes "the uneven distribution 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). Accordingly, "it is crucial that all countries, large and small, rich and poor, take advantage of science, technology and innovation as fundamental elements for their development strategies, poverty reduction and the construction of a Knowledge Society" (OAS, 2005).

The lessons learnt have led to a collective insight that the most valuable asset in any organization or society is investment in intangible, human and social capital and that the key competitive drivers are knowledge, creativity, and innovation. "The countries that thrive will be those that encourage their people to develop the skills and competencies they need to become better workers, managers, entrepreneurs, and innovators. Today's policy makers must extend their country's existing strengths through careful investments in education, institutional quality, and relevant technology. They must create enterprises that are knowledgeable enough to recognize new competitive opportunities - and skillful enough to convert those opportunities into wealth" (WBI, 2008).

"In order to live up to their expected role as a powerful mover and shaker in the necessary transformations of our times, universities have started to reform themselves, often forced by external pressures such as accreditation standards, qualification frameworks, and funding formulas. Business thinking has infiltrated academic management, competition for the best students and faculty members has become a vital priority, and value chains are applied to complement the traditional key performance areas of lecturing, research, outreach, and leadership" (Schmitt & Butchart, 2014).

Higher Education Institutions (HEI) are regarded as the key agents in stimulating long-term economic growth by educating talented, creative, and capable graduates and by producing inventive, pioneering, high-impact research and entrepreneurial spin-offs. However, their efforts to stay relevant are not without criticism, having resulted in higher non-academic staff ratios and cost increases (Economist, 2012) with - according to some commentators - not much to show for as ex-

emplified by questionable impact (Economist, 2012), administrative bloat (Economist, 2013), and non-forthcoming technologies of learning (Laurillard, 2009; OECD 2009; Thille, 2010).

"About 100 years ago, higher education re-structured to meet the needs of the industrial age. It has changed little since, even as the internet has transformed life. Another revolution is needed to modernize universities and prepare graduates for a 21st century working environment. We continue to prepare students as if their career path were linear, definite, specialized and predictable. We are making them experts in obsolescence. We are doing a good job of training them for the 20th century" (Davidson, 2011). Unfortunately, time for institutions to rethink themselves fast enough is in short supply.

A development under way, exploiting the opportunities of cloud-based platforms and applications, is said to become the fourth industrial revolution; it is termed the 'Industrial Internet' (Evans & Annunziata, 2012) or 'Cyber-Physical Systems' and will facilitate machine learning, machine-to-machine communication, big data analytics, and the Internet of Things by incorporating networked sensors and software into goods and machines resulting in the self-organizational capability of complex value chains. A looming further scenario is the singularity - a point in time when artificial intelligence will outsmart human intelligence. In 'How to create a Mind', Kurzweil (2012) foresees the opportunity to amplify the advantageous abilities of the human brain "by migrating from biological to non-biological intelligence. Once a digital neo-cortex learns a skill, it can transfer that know-how in minutes or even seconds".

As a consequence, the work environment will dramatically change even further. The 'Future of Employment' study estimates 47% of the current US employment to be still at risk due to recent technological breakthroughs able to turn previously non-routine tasks into well-defined problems susceptible to computerization; the impact on the 702 analyzed occupations is shown in Table 1 (Frey & Osborne, 2013). In following up on the computerization of European jobs, Bowles' calculations estimate impacts of new technology onto old areas of employment to range from around 45% of the labor force being affected to well over 60% across the EU-28 countries, with countries on the periphery of the EU most at risk. An impact of this magnitude would necessitate a reallocation of workers towards tasks less susceptible with the likely prioritization of creative and social intelligence. Such a restructuring of the European human capital "is a prospectively painful process and it seems evident that education systems will have to adapt [even further] to meet this challenge" (Bowles, 2014, based on Frey & Osborne, ILO, and EU Labor Force Survey figures).

Table 1: The Future of U.S. Employment (based on Frey & Osborne, 2013)

Probability of Computerization in %	**< 10**	**10-20**	**20-30**	**30-40**	**40-50**	**50-60**	**60-70**	**70-80**	**80-90**	**> 90**
Number of 702 Occupations affected	175	32	34	32	28	32	53	54	103	159

The new economic focus as well as a smoothly performing society require people everywhere - in their personal lives and as part of the workforce and society - to operate effectively based on the best available knowledge for whatever function they need to perform, including entrepreneurial activities. Accordingly, managing "knowledge and knowledge-related processes throughout society - Personal Knowledge Management (PKM) - has become a central issue" (Wiig, 2012).

The objective of this project report and applied research paper is to present a PKM concept and system that favors the strategic and efficient use of novel personalized ICT devices and focusses on the development of the related knowledge, skills and competences, teaching, self-learning and

inventiveness of the workforce and citizens. It further aims to make the strong interdependencies between the PKM approach and its role for e-Literacy and e-Skills transparent.

Advancing the Personal Knowledge Management Notion

During the 90s, the author started to develop a concept for Personal Knowledge Management and with it a prototype system which has been continuously expanded and used personally for career support as a management consultant, scholar, professor, and academic manager. Recent advances in development and hosting platforms have now provided a viable opportunity for innovation and its conversion into an application serving a wider audience across technological environments.

Over the last two years, a range of papers and posters (Schmitt, 2012, 2013a-f, 2014a-k) have focused on various aspects of Personal Knowledge Management (PKM), backed up by the further advancement of the PKM System (PKMS) prototype. In acknowledging the trans-disciplinarity of the PKM notion, the peer-reviewed papers received feedback from and addressed a wide scope of conference themes, including Knowledge Management and Knowledge Technologies, Management and Social Sciences, Higher Education and Human Resource Development, Innovation and Creativity Support Systems, Organizational Learning and e-Learning, as well as Future Studies.

Although the concept of the PKM prototype is novel, the need for such a system can be traced back to 1945. 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 has remained unfulfilled (Davies, 2012; Kahle, 2009; Osis, 2011). The tools available disappoint: "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 Organizational Knowledge Management" (Schmitt, 2012).

Academically, Personal Knowledge Management has been placed in a narrow individualistic confinement (Cheong & Tsui, 2011b). In limiting its scope, it has been labelled as sophisticated career and life management with a core focus on personal enquiry (Gorman & Pauleen, 2011) 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 (Davenport, 2011).

In 'People-Focused Knowledge Management', Wiig (2004) instead argues for shifting the focus of Knowledge Management (KM) toward strengthening the ability of people to act in the best interest of their enterprise and its desired strategies and performance. In this context, PKM needs to be regarded - more appropriately - as a bottom-up approach to KM (Pollard, 2008), as opposed to the more traditional, top-down Organizational KM (OKM) view. As such, PKM also "goes beyond personal information management" (PIM) which focusses predominantly on information processing without the emphasis on creating new knowledge (Cheong & Tsui, 2011a).

In agreeing with these latter positions, a prior paper urges of advancing PKM for 'Furnishing Knowledge Workers with the Career Tools they so badly need' (Schmitt, 2013a). Accordingly, the aim of the PKM concept and system-in-progress portrayed is to aid teamwork, lifelong learning, resourcefulness, and creativity of individuals throughout their academic and professional life and as contributors and beneficiaries of organizational and societal performance. It also strives to live up to Bush's vision alluded to and to a scenario put forward by Levy (2011): "Just as computer science underwent a revolution in the 1980s with the wide-spread use of personal comput-

ers, it is possible that KM will in the twenty-first century experience a decentralizing revolution that gives more power and autonomy to individuals and self-organized groups".

The PKM4D Dozen for Promoting e-Literacy and e-Skills

In order to make the case for Personal Knowledge Management in the e-Skills Conference's and e-Summit's context of promoting e-literacy and in developing and supporting e-skills (ICT skills) at all levels of life and work, the arguments put forward are structured according to a newly created framework of twelve PKM for Development (The PKM4D Dozen) criteria.

The scope of the term 'Development' – in this regard – is meant to address capacity development holistically and not restricted in space (e.g. development countries) or time (e.g. phase of formal education). After all, with high levels of unemployment and increasing inequality in many countries, the need for improving skills and competencies applies to people at any age and location.

By the same token, the term 'Knowledge Worker' - as used in this paper - does not only apply to the narrowly defined socio-economic categories of the developed world. Florida (2012), for example, introduced the concept of the Creative Class as a rising and driving force of economic development and added it to the traditional division of the workforce into an agricultural, working, and service class. Estimated to be one third of the workforce in the United States, their economic function is to create new ideas, new technology, or new creative contents as well as to engage in complex problem solving that involves a great deal of independent judgment and requires high levels of education or human capital.

Yet, Knowledge Worker attitudes and ambitions also do have a role to play in the emerging knowledge societies of developing countries or the countless unemployed graduates seeking to devise a personal career script that can bring fulfillment and meaning in the developed world affected by economic turbulences. Fittingly, Gurteen (2006) places - rather than an individual's type of work - the virtue of responsibility at the center of his reflections: "Knowledge workers are those people who have taken responsibility for their work lives. They continually strive to understand the world about them and modify their work practices and behaviors to better meet their personal and organizational objectives. No one tells them what to do. They do not take 'no' for an answer. They are self-motivated". To his mind, they "cannot be coerced, bribed, manipulated or rewarded and no amount of money or fancy technology will 'incentivize' them to do a better job. Knowledge workers see the benefits of working differently for themselves. They are not 'wage slaves' - they take responsibility for their work and drive improvement".

The 'PKM4D Dozen' criteria put forward incorporate the four ICT for Development (ICT4D) criteria of a framework for designing ICT for human development, named Capable and Convivial Design (CCD). As pointed out by its authors, current ICT for Development efforts "are [unfortunately] primarily framed in the theory and practice of development and empowerment", signifying "a disproportionate emphasis […] on fulfilling basic needs of users in low-resource environments without adequate attention to user-motivated concerns which would enrich their lives rather than merely provide access and satisfy basic needs." Based on Sen's idea of capabilities and Illich's notion of conviviality, Johri and Pal present their CCD framework to overcome this gap and propose targeting its four primary design characteristics, if ICT4D is to "satisfy its purported goal of making a real difference in the lives of its intended beneficiaries - those that are significantly disadvantaged in terms of resources as well as opportunities" (Johri & Pal, 2012).

Johri's and Pal's differentiation between basic resources and enriched opportunities also translates well into the context of the Digital versus the Innovation Divide already alluded to. In the author's opinion and the PKM context, the four ICT4D criteria also fully apply to knowledge workers anywhere and, hence, have taken up position as PKM4D criteria 1, 3, 5, and 7. Figure 1 provides an overview of the 'PKM4D Dozen' criteria which have been placed on and linked to

the levels of an extended version of Maslow's Hierarchy of Needs (Koltko-Rivera, 2006). Each criteria and its e-Skill relevance will be presented under its individual sub-heading.

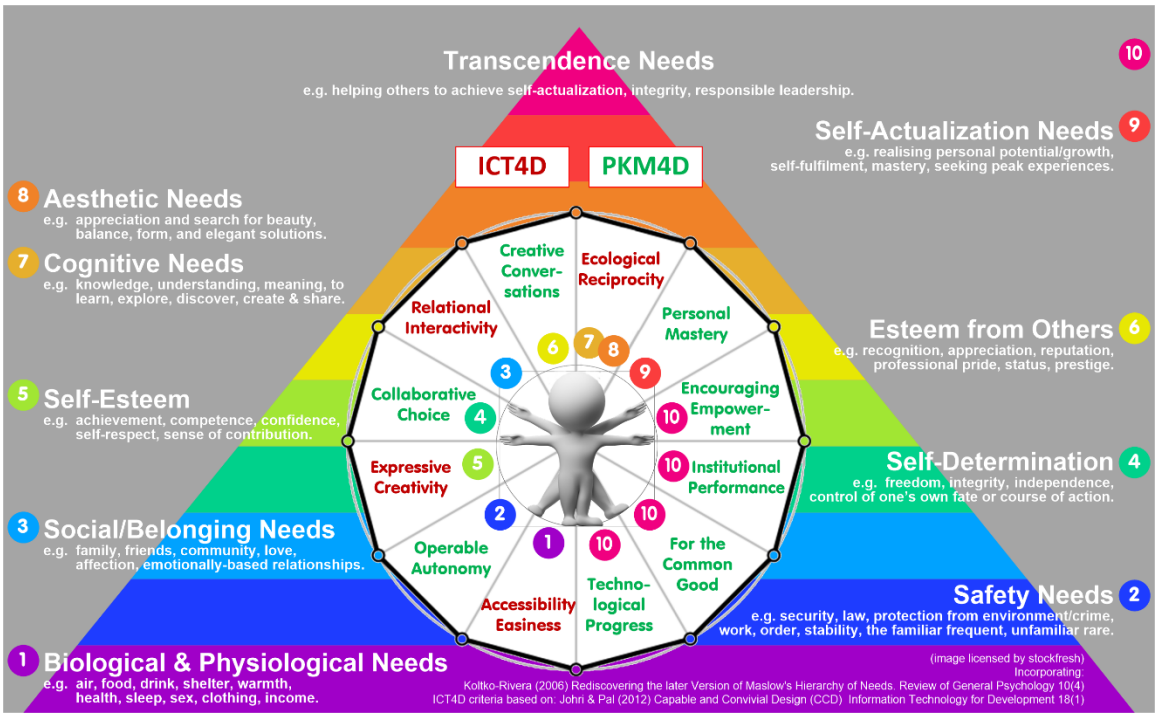

Figure 1: The 'PKM4D Dozen' Criteria versus the Extended Maslow Hierarchy of Needs. (with integration of Koltko-Rivera, 2006; Johri & Pal, 2012)

PKM4D Criteria 1: Accessibility Easiness (ICT4D-1)

Hughes (2011) makes the point that human evolution and civilization have not only thrived on big brain memory and communication technology, but also on an insatiable urge to use this technology for the purpose intended. Due to advances in ICTs and their widespread affordability, this urge triggered a recent exponential growth of information. As a result, the familiar problem of information scarcity (few sources/channels, high associated costs) has been substituted with a never before experienced ever-increasing attention-consuming information abundance.

To sustain one's human existence, certain physiological needs have to be met in order to assure survival. To sustain one's life as a 'digerati' (Drori, 2010) participating in a knowledge society, access to appropriate artefacts linking up to data and information has to be obtained to escape opportunity constraints. 'Accessibility Easiness' ensures that the essential "artifacts are universally accessible and that the ability of one person to be able to use the tool should not take away the opportunity from another person" (Johri & Pal, 2012).

The support of a recently introduced modular Master Program at the University of Botswana by a dedicated Google Apps intranet and collaboration platform provides a good example. It facilitates the just-in-time (correct and complete) e-provision of reading material, assignments and solutions to make up for participants' limited on-campus times and access to lecturers and libraries as well as circumvents the unreliable connectivity of their home and work e-mails. But, moreover, it makes up for the reduced time available (30% compared to program's full-time mode delivery) for the participants (who are full-time employed across the region) to meet each other face-to-face for discussions, group work, and team building activities.

In the PKM context, 'Accessibility Easiness' has to be provided by being able to use effective low-cost devices and Personal Knowledge Management System applications.

Figure 2: A Brief PKM Needs Survey in Flickr Images (Schmitt, 2014e; see also the Acknowledgements section)

PKM4D Criteria 2: Operable Autonomy

With one's physical needs relatively satisfied, an individual's safety needs take precedence (Figure 1). In terms of PKM, this equates to the state of our personal knowledge preservation (Figure 2). Here, "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).

A remedy – as already briefly alluded to – has been put forward by Bush (1945) and his vision of the Memex. However, "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). The question in need to be asked, why - after nearly seven decades – are we still lacking such an empowering state of personal knowledge formation?

A number of barriers have been identified preventing the establishing of productive PKMS; "they are counterproductive and annoying for wasting time and efforts of individuals, but can be eliminated by initiating sound PKM approaches, shifting paradigms, changing habits, and innovating solutions". To neutralize these barriers, they have been transformed into a plea for Five Vital Provisions which will strengthen the second PKM4D criteria 'Operable Autonomy' (Schmitt, 2014e):

- Digital personal and personalized knowledge is always in the possession and at the personal disposal of its owner or eligible co-worker, residing in 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 performances.
- The PKM system designs and complex operations are based on a concept, functionalities, and interventions which are clearly understood and are painlessly applied in practice.

'Operable Autonomy' is supporting individual sovereignty by employing grass-roots, bottom-up, affordable, personal applications. It aims to put an end to the detrimental dependencies experienced as a member of a captured audience and signifies the departure from today's top-down, heavyweight, prohibitive institutional approaches and centralized developments. As professionals move from one project or responsibility to another, they will want to take their version of a knowledge management system with them supporting 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" (Rosenstein, 2009).

PKM4D Criteria 3: Expressive Creativity (ICT4D-2)

Self-Esteem defines the confidence in one's own worth or abilities obtained by self-respect, achievement, and recognition (Figure 1). 'Expressive Creativity' "focusses on the actual use of the artifact [referred to under ICT4D-1] beyond just access to it for means that give the user joy" and allow for self-expression, for using one's personal energy creatively, and to personalize one's environment (Johri & Pal, 2012).

Although the many web-based computing artifacts available today have provided tremendous opportunities in this respect, in KM terms we are also facing an unparalleled accelerating state of information abundance or – as experienced by many – information overload. As a consequence, the accumulating "wealth of information is creating a poverty of attention." Hence, it "is not enough 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).

So, the stacks of time and attention we currently loose in our daily grind due to redundant findings, mundane tasks, and rework need to be rather mobilized by appropriate solutions for concentrating - instead - on the creative or innovative targets set (Schmitt, 2013d). PKM concepts and devices, therefore, have to support one's learning and authorship as well as the development and articulation of one's own ideas based on one's knowledge and background.

Henceforth, what the meme-based PKMS concept and prototype portrayed refer to is smaller and more distinct than documents. 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 (Figure 3) through a Darwinian process of variation, selection and transmission (Collis, 2003). By digitally capturing, referencing, and visualizing these basic information units and converting them into building blocks of knowledge (in the eyes of the

beholder), the 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.

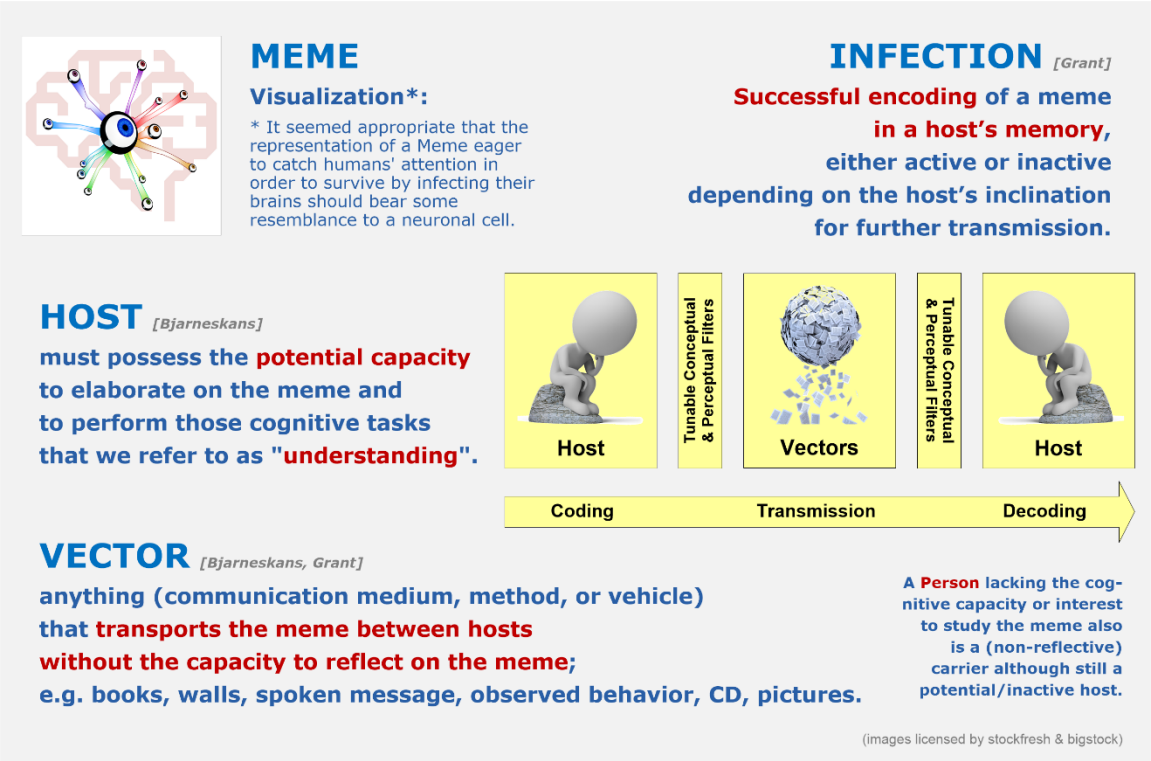

Figure 3: The Transmissions of Memes between Hosts via Vectors (Bjarneskans, Grønnevik & Sandberg, 1999; Grant, 1990; Schmitt, 2014c).

A description of the detailed processes and learning cycles has been provided in an earlier paper (Schmitt, 2014a) and visualized in posters (Schmitt, 2014d, 2014k). Another recent paper adds the corresponding hands-on user perspective and reports how the concept is applied by utilizing the prototype for the paper's creation (Schmitt, 2014c). A paper focusing on the significance of memes in the PKMS context is forthcoming (Schmitt, 2014j).

PKM4D Criteria 4: Collaborative Choice

Self-determination guides the process of controlling one's own life and career and one's choice of personal and professional acquaintances (Figure 1). Wiig (2011) reminds institutions that "the overall performance and viability of societies and enterprises result from innumerable small actions by individuals. Small personal 'nano actions' combine with larger departmental actions that combine to create consolidated enterprise actions that result in the performance of the whole organization. [Hence], people must be provided with resources and opportunities to do their best. They need knowledge and understanding as well as motivation and supportive attitudes".

Florida (2012) stresses that the norms of today's Creative Class "are different from those of more traditional society. Individuality, self-expression, and openness to difference are favored over the homogeneity, conformity, and 'fitting in' that defined the previous age of large-scale industry and organization." He describes a "new model of economic development that takes shape around the three T's – technology, talent, and tolerance", he reports that "the most successful and prosperous

metros excel at all three", and he finds that "companies were moving to or forming in places that had the skilled people" instead of people moving to jobs. Knowledge workers, who can successfully reconcile the conflicting chances and demands alluded to, have numerous options on where, how, and for whom they will put their portable and mobile knowledge to work, provided they prepare themselves for the opportunities and safeguard against limited alternatives.

Accordingly - like any organization - an individual needs to reflect on his/her past, the current situations, and the future (Figure 4) to adequately prepare for the way ahead - supported by one's PKMS. The four components of a strategy, Andrews (1987) advocated for enterprises also apply for the individual. Abilities, power, resources (can do), obligations, ethics, social responsibilities (should do) and personal values, motivation, aspirations (want to do) have to be matched against potential opportunities and risks (might do). Choosing the right actions requires also defining the means (ways to do) and ends (agree to do, if not with stakeholders in an organization, then maybe with family and friends). Based on the finalized planning details, the relevant activities have to be timely carried out and the actual performance measures and results need to be monitored in order to take corrective action if required (Schmitt, 2012).

In this endeavor, 'Emotional Capital' (EC) represents the set of resources (emotional competencies) that inhere to the person useful for his or her cognitive, personal, social and economic development […] It is also a crucial resource allowing individuals and institutions to be more effective in achieving common objectives [and] seems to be an important factor in explaining why human capital formation, accumulation and exploitation can be different across individuals, jurisdictions and national borders" (Gendron, 2004). As a vital source of self-understanding and self-reflection, Emotional Capital also encompasses the capacity to build emotional resilience and fortitude that will be so important for taking courageous action (Gratton, 2011).

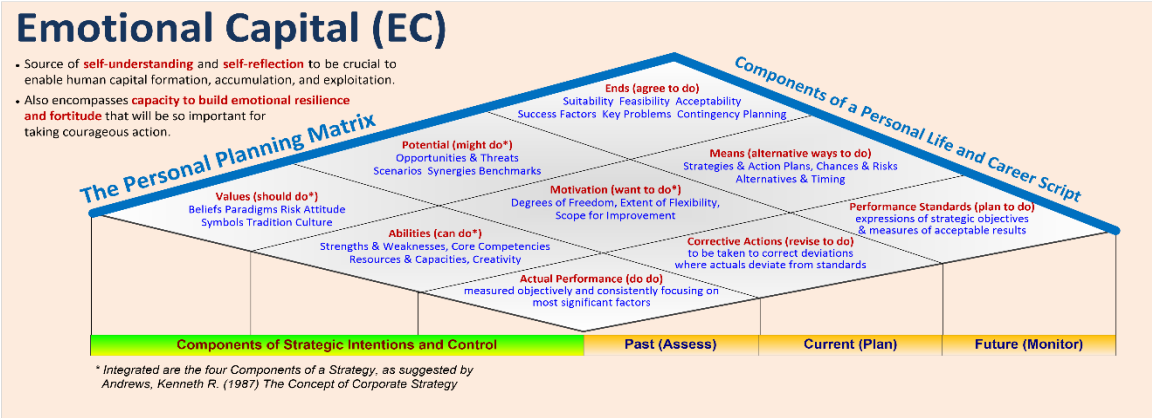

Figure 4: Personal Planning and Emotional Capital (Andrews, 1987; Schmitt, 2014d)

PKM4D Criteria 5: Relational Interactivity (ICT4D-3)

The relational third component of the CCD framework "stems from the focus of capability and conviviality on the social aspects of human life and the ability and need for people to form ties with other people. People should be able to develop and maintain associations with others to share ideas and this augments their creativity. This is the backbone to producing and sustaining a society that values individual freedoms" (Johri & Pal, 2012). The notion fits well with Maslow's level of social needs (Figure 1) which acknowledges the human sense of belonging and acceptance among their social groups, regardless of their population size and the evasion of demoralizing isolation.

Also, “knowledge, as part of all reality, is socially constructed. […] We learn in context with others. We 'stand on the shoulders of giants' when we adopt given wisdom, or rote learning. And, importantly, if our own original thoughts are to be useful to ourselves and others, they must fit within existing structures of meaning, that is, they must 'make sense' to our referent group” (Kolb & Collins, 2011). Accordingly, "there is a large school of network researchers who come from a rational self-interest paradigm", where "individuals consider the creation of ties as an investment in the accumulation of social resources or social capital” (Katz, Lazer, Arrow, Contractor, 2004).

Social Capital (SC) has been defined as the “sum of the resources, actual or virtual, that accrue to an individual or group by virtue of possessing a durable network of more or less institutionalized relationships of mutual acquaintance and recognition" (Bourdieu & Wacquant, 1992). Hence, organizations and individuals share a common knowledge management predicament: the scope of a pure contact database or directory is insufficient; one needs insights concerning the resourcefulness of the intellectual capital involved, in terms of the sum of one's ties and the depth of one’s networks.

Gratton (2011) predicts that connections and interactions will become ever more vital. Since finding and keeping regenerative relationships will be a key competence, they also will have to be crafted and nurtured in conscious ways. Lin (2008) described the process of how social capital is expected to produce returns in terms of access or mobilization. "’Accessed Social Capital’ estimates the degree of access to such resources or the extent to which a potential pool of resources capable of generating returns is available in the networks to the actor. It indicates the capacity of capital. An assessment or inventory of resources in the social networks of an actor - accessible or embedded resources - reflects such capacity. [...] ‘Mobilized Social Capital’ reflects the actual use of a particular social tie and its resources in the production or consumption in the marketplace. It represents a selection of one or more specific ties and their resources from the pool for a particular action at hand. For example, using a particular contact with certain resources (e.g., his/her wealth, power or status) in a job search process may indicate a mobilized social capital".

Fittingly, "network researchers have examined a broad range of types of ties. These include communication ties (such as who talks to whom, or who gives information or advice to whom), formal ties (such as who reports to whom), affective ties (such as who likes whom, or who trusts whom), material or work flow ties (such as who gives money or other resources to whom), proximity ties (who is spatially or electronically close to whom), and cognitive ties (such as who knows who knows whom). Networks are typically multiplex, that is, actors share more than one type of tie" (Katz et al., 2004).

The PKMS knowledge bases accommodate the capturing of basic contact information of people, teams, organizations, or communities and allow classifying them according to their research/business/service-related or geographic relevance. Additionally, the PKMS concept and prototype portrayed offers to qualify this Social Capital further by recording their P.R.O.F.I.L.E.S. inter-relationships and roles (Figure 5) as well as their access to relevant personal and shared intellectual capital. The deep and wide coverage of these assets is a key feature and objective of an organizational KMS, but, as pointed out, the relevance equally applies to a Personal KMS. Thus, ‘Relational Interactivity’ - in terms of PKM4D – strengthens the ability to interact and form or maintain relationships with others.

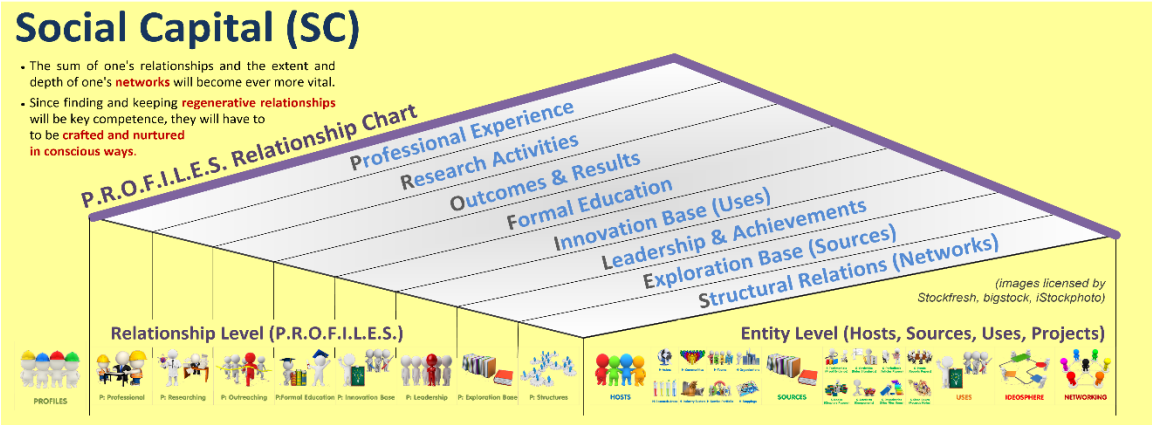

Figure 5: Social Capital and the P.R.O.F.I.L.E.S. Relationships (Schmitt, 2014d)

PKM4D Criteria 6: Creative Conversations

Compared to the previous criteria 'Relational Interactivity' where a PKMS acts primarily as a recording device of contacts and relationships, the criteria of 'Creative Conversations' refers to the actual facilitation of real-time conversations or collaborations between PKMS device users.

The term 'Creative Conversations' has been adopted from Levy (2011) who has been cited already with his predicted scenario of a KM revolution putting PKM potentially right at the center stage of the next Knowledge Management System generation. This endeavor has to reach beyond the focus of the first generation of [organizational] Knowledge Management Systems, described by Pasher and Ronen (2011) as the capturing, storing, and reusing of existing knowledge which was viewed as a foremost strategic organizational asset in need to be measured and protected. The next KM generation 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.

Levy (2011) bases his scenario on the assumption of decentralized autonomous PKM capacities. Nourished by creative conversations of many individuals' personal knowledge management activities, PKM systems are envisaged to constitute "the elementary process that makes possible the emergence of the distributed processes of collective intelligence, which in turn feed it". Figure 6 attempts to visualize these decentralized creative conversations of autonomous PKM capacities with examples of beneficiaries and opportunities. As a consequence, the PKMS concept offers not only effective low-cost autonomous applications (Accessibility Easiness & Operable Autonomy) and the means for contributing own ideas based on one's background and preferences (Expressive Creativity & Collaborative Choice), it also facilitates to do it in productive collaborative environments with other users/owners (Relational Interactivity & Creative Conversations).

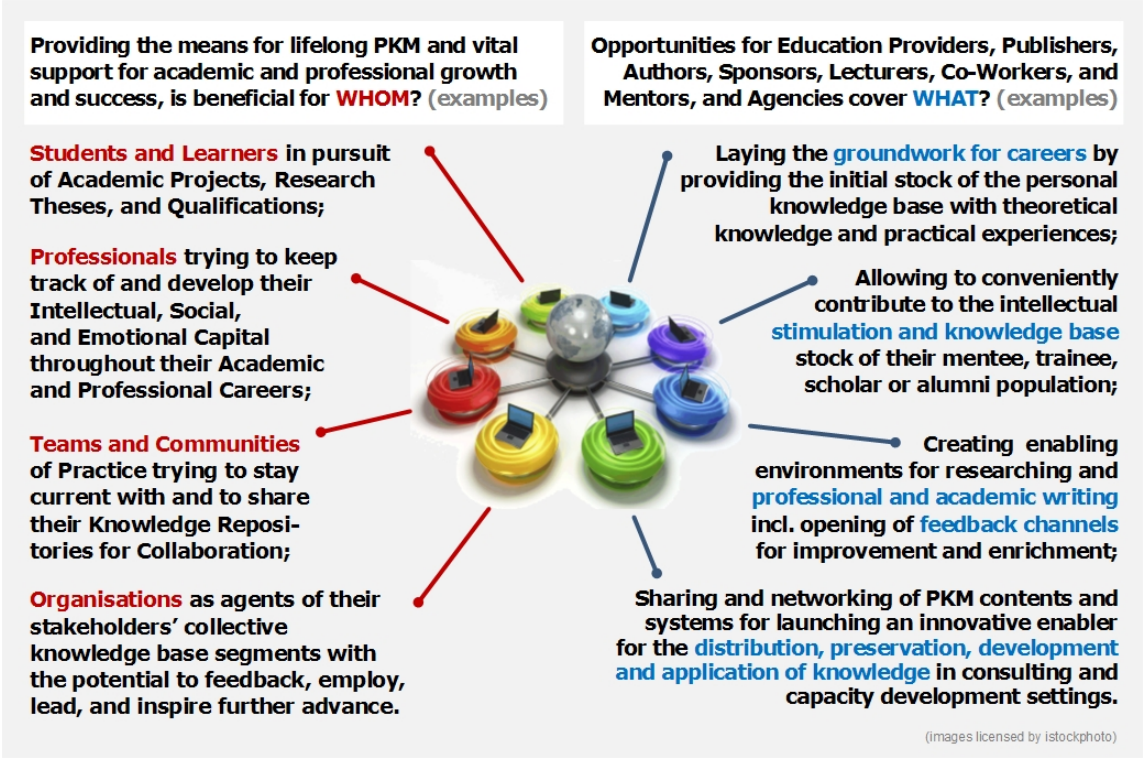

Figure 6: Creative Conversation Clusters of Individual PKM Devices (Schmitt, 2013f)

PKM4D Criteria 7: Ecological Reciprocity (ICT4D-4)

"The root objective of PKM is the desire to make citizens highly knowledgeable. They should function competently 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" (Wiig, 2011).

Thus, the final ICT4D criteria 'Ecological Reciprocity' highlights "the need for people to give back to their environment and not just take resources from it, [a vital pre-requisite for a] participative culture and working in a collective milieu" (Johri & Pal, 2012). The criteria ties in with Maslow's cognitive and aesthetic needs (Figure 1) and is supposed to translate into opportunities to enrich the environment rather than encountering prospect-poor restraining horizons. But, bearing in mind Gurteen's definition of a knowledge worker (2006), 'Ecological Reciprocity' is not only tied to 'tit-for-tat' or work-for-pay-type of interactions, for example:

- "Imagine a world in which every single human being can freely share in the sum of all knowledge" is part of Wikipedia's commitment and vision statement (2014) in order to create its free online encyclopedia - written entirely by its mostly volunteering users.
- The website Galaxy Zoo has recruited more than 200,000 online volunteers to help astronomers classify galaxy images.
- The Foldit project has recruited 75,000-plus participating volunteers to play an online game challenging them to solve how DNA gives rise to the molecules called proteins.

In 'Reinventing Discovery', Nielsen (2011) gives examples of many more citizen science projects. He disagrees with the cynical views "that most people aren't smart or interested enough to

make a contribution to science" and reasons that "all that's lacking are tools that help connect them to the scientific community in ways that let them make that contribution".

For a PKMS concept to assist its user in productively enriching the wider environment and to develop the related skills, it has to support the full cycle of knowledge identification, acquisition, development, distribution, use, preservation, measurement, and goal-setting, referred to as the eight building blocks of knowledge management (Probst, 1998). Boisot's 'Agent and the World' (2004) provides a basic outline for what is involved and has been adjusted to suit the PKM4D context (Figure 7).

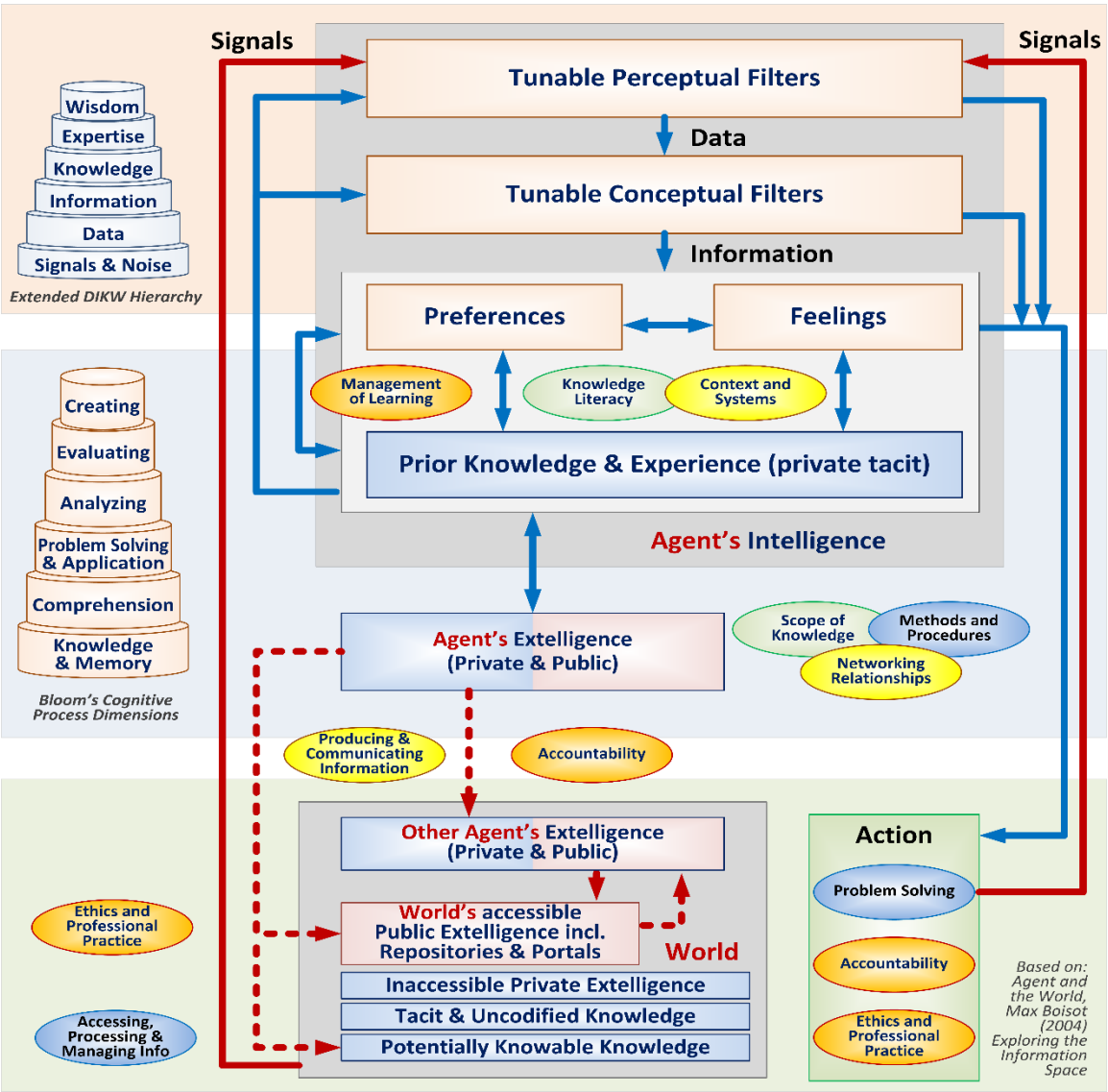

Figure 7: Agent and World Extelligence (based on Boisot, 2004)

Individual intelligent agents convert external signals into data, information, and thence into knowledge through filtering processes that are guided by preferences, feelings, and the possession of prior knowledge. But, agents have finite brains and intelligence, and the data and information encountered often exceeds what they are able to process or memorize. To overcome these insufficiencies, they make use of external processing and storage devices (Boisot, 2004), referred to as Extelligence. Extelligence forms the external counterpart to the intelligence of the human

brain/mind and deals in encoded information whereas intelligence deals in understanding; together they are driving each other in a complicit process of accelerating interactive co-evolution. All of the world's extelligence represents the cumulative archive of the human cultural experience and know-how accessible and augmentable by any individual who knows how (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. Also, encoded knowledge is "inevitably simplified and selective, for it fails to capture and preserve the tacit skills and judgment of individuals [comprehensively]" (Lam, 2000). Owed to these continuous cycles and learning experiences, an agent also acquires 'Expertise' (knowledge that can be demonstrated) and Wisdom.

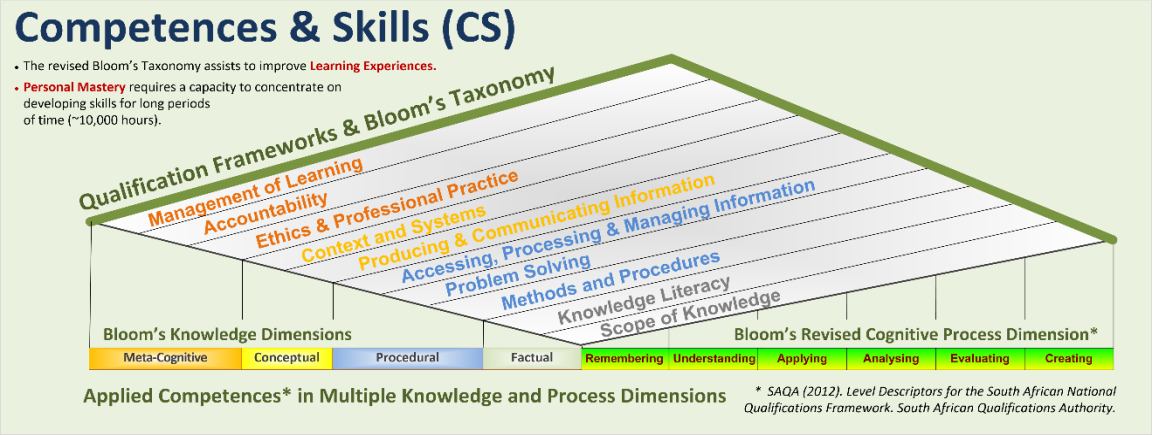

Figure 8: Competences, Skills, and Qualification Framework (Schmitt, 2014d; SAQA, 2012)

To successfully navigate this environment, an agent ought to possess a number of skills and competencies. Figure 7 incorporates the ten applied competence categories of the South African National Qualification Framework (SAQA, 2012) detailed in Figure 8.

Contents related to the 'Scope of Knowledge' and 'Methods and Procedures' competencies can be stored in the PKMS's knowledge base to support user's 'Problem Solving' actions. The results and feedbacks of these activities enable learning and the encoding of the knowledge gained, documenting 'Knowledge Literacy' and explaining 'Context and Systems' in the process. In order to perform information tasks, the competencies 'Accessing, Processing, and Managing' and 'Producing and Communicating' have to be applied by making use of 'Networking and Relationships' which might also be maintained in one's PKMS as discussed earlier. The handling of these tasks requires 'Management of Learning' skills which can be guided by the PKMS assisting and controlling functionalities. Whenever actions are carried out and external extelligence is utilized or contributed, matters of 'Accountability' and 'Ethics and Professional Practice' have to be adhered to (respective rules, standards, and support can be hosted by the PKMS).

The user's PKMS interactions and the e-Skills employed involve all of Bloom's six cognitive process dimensions (remembering, understanding, applying, analyzing, evaluating, and creating). The realization of decentralized autonomous PKM capacities, enabling 'Creative Conversations' based on the Five Provisions alluded to, will considerably ease the processes depicted and allow users to interrelate with extelligence more systematically to either develop one's own competencies further or to add productively to the world's record in order to enrich the environment.

PKM4D Criteria 8: Personal Mastery

The fragmentation of work and the poverty of attention cause considerable repercussions for knowledge workers. Gratton identifies them as the slipping control over constant interruptions, the loss of time for real concentration, and less learning by observation and reflection. However, it takes time and concentration to become masterful. Gratton (2011) cites psychologist Daniel Lvitin's study of people who have achieved mastery in their role as composers, basketball players, fiction writers, ice skaters ... and master criminals. Lvitin found that, despite their very different areas of skill, they all had one thing in common, "a capacity to concentrate on developing their skill for long periods of time. In fact, he found that 10,000 hours is the common touchstone for how long it takes to achieve mastery" (Gratton, 2011).

In order to steer clear of a lack of proficiencies and "to write a personal career script that can bring fulfillment and meaning", Gratton (2011) recommends attending to and growing one's three sources of capital or resources: Social (SC), Emotional (EC), and Intellectual Capital (IC). The significance of the two former have already been considered in respect to criteria 'Relational Interactivity' and 'Collaborative Choice'. The latter, Intellectual capital, also will become increasingly important for creating valuable jobs and careers, but - to succeed - one has to differentiate oneself from the crowd by building depth and by putting in the time and resources to create a body of knowledge and skills - not only in one single but multiple areas. Greene (2012) describes the intellectual journey involved in this endeavor as follows:

- "You want to learn as many skills as possible, following the direction that circumstances lead you to, but only if they are related to your deepest interests.
- You value the process of self-discovery and making things that are of highest quality.
- You are taking full advantage of the openness of information, all of the knowledge about skills now at your disposal.
- You are not wandering about because you are afraid of commitment, but because you are expanding your skill base and your possibilities.
- When ideas and opportunities inevitably present themselves to you, all of the skills you have accumulated will prove invaluable.
- And, you will be the Master at combining them in ways that are unique and suited to your individuality" and to the needs of your clients and customers.

These needs and desires expressed correspond closely to Maslow's hierarchical level of Self-Actualization (Figure 1) where "the individual works to actualize the individual's own potential" (Koltko-Rivera, 2006). Going beyond one's potential, has been formulated as the Peter Principle which states that - given enough time – "in a hierarchy each employee rises to, and remains at, his[/her] level of incompetence" being unable to carry out his/her duties from that point in time. Work is accomplished only by "those employees who have not yet reached their level of incompetence" and are still awaiting their final promotion (Peter & Hull, 1969).

Unfortunately, people who are unskilled in many social and intellectual domains "suffer a dual burden: Not only do these people reach erroneous conclusions and make unfortunate choices, but their incompetence robs them of the metacognitive ability to realize it" (Kruger & Dunning, 2009). The study results concur with the saying: "Not ignorance, but ignorance of ignorance, is the death of knowledge" attributed to Alfred North Whitehead. Thus, developing our intellectual capital requires more advanced assistance "for identifying and filling knowledge gaps, detecting and correcting flaws, and deciding on suitable means for evaluating and advancing our repositories including the recording of related to-dos, progress, processes, and feedback (Schmitt, 2012).

Fortunately, the domains of ignorance (Armour, 2000; Kerwin, 1993; Schamanek, 2012; UAHSC, 2012) being given prominence by Donald Rumsfeld (2002) provide us with a fitting

classification system to structure the tasks involved and to address the concerns raised and with it some means to overcome them. Figure 9 depicts the extended nine-sector version with the Ignorance Matrix also showing the related learning cycles and associated wastes (Schmitt, 2013f).

In the top corner of Figure 9, the 'known knowns' resemble all the explicit or formal knowledge we know we know or have access to; they form the base we are operating from at any given time. The 'unknown knowns' in the bottom corner refer to implicit knowledge (expressible but previously unexpressed or tacit) that is gained experientially and, hence, difficult to articulate, explain, or share. The 'known unknowns' in the right corner cover things we know we don't know; these are personal knowledge gaps in need of being addressed, but also involve knowledge avenues briefly explored but found to be futile. Lastly, the 'unknown unknowns' in the left corner represent things we don't know we don't know due to a lack of awareness of their existence.

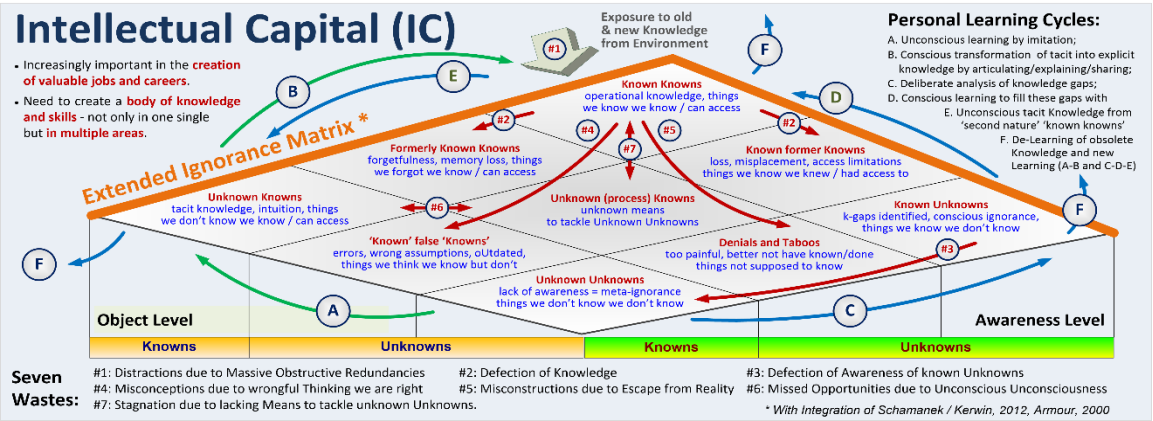

Figure 9: Intellectual Capital and the Extended Ignorance Matrix (Schmitt, 2014d; based on Kerwin, 1993; Armour, 2000)

The blue lines depict the Learning Cycles and Personal Development Support Needs and address unconscious experiential learning by imitation to create implicit or tacit knowledge (A) and its subsequent potential state of conscious awareness or externalisation (B). Alternatively, they involve deliberate analysis of knowledge gaps (C), conscious learning to fill these gaps (D) with some of the 'known knowns' to become 'second nature', so that further personal tacit knowledge might be created unconsciously (E).

In addressing gaps, any 'unknown unknowns' have to be critically examined, if they can be categorized as 'Knowables' (we might not know but others do) or 'Unknowables' either temporary (nobody knows yet) or permanently (nobody will ever know). The Cynefin Model shows that the distinctions are of particular relevance when systems or decision making contexts change from simple and complicated to complex and chaotic (Snowden, 2002).

Also, in a dynamic environment, continuous progress and changes take place and newer knowledge adds to or substitutes for older knowledge rendering some of our own 'knowns' obsolete. Accordingly, we are in need of keeping our intellectual, social, and emotional capital in a continuous mode of maintenance by monitoring our environment and being guided. This enables us, when needed, to take deliberate corrective action via de-learning (F) and new learning (A-E).

By extending the original domains of ignorance chart from four sectors to a 3x3 matrix personal memory gaps and losses can be distinguished and visualized in the same manner as the personal learning cycles discussed. The approach results in seven potential wastes and resembles the Muda method introduced by Taiichi Ohno (2007) and successfully applied in Lean Operations Practic-

es. The Muda (Japanese term for waste) method provides a common sense heuristic where the elimination or reduction of waste (assuming overall balance is maintained) is improving the overall status of the whole system. In the PKM context, the wastes manifest themselves in form of lost opportunities (time, money, status) or negatively impacted relationships and well-being.

Waste #1: Distractions due to Massive Obstructive Redundancies

The intensifying information overload mentioned is fed by high degrees of noise and trivial chatter as well as replicated, fragmented, misconstrued, and incomplete contents exaggerated by missing, broken, or pretentious web links or references. Since Simon (1971) warned about attention poverty, academic publications have increased due to rising student numbers and 'publish-or-perish' career policies; repetitions are thriving since many authors appear to be standing on the shoulders of the same giants. Estimates in 2005 predicted that all the knowledge that had been known then will comprise only 1% of all the knowledge available by the year 2030. The advances in search engines are unable to keep pace and, hence, daunting, discouraging, and time-wasting necessities are taking over and weaken individuals' productivity and advances. Accordingly, our limited time budgets and attention spans are prevented from following any of the more fruitful learning cycles portrayed earlier.

Waste #2: Defection of Knowledge

Complementing the sorry consequences of our storage habits (Figure 2 and 'Operable Autonomy' criteria), forgetfulness and bad memory cause our non-obsolete knowledge to further deteriorate; but even if we do remember, limited access to or loss and misplacement of records might still prevent a total recall. As a consequence, time and effort has to be re-spent to regain the status of knowledge we once commanded or erroneous conclusions and unfortunate choices transpire.

Waste #3: Defection of Awareness of known Unknowns

To some degree we are aware of our areas of ignorance and we have made plans to address them. Alternatively, we might have made a deliberate decision to keep it that way because the expense and time exceed the perceived benefit of investing in that knowledge at a particular point in time (e.g., a source considered not to be useful for a current project). This 'rational' state of ignorance can be affected by the same factors discussed in regard to waste #2 with the same consequences.

Waste #4: Misconceptions due to wrongful Thinking we are right

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 this category up to unacceptable levels. In 'The Half-Life of Facts, Arbesman (2012) 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.

Waste #5: Misconstructions due to Escape from Reality

At times, we also might deliberately deny to know, because we are not supposed to (taboos, faith, secrets) or we want to avoid accountability and potential retributions. This waste also includes the psychological suppression of realities to evade distress and pain caused, for example, by traumatic events or experiences.

Waste #6: Missed Opportunity due to Unconscious Unconsciousness

Nonaka's SECI Loop Model promotes the externalizing of implicit or tacit knowledge in an organizational context for subsequent combination, internalization, and socialization (Nonaka & Takeuchi, 1995). In the light of PKM, being unaware of one's implicit or tacit knowledge is being ignorant of one's personal strengths or weaknesses and their potential for improvement and personal progress. This waste or lack of awareness of one's tacit operational knowledge is closely linked to a similar lack of process knowledge, the 'unknown "process" unknowns' (Armour, 2000) depicted in the center of the three-dimensional ignorance matrix (Figure 9).

Waste #7: Inertia due to lacking Means to tackle unknown Unknowns

In surroundings of ever-increasing 'unknown unknowns' and expectations of tackling increasingly complex problem spaces, individuals feel the pressure to engage in wider or unfamiliar contexts of often multi-disciplinary nature in order to widen their horizons. Hence, the seventh waste refers to the lack of process knowledge and suitably efficient means to become aware of relevant 'unknown unknowns' and how to tackle them (management of learning at the meta-level). In our context, this need of process knowledge literacy applies to all categories of the ignorance matrix. Lack of it considerably inhibits Personal Learning Cycles and their aim to keep à-jour, to intentionally move things from "unknown" to "known" as well as to avoid involuntarily letting things slip from "known" to "unknown" categories.

PKM systems can considerably service 'Personal Mastery' by "supporting the personal learning cycles and by avoiding or minimizing the risks of the seven wastes. Users obtain the means to retain and build upon knowledge acquired in order to sustain personal growth and to facilitate productive contributions and collaborations between fellow learners and professional acquaintances" (Schmitt, 2013f). In effect, a PKMS enables self-reflecting monologues of its users over lifelong learning periods, ensures that the extelligence assembled is biographically self-determined and presents itself as a former state of personal knowledge captured. It further secures that users are autonomous in the development of their expertise and how it is used or exchanged with people, communities, or organizations close to them (Schmitt, 2014e).

PKM4D Criteria 9: Encouraging Empowerment

The conventional description of Maslow's Hierarchy of Needs does not reflect his later amendment which "places self-transcendence as a motivational step beyond self-actualization" at the highest level (Figure 1). Self-transcendence seeks to further a cause beyond the self and "may involve service to others or a devotion to an ideal (e.g., truth, art) or a cause (e.g., social justice, environmentalism, pursuit of science, religious faith)" (Koltko-Rivera, 2006). The criteria 'Encouraging Empowerment' takes this notion on board by helping others to achieve self-actualization, by aiming to ensure that their potentials are not overlooked, and by acknowledging responsible leadership and integrity in the process.

It is only a century ago, that Frederick W. Taylor, considered to be the father of scientific management, stated: "In our scheme, we do not ask the initiative of our men. We do not want any initiative. All we want of them is to obey the orders we give them, do what we say, and do it quick" (Will, 1997). Since then, the world has experienced an accelerating co-evolution of Physical and Social Technologies (Beinhocker, 2006), including ever-adapting management techniques which have thoroughly transformed Taylor's hierarchical leadership thinking. Fittingly, Florida (2012) backs this notion in the 'Rising Creative Class' by referring to Barley´s observation that bosses – unlike in the old days – do not know their business better than their subordinates any more. Also, not only are the knowledge and skills of a knowledge worker portable and mobile, in our wired world, "information in the form of pure energy can easily fly out of the door and morph into a

thousand variations of the product and service we used to think we owned" (Tarlow & Tarlow, 2002).

What this means to teams, organizations, and communities has been summoned up by Hamel (2012) in 'What matters now': "Today, no leader can afford to be indifferent to the challenge of engaging employees in the work of creating the future. Engagement may have been irrelevant in the industrial economy and optional in the knowledge economy, but [in today's creative economy] it's pretty much the whole game now. [Hence,] if you are a leader at any level in any organization, you are a steward - of careers, capabilities, resources, the environment, and organizational values".

This call for stewardship applies, in particular, to mentors, coaches, and educators. In line with his prediction of a PKM revolution, Levy (2011) reasons that "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 Personal Knowledge Management".

But, as indicated in the background section, the leadership of educational institutions is seriously questioned and their performance more than ever under scrutiny due to non-delivering e-Learning technology and the declining value-for-money to their students. "Educational services ought to be built on carefully understanding the deeper and long term needs of their clients/students, and then providing them with the means [like PKMS devices in order] to retain and build upon knowledge acquired to sustain personal growth and facilitate productive contributions and collaborations in the advocated knowledge societies" (Schmitt, 2013a). Having internalized and benefitted from the PKMS-supported processes (Figure 10), a graduate can then adopt the technology and methods in a wider context during his/her professional life.

In exploring the hypothetical question: 'What if an institute of higher learning would not only succeed in accomplishing the learning outcomes set, but also provide its staff, students and graduates with the means whose backing and support would encompass the full life span of an individual's academic and professional career?", a recent paper contemplates where a PKM system support approach can make a difference in academic value chains, in the logics and logistics of new knowledge formation, and in paving the way for personal accomplishments (Schmitt & Butchart, 2014).

With PKMS Part and Parcel of the Educational Experience:

- **Known Knowns will provide the potentially limitless Soil,**
- **Learning and Research (existing memes) the life-spending Water,**
- **One's own Thoughts (new memes) the Fertilizer,**
- **Re-combinations, Re-phrasing, and Re-purposing the Farm Work,**
- **Supporting Collaborators and Mentors (peers' memes) the Helping Hands,**
- **Publications, Presentations, and Contributions, the Crop, and the**
- **Shared Harvest will be represented by Knowledge Dissemination leading to Adaptations, Co-operations, Innovations.**
- **The digital PKMS quartermaster will Guard the Fruits and the way for mastering the interdependent & iterative Cycles."**

(images licensed by stockfresh & bigstock)

Benefitting Education

- **Laying the groundwork for careers by providing the initial stock of the personal knowledge base with theoretical knowledge and practical experiences acquired from the education provider,**
- **Enabling lecturers, authors, publishers, sponsors, and institutions to conveniently contribute to the intellectual stimulation and knowledge base stock of their scholar and alumni population,**
- **Creating a constructive environment for researching and writing academic project papers, theses, and dissertations to meet academic and professional qualification requirements,**
- **Offering feedback channels to students, mentors, supervisors which connect directly to the relevant memes and enrich the potential of their improvement or further development,**
- **Sharing and networking of meme-based PKM contents and systems for launching an innovative enabler for the distribution, preservation, development and application of knowledge.**

Figure 10: PKMS Metaphors and Benefits in the Educational Context

The PKMS concept and interactions, as shown, foster the development of applied competencies. The knowledge repositories of the current prototype host the memes (text and figures) of all the author's papers as well as the contents of their referenced citations. They serve as one of the system testing grounds, are used for advancing own authorship projects, and are envisaged as documentation for system support and training.

However, due to the systemic meme-based nature of the PKMS, this support will not only be document-based but available within the system in its meme-based representation with its context-rich linkages, capable of integrating a user's annotations, comments, lessons learnt and ready of being re-used, re-purposed, and assimilated benefitting the user's subsequent intended purposes.

A further obvious spin-off of the current system migration process is designing a PKM/OKM course description and training concept in support of the educational needs (Schmitt, 2014b), as highlighted by Levy. The applied research and prior papers have established that central KM philosophies and methodologies can be neatly integrated in the overall PKM concept proposed.

KM Scholars have described the types of knowledge and KM approaches in sometimes complementary, sometimes overlapping or conflicting ways or differentiated, like Skovira (2011), according to Western or Eastern Narratives. Due to the integrative nature of the PKMS concept and technology, the system embodies a common point of departure to introduce a substantial set of KM tools and ideas and their authors in a transparent and coherent manner. Hence, the publishing of a book and the development of corresponding online courses on appropriate platforms - based on the context-rich, multi-dimensional meme structures and trails already in place - are also on the agenda.

PKM4D Criteria 10: Institutional Performance

It has been argued, that the networked academic world paired with the web and cloud-based functionalities of a meme-based PKMS technology is able to provide an enabling environment for the distribution, preservation, development and application of knowledge. Scholars can substantially benefit from its use and its accumulating personalized intellectual, social, and emotional capital and knowledge bases are likely to be a potent trigger for further on-going PKM practices in their commencing careers. As a result, the world's record is likely to flourish thanks to more empowered individuals with better how-to-employ and how-to-create extelligence skills and due to added knowledge memes and non-fading trails with their superior accessibility.

In regard to the 'Digital Divide', a decentralized personal low-cost PKMS device presents a low access barrier, in particular, in those development countries which, in recent years, have experienced a considerable drop in ICT hardware prices and improved Internet and broadband services at reasonable speeds and affordable fees. Foremost, a PKMS addresses the 'Innovation Divide'.

"Assuming educational institutions would drop their centralized knowledge services software solutions in favor of a decentralized networked PKMS solutions, the students leaving their alma maters would - at last - be able to seamlessly continue to utilize the systems they were familiarized with during their studies in their private and professional life with the potential to benefit from lifelong learning support offered to them as alumni. As a welcome by-product, the PKM skills acquired would contribute significantly toward many of the currently advocated graduate attributes and generic learning outcomes, for example, literacy in ICT; research and information literacy; communication skills; self-directed, lifelong learning; organization and teamwork; entrepreneurship and employability" (Schmitt, 2014h).

Although the PKMS concept aims at departing from the centralized institutional developments and at strengthening individual sovereignty and personal applications, it is not meant to be at the expense of Organizational KM Systems, but rather as the means to foster a fruitful co-evolution.

Firstly: Organizations will probably more than welcome recruitees armed with the skills and competencies a PKM system imparts on them, because "the quality and extent of knowledge possessed by people - their competence - and structural IC assets available to them determine the realized enterprise performance" (Wiig, 2011).

Secondly: Although the complexity, management and resource requirements (technology & overheads) of an Organizational KMS far exceed those of a Personal KMS, the "shared base of methodologies and concepts, the common resource of the world's record, and the joint aim to stay competitive and innovate provide strong arguments for OKM and PKM to exploit synergies for mutual benefit" (Schmitt, 2014g). Recent papers have established a common ground of OKM methodologies which have been fully integrated in the PKM concept (table 2); the integration has been visualized in a 3D-Information-Space Model (Boisot, 2004; Schmitt & Butchart, 2014).

Thirdly: Due to these synergies, PKMS and their organizational counterparts ought to partner for pooling and feeding back records and relations. While corporate communication, project, and KM tools currently allow corporate users instant access to resource plans, progress reports, and team members' contributions for works-in-progress, the release of some of the yields into the personal custodies of those contributing tends to be not part and parcel of their functionalities. In an increasingly mobile and cooperative world, KM systems ought to be more 'care & share' oriented for the mutual benefit of its stakeholders (Schmitt, 2012). The aim has to be to collaboratively interlink and collectively harvest prior accumulated knowledge subsets provided the PKMS user also benefits. The integration of 'individualization' and 'institutionalization' to facilitate consolidated team actions that convert individual into organizational performances and the related role of personal and organizational knowledge assets will be explored further (Schmitt, 2014g, 2014i).

Table 2: Organizational KM Methodologies integrated into the PKM Concept

Methodology	Reference to Originators	Reference to Author's Paper
Eight Building Blocks of Knowledge Management	(Probst, 1998)	(Schmitt, 2012)
Domains of Ignorance Matrix and its Extensions and Wastes	(Kerwin, 1993) (Armour, 2000)	(Schmitt, 2013f)
The Agent and the World, Concept of Extelligence	(Boisot, 2004) (Stewart & Cohen, 1999)	(Schmitt, 2013b)
Model of the Sensemaking Loop for Intelligence Analysis	(Pirolli & Card, 2005)	(Schmitt, 2013b)
SECI Loop Model; Concept of 'Ba'	(Nonaka & Takeuchi, 1995) (Nonaka et al., 2000)	(Schmitt, 2013d, 2014i)
JAIST Nanatsudaki Model or Seven Waterfalls Model	(Wierzbicki Nakamori, 2007)	(Schmitt, 2013d)
Three Sources of Human Capital or Resources	(Gratton, 2012)	(Schmitt, 2013a)
Academic Value Chain with its 10 Commitments	(Schmitt & Butchart, 2014)	(Schmitt & Butchart, 2014)
Ten Applied Competencies ZA Qualification Framework	(SAQA, 2012) [33 46 35].	(Schmitt & Butchart, 2014) (Schmitt, 2013b)
Information Space Model (I-Space) *	(Boisot, 2004) [42 38 37].	(Schmitt, 2014a, 2014c, 2013d, 2013e, 2013c, 2014k) *

* The progress in the development of the PKMS system and functionalities has been visualized in the three-dimensional I-Space Matrix as a series of consecutive figures or posters.

PKM4D Criteria 11: For the Common Good

"Extelligence is not just a matter of 'keeping a record'. The intelligence of each individual allows them not only to access the cumulative body of extelligence, but to add to it or change it. […] We are what we are because of a remarkable complicity between intelligence and extelligence. Intelligence invents but cannot reliably and accessibly remember what it has invented; extelligence can remember but (on the whole) not invent. Extelligence deals in Information; Intelligence in Understanding" (Stewart & Cohen, 1999).

So, rather than extelligence and "knowledge being shut up in silos and balkanized within small closed communities, one of the ideals of social knowledge management is clearly its decompartmentalization, exchangeability and commensurability. An intelligent collectivity or a collaborative learning network has a truly shared memory only insofar as that memory is constructed and modelled by the creative conversation of its members in a unifying medium" and cannot be optimized via 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).

A further emerging bottleneck has been pointed out by Nielsen (2012). In 'Reinventing Discovery', he reminds us that - since the 17th century - the academic-paper-based citation system has been the basis for the reputation economy in science. 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".

To take advantage of today's online realities, Nielsen (2012) 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. "If 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 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".

The suggested overhaul would not only benefit the contributors of the many citizen science projects Nielsen refers to, but also would provide further relief from the detrimental effects caused by the opportunity divides as discussed in the subsection 'Ecological Reciprocity'.

Bush (1945) based his bold vision on the observations of 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". He also believed that "the world has arrived [back then in 1945!] at an age of cheap complex devices of great reliability" and, hence, that this technology would be able to provide the means to make 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". His remarkable insight is proving more relevant than ever before.

Bush foresaw the appearance of new forms of encyclopedias with an extensive mesh of associative multi-disciplinary trails already built-in as well as a new profession of trail blazers who find delight in the task of establishing useful trails through the enormous mass of the common record.

The PKMS concept portrayed aims to provide users finally with the functionalities of the Memex envisioned seven decades ago. To paraphrase Bush: "As an added benefit of the trails captured, content provided by the PKMSs' creative conversations becomes not only their additions to the world's record and extelligence, but includes for the acquaintances or community the entire scaffolding by which the content has been erected" (original: "As an added benefit of the trails captured, the inheritance from the master becomes not only his additions to the world's record, but includes for his disciples the entire scaffolding by which they have been erected." (Bush, 1945))

A dedicated paper-in-progress explores these challenges and opportunities further in the context of paper-versus cloud-based publications, document-versus-meme-based repositories, individual and institutional curation, digital scholarship, and academic citation systems.

PKM4D Criteria 12: Technological Progress

A recent paper (Schmitt, 2014f) looks at human development and argues that the progress of civilization has been primarily shaped by four successive co-evolutions (CE) which resulted in the rises of Embodied and Embrained (CE1), Encapsulated and Encultured (CE2), Encoded and Organizational (CE3), and Digitized, Networked, and Enclouded Knowledge (CE4). At each transitional stage, civilization had been running into constraints which could only be overcome with the emergence of a further powerful co-evolution triggered by the emergence/invention of Learning, Imitation, and Language (CE0-1), Writing, Printing, and Institutional Memory (CE1-2), Digitization, Information and Communication Technology (CE2-3), and Cloud Computing and the Industrial Internet (CE3-4).

The paper considers this over-abundance of information as the presently emerging barrier to individual and collective development. It expects that the prospective realities will further defeat the very attention our cognitive capabilities are able to master - at least until direct access to the Internet through brain implants will allow us to have "the entirety of the world's information as just one of our thoughts" (Shelf, 2004; Stibel, 2009). In the interim, it concludes, autonomous PKMS devices ought to make the crucial next difference by providing the overdue support tools for the problems already faced today and an enabling environment for the creative conversations needed.

Thus, the system-in-progress provides a missing enabler to personal development and people empowerment in the form of an innovative decentralized technology for individuals to engage in Personal Knowledge Management and Creative Conversations. It thrives on the presented KM-related needs and concepts put forward by Bush, Bloom, Maslow, Simon, Andrews, Dawkins, Bjarnekaans, Collis, Grant, Gratton, Hamel, Florida, Gurteen, Johri, Pal, Pollard, Wiig, Levy, Probst, Stewart, Cohen, Boisot, Pirolli, Card, Nonaka, Takeuchi, Ohno, Wierzbinski, Nakamori, and others which can no longer be accommodated based on conventional paradigms and tools.

Interestingly, in reviewing a wider range of features for the 'Next KM Generation' (suggested by Sveiby, Wiig, Snowdon, McElroy, Ponzi, Miles, St Onge, Allee), the most strongly prioritized among the identified seven key themes are 'using existing knowledge and creating new knowledge' as well as 'the personal and social nature of knowledge' (Grant & Grant, 2008). The concept proposed is a perfect fit in this regard; it provides a novel and feasible meme-based solution and fully feeds into Levy's scenario of a decentralized PKM revolution.

The PKMS prototype's name 'Knowcations' is meant as a reference to our knowledge and know-how as well as to the locations and spaces ('ba') or the vocations and abilities (vital to further our expertise and careers) and to promote an innovative KM technology for:

- Managing and growing the Intellectual, Social, and Emotional Capital of Individuals,
- Supporting their Creative Authorship throughout their Academic and Professional Careers, anywhere and as Contributors and Beneficiaries of Organizational and Societal Performance, and for
- Fostering Creative Conversations of Teams and Enterprises throughout their Organizational Life Cycles and for Mutual Benefit and Competitive Advantage via Information and Cloud Technologies and Educational Services, as well as for adding productively to the world's Extelligence.

The Road Ahead

It is planned to transform the prototype into a viable PKM software application within 18 months. The concerns to be further elaborated in further papers – as pointed out – address the issues of integration of 'individualization' and 'institutionalization' in respect to the next generation of Organizational Knowledge Management Systems and the technological aspects in the context of scholarship, curation and citation systems. A book and an appropriate Training and Service Concept for Personal and Organizational Knowledge Management aimed at Higher Education and Professional Training are further issues in the pipeline.

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Biography

Ulrich Schmitt's professional background covers positions as IT and management consultant in London and Basle, as professor and vice president at two independent universities in Germany, as well as Vice Rector at the Polytechnic of Namibia and Dean of the Graduate School at the University of Botswana. He studied Management and Industrial Engineering at TU Berlin and Cranfield University, completed his PhD at Basle University, and a Science and Research Management Program at Speyer University. Currently, he is focussing on Personal Knowledge Management and is Professor Extraordinaire at the University of Stellenbosch Business School.
See web site for previous and upcoming PKM related work:
http://pkm.knowcations.net/publications