Informing Science:
the International Journal of
an Emerging Transdiscipline

An Official Publication
of the Informing Science Institute
InformingScience.org

Inform.nu

Volume 25, 2022

INFORMING AT THE CROSSROADS OF DESIGN SCIENCE RESEARCH, ACADEMIC ENTREPRENEURSHIP, AND DIGITAL TRANSFORMATION: A PLATFORM ECOSYSTEM ROADMAP

Ulrich Schmitt — University of Stellenbosch, Business School, Bellville, South Africa — schmitt@knowcations.org

ABSTRACT

Aim/Purpose	Developing Digital Platform Ecosystems (DPE) to transform conventional Knowledge Management Systems (KM/KMS) scenarios promises significant benefits for individuals, institutions, as well as emerging knowledge economies.
Background	The academic entrepreneurship project presented is aiming for such a KMS-DPE configuration. Having consolidated this author's own and external research findings, realization is currently commencing with a start-up in a business incubator.
Methodology	Design science research applying mixed one-sample case study and illustrative scenario approach focusing on conceptual analysis and entrepreneurship.
Contribution	Although (academic) entrepreneurship is a young research area with recently growing interest, publications focusing on this transitional stage between maturing research and projected commercial viability of digital technologies are rare.
Findings	A roadmap looking beyond the immediate early-start-up perspective is outlined by integrating recent development-stage-related DPE-research and by addressing stakeholders diverse informing needs essential for system realization.
Recommendations for Practitioners and Researchers	As this transdisciplinary perspective combines KM, informing, design science, and entrepreneurial research spaces, it may assist other researchers and practitioners facing similar circumstances and/or start-up opportunities.
Impact on Society	The article advances the understanding of how DPE communities may serve members with highly diverse skills and ambitions better to gainfully utilize the platform's resources and generative potential in their personal and local settings.

Accepted by Editor Eli Cohen | Received: January 11, 2022 | Revised: March 24, March 27, 2022 | Accepted: March 28, 2022.
Cite as: Schmitt, U. (2022). Informing at the crossroads of design science research, academic entrepreneurship, and digital transformation: A platform ecosystem roadmap. *Informing Science: The International Journal of an Emerging Transdiscipline, 25,* 143-160. https://doi.org/10.28945/4944

Future Research	As the entrepreneurial agenda will complement (not substitute) the academic research, research priorities have been highlighted aligned to three future stages.
Keywords	digital platform ecosystem, knowledge management system, digital academic entrepreneurship, design science research, informing science, start-up

INTRODUCTION

Successfully launching any entrepreneurial venture has been metaphorically compared to a journey: "Moving through 'mystery' phases where the idea is born and a gestation period is experienced to a more 'heuristic' environment where the idea is developed, executed, and results in the development of the service or product. In a more controlled, 'algorithmic' environment the business can mature, be sustained, and grow until renewal becomes necessary to sustain the business and some of these processes start all over again" (Scott et al., 2016).

If the desired destination is building a digital platform ecosystem, a further common ground shared by currently dominating providers may be the history as a recent novel start-up with a convincing vision and compelling growth and internationalization strategies. Success relied on attracting support and speculative investments from early funders to rapidly exploit perceived market opportunities.

Accordingly, digital ecosystems considerably differ from their conventional business counterparts. While the latter operate on decision making by hierarchical management, the former often depend on cooperative processes and mutual assistance. Competition is replaced by collaborating participants whose status and capabilities become less relevant, and their alliances may amalgamate incubators (business or project-specific alliances), networks (distribution across space and time), and clusters (close functional linkages and/or geographical proximity) (Barykin et al., 2020). Such ventures also exemplify the "shift from a dominating industry–government dyad in the Industrial Society to a growing triadic relationship between university, industry, and government in the Knowledge Society" (Etzkowitz & Ranga, 2015) known as triple helix systems perspective. It also encompasses digital academic entrepreneurship, a "promising and under-researched field" (Rippa & Secundo, 2019).

In this context of digital entrepreneurship, researchers are striving to conceptualize the key attributes that differentiate the failing ventures from today's thriving global high-tech giants (exemplified by FAANG stocks as acronym for Meta (formerly Facebook), Amazon, Apple, Netflix, and Alphabet (formerly Google). But a review of venture creation literature has demonstrated that recent publications have mostly focused on few isolated elements (Padhi, 2018).

The author of this article currently finds himself right in the middle of these challenging spaces. Engaged in a longitudinal stream of academic Knowledge Management (KM) and Design Science Research (DSR) (including thirty-two Scopus-indexed publications and a combined literature review with around 500 unique external references), he is aiming for innovating KM artifacts and their effective conceptualization, design, prototyping, implementation, and application. The transition from digital academic entrepreneurship to a start-up business venture is, hence, just a further logical step towards system realization. This complementing expansion started in February 2022.

An approval was granted by the Economic Development Board (EDB) based on a 5-year business plan (to build a novel digital Community Platform for Knowledge Co-Creation), and contractual agreements allow to initially operate the company at a business incubator accredited by the National SME Incubator Scheme under the aegis of Mauritius Research and Innovation Council (MRIC).

Because (academic) entrepreneurship is a young research area with recently growing interest, publications focusing on the transitional stage between maturing research and envisaged commercial viability of digital technologies are still missing. Especially, the inherent complexities of informing different clusters of clientele are of considerable concern. Due to the broad scope of the potential determinants, this article uses a mixed one-sample case study (existing artefacts) and illustrative scenario (projected artefacts) approach (Peffers et al., 2012; Yin, 2009) together with conceptual analysis.

Being in this real-time position, the research question focusses on the cumulative synthesis of available guidance a 'digital platform' start-up can rely on to chart the way forward for rolling out a viable innovative venture and complex artefact. It further aims to provide understandings for improving the processes of informing a diversity of stakeholders. The article is structured as follow:

- The next section introduces the research methodology and transdisciplinary scope,
- Followed by a summary of the digital platform concept/project and a brief recapitulation of informing science, KM and DSR research already carried out,
- Followed by presenting the current complementing entrepreneurial start-up undertaking,
- Followed by introducing the current landscape of digital platform ecosystem (DPE),
- Followed by the three-phase roadmap for the DPE-instantiation and its anticipated digital transformational impact (serving a growing community) as well as concluding remarks.

METHODOLOGIES APPLIED AND TRANSDISCIPLINARY SCOPE

DSR guidelines expect newly developed DSR artefacts to be rigorously evaluated (Hevner et al., 2004). A recent review (Peffers et al., 2012) showed based on 148 journal articles that, after technical experiments (62%), illustrative scenarios (14%) and case studies (5%) were ranked a combined second among eight DSR evaluation methods identified. While the case studies assess the efficacy/performance of designed objects in complex specific real-world settings (Yin, 2009), illustrative scenarios extend this scope to artefacts' suitability/utility within synthetic environment by accepting more generalizable or ideal contexts (Peffers et al., 2012) and by tolerating research limitations referred to as a "rigor-relevance dilemma" (Dresch et al., 2015).

Although the body of related research is growing, recent exploratory review studies of articles covering information systems (Schuster et al., 2018), KM (Mariano & Awazu, 2016), and DSR (De Sordi et al., 2020) stated that most contributions remain isolated so that an accumulation and evolution of the underlying knowledge is not taking shape. To improve the reuse, maturity, timeliness, and currency of the body of design knowledge, three criteria are to be integrated in submission guidelines aiming to better "plan, coordinate, and communicate complex design research activities over time and space", namely, fitness-for use-and evolution, confidence based on evaluations applied, and projectability (Vom Brocke et al., 2020). The quest for better knowledge evolution also motivated suggestions to scrutinize "social and organizational design artifacts" by utilizing a "logic for worldmaking projections", by differentiating 'actual real worlds' and 'future possible worlds', and by accommodating vertical (theoretical-to-empirical/practical generalizability) and horizontal (theoretical-to-theoretical) projectabilities (Baskerville & Pries-Heje, 2019). These measures have already been applied to be referred to later.

As artefact clusters combine constructs, models, methods, instantiations, and theories, various of these objects have been developed in the DSR project to be presented, some have been tested, with further evaluations and developments being in progress (subject to the roadmap phases to be determined). The resulting envisaged DPE resembles a meta-artefact (Eck & Uebernickel, 2016) and new type of KMS aiming to "afford clients with highly diverse skills (gifts) and ambitions (ends) to gainfully utilize its resources and generative potential (means) in their personal and local settings (contexts)" (Schmitt & Gill, 2020).

Informing Science (Cohen, 2009; Gill, 2015a, 2015b) continues to play a significant role (Schmitt, 2015). To further express complexities and reconcile gaps between DRS, KM, and related disciplines, the principle of 'Theory Effectiveness' has been adopted; it expects designs to be purposeful in terms of utility (a matter of content) as well as communication (a question of presentation) to an audience (O'Raghallaigh et al., 2011).

Some significant features of digital ecosystems have been highlighted above. Padhi (2018), hence, put forward a more holistic multi-factor model to also take account of the complex dynamic interactive

relationships "comprising five pivotal elements (i.e., the top leadership team, market opportunity, the knowledge and experience of the firm, the technology, and the internationalization process).

Complementing a digital ecosystem with a platform adds a central technological and supportive infrastructural environment. It provides a foundation for stakeholders' autonomous interaction and operation to co-create value in many different configurations. Accordingly, Padhi's five elements alone are not sufficient as a guiding roadmap for any particular novel start-up to follow in FAANGs' and others' footsteps. Fortuitously, recently published research provides valuable frameworks and assistance (Murthy, 2021) to be referred to later.

SUMMARY OF KMS'S DIGITAL PLATFORM CONCEPT/PROJECT

In contrast to conventional Organizational KMS (OKMS: focusing on monolithic, centralized, top-down, heavyweight, and high-investment/maintenance technologies), the novel KMS-DPE follows an alternative decentralized and knowledge-worker-centric approach favoring personalization, mobility, generativity, and entropy reduction (to be further addressed as Personal KMS (PKMS)). Table 1 informs about this undertaking utilizing a typical layout for entrepreneurial start-ups.

Table 1. System-in-Progress summarized as Start-up Pitch (relevant references added).

Pitch: Serving Communities with diverse Ambitions & Potentials in Personal & Collaborative Contexts by building the leading digital Community Platform for Knowledge Co-Creation.
Problem & Solution **The Problem:** An insatiable urge to use recent Information and Communication Technologies (ICT) advances has led to an ever-increasing attention-consuming abundance of information and noise. It is threatening the finite attention individuals' cognitive capabilities are able to utilize. In consequence, it is resulting in widening opportunity/innovation divides world-wide.(Bush, 1945; Giebel, 2013; Simon, 1996). **The Solution:** A novel Digital Platform Ecosystem and Community for collaborative Knowledge Co-creation, trade-marked "Knowcations", provides effective tools for selecting, structuring, personalizing, and making sense of the vast amounts of digital resources available to us. (Schmitt, 2021b).
Business Model **Customers:** Individual Scholars and Knowledge Workers anywhere with diverse Ambitions/Potentials in Personal/Collaborative Contexts (Schmitt & Gill, 2020). **Offering:** • Decentralized personal Knowledge Access/Creation Devices. • Iteratively curated/optimized voluntarily shared Contributions. • Cloud-Service feeding Content back to Community Members. **Revenue Model:** Subscription Model and Value-adding Services. Sustainability: Projections foresee the Potential for a Dominant Design with demand-and-supply-side Network Effects with achieving the Quasi-Irreversibility of Switching Costs (Schmitt, 2019c). **Unique Selling Proposition (USP):** Facilitating to navigate the Worlds of Knowledge by: • Building on your own captured content, systemically. • Co-creating new insights with community, sustainably. • Leaving footprints in human knowledge heritage, traceably. • Serving to drive collective performances, mutually beneficiary.
Ambition **Long-term Ambition:** Building the leading Community Platform for Knowledge Co-Creation. **Short-term Strategy:** Scaling the User Community based on an Appreciation (for recruitment) and Knowledge Development Model (for retention) supported by Knowcations' educational Agenda. **Environmental & Social Impact:** Closely correlated with ICT for Development Objectives (Johri & Pal, 2012; Schmitt, 2016): • Focus on making effective low-cost applications and information available (accessibility easiness). • Enable authorship and contribution of own ideas based on one's background (expressive creativity). • Alone or in collaborative environments with other users/owners (relational interactivity). • With the opportunity to add productively to the world's extelligence (ecological reciprocity).

As the most applicable academic domain, the term Knowledge Management is an essential reference in any of the author's prior conference papers and journal articles; in Table 1 the term is missing. As most stakeholders (including potential clients, investors, entrepreneurial peers, or approving authorities) are unfamiliar with KM concepts, the mentioning of KM introduces an informing obstacle necessitating lengthy up-front explanations before the novel conceptual and system affordances can be discussed. This barrier even emerges when the informee is familiar with KM but predisposed by the conventional interpretation of its organizational contexts. This predicament is not eased by expanding on the topic in terms of ecosystems, platforms, and providers (to be referred to later).

Nonaka's (1994) SECI loop (socializing, externalizing, combining, internalizing) is one of the most widely cited KM models known as theory of organizational dynamic knowledge creation. Its aim is to "socialize" individuals" tacit knowledge (gained experientially; difficult to articulate, explain, share), to "externalize" (explicated as formal/explicit knowledge), to be more easily measured, captured, stored, protected, shared, and utilized or newly "combined" independent of the availability of the original knower concerned, so it can be "internalized" by others (Nonaka et al., 2000). The term KM has, hence, been substituted by the more easily understandable (co-)creation reference.

Conceptually and visually, the PKMS model has been presented as an extension (added stock/flow) and a reversed direction of the cycle. This different perspective is supported by empirical research resulting in the Notional Model of the Sensemaking Loop for Intelligence Analysis (Pirolli & Card, 2005; Schmitt, 2020a), in an extension of the Concept-Knowledge-Design Theory (CKDT) in the knowledge heritage context (Carvajal-Pérez et al., 2018; Schmitt, 2020c), and the specification of ten typical flows within Digital Entrepreneurship Ecosystems (DEE) (Elia et al., 2020; Schmitt, 2021b). As important these findings are in conducting and publishing rigorous academic research, in the entrepreneurial context they just provide further backing once initial interest has been established.

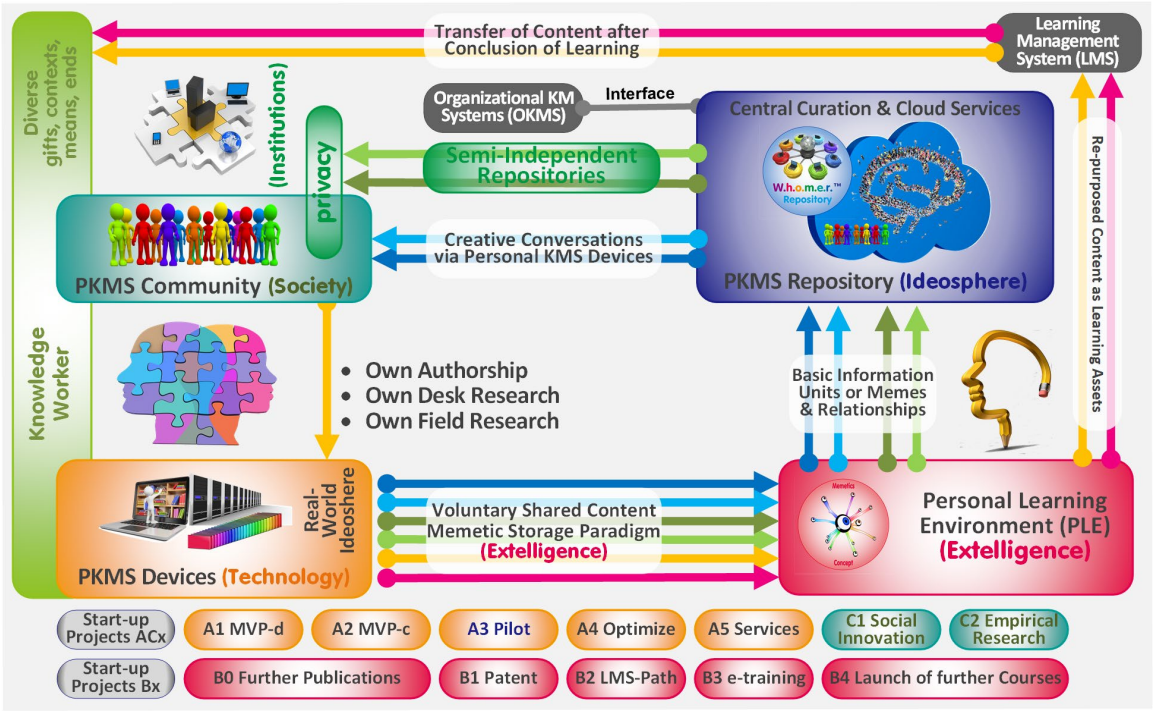

Figure 1. Personal KMS Design as a Digital Platform Ecosystem (DPE) (Schmitt, 2021b)

Figure 1 provides a bird's eye perspective of the PKMS-DPE. It "depicts individual social actors (left) with their decentralized Personal KMS devices as members of the PKMS user community. The anti-clockwise workflow shows that the voluntary shared individual content is centrally synthesized and curated (top-right) before it is fed back to the community. It may also be repurposed as learning

assets to foster personal learning environments (PLE) which comprise self-developmental activity spaces which encourage the reusing, remixing, and sharing of learning resources (Rahimi, 2015). Adding to the broader DPE context are further interactions with organizational knowledge and learning management systems (OKMS, LMS) (top-middle-and-right)" (Schmitt, 2021b). The rounded rectangles (bottom rows labelled A1-A5, B1-B4, and C1-C2) represent eleven interdependent start-up projects; their colors match sections of the PKMS cycle (technology, extelligence, society, knowledge worker complemented by ideosphere and institutions) with distinct attributes and affordances.

As the PKMS publications keep on reporting on the DSR-typical "continually evolving artefacts and design theories" and on the projected "visions of technology impact [and] studies of [applied] technology impact on users, organizations and society" (Baskerville et al., 2018), a recent article (Schmitt, 2021a) has portrayed – as discussed above - the author's PKMS contributions according to the measures and worldmaking logic suggested (Baskerville & Pries-Heje, 2019). The worldmaking matrix published has been expanded in this article (entrepreneurial and roadmap phases), and some of its referred articles have been reallocated (Table 2).

Table 2 shows a subset of peer-reviewed PKMS articles (often terminating a sequence of prior papers addressing the same triangulating objectives). It demonstrates that the first phase of published research has focused on 'actual real-world' issues or has aimed to relate to and integrate relevant 'horizontal' theoretical knowledge (left column, rows 2 and 3). As the design and prototype testing matured, theory effectiveness has been further strengthened by validating progress made against relevant 'vertical' empirical/practical existing/emerging research findings, methodologies and practices (left column, row 4). The 'real' factual and horizontal/vertical findings enabled the continuous fusion of extelligence and knowledge dissemination.

Table 2. Selected Articles/Triangulations carried out with other relevant external Artefacts (left: academic research publications) as a baseline for the DPE Roadmap (right)

	Academic Informing/Design Science Research Phase		Digital Academic Entrepreneurship Phase		
Extelligence (Research)	***Focus on actual real World (incl. fixations & unsustainabilities)***		***Focus on Start-up Stage (Entrepreneurial Toolset)***		Technology
	Digital Scholarship/Curation & Traceability	(JTKS:2015i)	*Economic Development Board: 5-YR-Business Plan & Investment Application*		
	Hierarchy of Needs & Kano Model	(Procedia-ICKM:2016h)	*Research and Innovation Council: Incubator-Incubatee-Mentor Agreement*		
	Design Science Research Guidelines	(InformSciJ:2016j)	*Minimum Viable Product (MVP), Proof of Concept (POC), Lighthouse Project*		
	Experience Management Concepts	(ProWM:2017a)	*Funding & Crowdsourcing Schemes, Strategic LMS/OKMS Partner Agreements*		
	Webs of Documents and Data	(IEEE-NextComp:2017e)	---		
	Digital Threats Assessment	(Sustainability:2018b)	At the Crossroads: A Platform Ecosystem Roadmap	(this publication)	
	Horizontal Projectability: theoretical-to-theoretical Synergies		***Focus on Incipient Stage (Problem Definition)***		Society
	Informing Science Methodologies	(InformSciJ:2015d)	Value Appreciation for PKMS Platform Adoption	(in-progress)	
	KM Models & Methodologies	(JIKM:2015f)	Sustainable Development Goals (SDG), Digital Intelligence	(planned)	
	Memetics	(LNCS/AISC:2016a)	Non-linear Personal eLearning Environments	(planned)	
	Schools of KM & Knowledge Assets	(ICKCCM:2016d)			
	Generativity & Fitness-Utility-Models	(Kybernetes:2019e)	Contexts of Social Entrepreneurship and Corporate Social Responsibility.		
	Entropy & Generativity Models	(Entropy:2020c)			
	Vertical Projectability: theoretical-to-empirical/practical Effectiveness		***Focus on Growth Stage (Ecosystem Design)***		Institutions
	Network Communities & Social Platforms	(InformSciJ:2017d)	Appropriation vs. Participation	(in-progress)	
	SMEs & Stage-Growth Models	(JEIEE:2018a)	Promise and Trust Engineering Methodologies	(planned)	
	General-Purpose-Technologies & Innovation	(ECKM:2019d)			
	CK-Theory & Scaling for Innovation	(Kybernetes:2020f)	Contexts of Knowledge Workers' Motivations and Absorptive Capacities, Confidence Building that Co-creating Affordances are beneficial and fair.		
Ideosphere (Design)	***Worldmaking, Scenario Building, and Visioneering***		***Focus on Maturity Stage (Ecosystem Dynamics)***		Knowledge Worker
	Twelve Dynamic Knowledge Creation Models	(EJKM:2019c)	Interdisciplinary Knowledge Organization	(planned)	
	Systems Dynamics & Activity-Based Modeling	(IJMO:2020b)	Decontextualized Boundary Objects Creation	(planned)	
	DPE: PKMS-OKMS-LMS Co-evolutions (Gifts...)	(InformingSciJ:2020e)	Heritage Management and Thought Leadership	(planned)	
	Visioneering, Vision Quality Criteria	(Sustainability:2021a)	ISO 56000:2020 Innovation Management Standard	(planned)	
	DSR Projectabiliy, Heritage & Domain Evolution	(Sustainability:2021b)			
	ISO 30401:2018-KMS Standard	(accepted, in-press)	Contexts of wider entrepreneurial (Triple Helix) and technological Spaces.		

The result of the emerging consolidated PKMS knowledge base is a growing explicated repository which allows tackling worldmaking, scenario building, and visioneering tasks holistically (left column, row 5). This aligning and cumulative synthesizing helps to address the underlying 'wicked' problems, defined as open-ended in the sense "that they are ill defined and characterized by incomplete, contradictory, and changing requirements and complex interdependencies and that the information needed to understand the problem depends upon one's idea for solving it" (Rylander, 2009).

Two recent articles in this last section were already projecting the anticipated entrepreneurial future. By recapitalizing and further rationalizing the novel PKMS approach and its affordances and functionalities, a desirable sustainable KMS vision has been crafted "shareable with a critical mass of

stakeholders as a prerequisite for creating the respective PKMS reality" (Schmitt, 2021b). As the PKMS at this transition stage offers a variety of novel 'future possible worlds' compared to conventional OKMSs, the benchmarking of the PKMS against the maiden ISOA 30401:2018-KMS Standard allowed solidifying the foundation for prioritizing development and resource allocations in the upcoming start-up phases (Schmitt, in press).

The chronological four-sector worldmaking matrix has proven to be an excellent condensed format for informing stakeholders in the entrepreneurial space to convey the breadth and depth of prior academic research and development (R&D) carried out. It also provides a solid base line from which to determine further academic publications as well as the practical-oriented DPE roadmap (Table 2, right column) to be detailed in the next sections.

COMPLEMENTING ACADEMIC ENTREPRENEURSHIP & START-UP

Digital academic entrepreneurship has been defined "by a high level of utilization of new digital technologies [(DTs)] to improve the emerging forms of academic entrepreneurship, such as the development of digital spinoffs and alumni start-ups, the creation of entrepreneurial competence supported by digital platforms, and a broader range of innovation development that goes beyond the region" (Rippa & Secundo, 2019). However, a recent structured literature review has shown that the 59 scopus-indexed articles published from 2005 to 2018 "are dominated by unrelated research" mainly concerned with (1) entrepreneurially equipped 'Fablabs' and maker spaces, (2) entrepreneurship education, and (3) the technological infrastructure for creating the related competences. A further area focuses (4) on the impact of DTs in the context of innovation and discovery of entrepreneurial opportunities (Secundo et al., 2020).

Although the PKMS provides (1) a maker space for creative authorship, (2) a supportive KM educational agenda that includes (3) digital structures for non-linear personal learning environments, its emphasis is (4) on affording DPE technologies to empower a diverse community of knowledge workers independent of their "space (e.g., developed/developing countries), time (e.g., study or career phase), discipline (e.g., natural or social science), or role (e.g., student, professional, or leader)" (Schmitt & Saadé, 2017).

While the PKMS fits the general definition of a DPE comprising "a platform owner that implements governance mechanisms to facilitate value creating mechanisms on a digital platform between the platform owner and an ecosystem of autonomous complementors and consumers" (Hein et al., 2020), it also deviates from current DPE typologies in some significant ways affecting its deployment viability:

- *PKMS-DPE's Ownership*: As the legal entity, the PKMS ownership provides the thought leadership for the DPE's design, evolution, service structure, flawless transactional facilitation, and prospective impact. It further shapes the governance structures and power distribution by constructively orchestrating its envisaged growing diverse community members who expect to gainfully utilize the DPE's resources and generative potential in their personal and local contexts (Eck & Uebernickel, 2016; Schmitt, 2019a).
- *PKMS-DPE's Value Proposition:* While other DPEs' value-creating mechanisms often depend on the quantitative and qualitative balancing of supply (complementors) and demand (consumers), the PKMS community members simultaneously assume both roles. To interact and exchange mutually beneficial value (encapsulated in their created and voluntarily shared knowledge assets), the PKMS's DPE provides decentralized personal devices and centralized intermediating services (exemplified in the roadmap sections) (Schmitt, 2020a). Each new member and novel contribution to the PKMS's curated negentropic knowledge base

increases the economies of generative scale, network effects, and innovative capabilities (Schmitt, 2020c).

- *PKMS-DPE's Community Member Autonomy:* Conventional OKMSs aim to explicate individual tacit knowledge for institutional measuring, capturing, storing, protection, sharing, and iterative knowledge creation for organizational benefit independent of the initial knower. Their institutional community represents "a fairly homogeneous set of stakeholders and cultures, surroundings and resources, practices, and objectives", but OKMSs often lack acceptance and buy-in as they do not serve their users' personal KM ambitions and self-interests. PKMS community members benefit, instead, from autonomous affordances (as embedded in the cumulative PKMS's generativity-and-entropy-related design decisions taken) "to retain and build upon knowledge acquired, to develop one's expertise for sustainable personal growth, and to collaborate with fellow learners and/or personal/professional acquaintances for mutual benefit" as well as to contribute to the world record (Schmitt & Gill, 2020). Accordingly, the PKMS relies on autonomous agents to voluntarily contribute to its creative/generative value proposition. While the negentropy-and-integrity-maintaining curation are confined to the internal centralized DPE services, the DPE architecture and control rights may allow members small-scale peer-to-peer-sharing confidentiality by setting up subnetworks/repositories; if not voluntarily shared by the group this content will neither be curated nor publicly stored in the central PKMS knowledge base.

From an informing and 'theory effectiveness' perspective, the transition from academic research to an entrepreneurial implementation space requires an adequate repurposing and expansion of prior conference-and-journal published knowledge (Table 2, left to right transitioning) which has already been cumulatively synthesized in the PKMS repository:

- The very preparation stage for a potential start-up striving to utilize entrepreneurial support schemes faces a range of 'new' semi-standardized structures and containers (see Table 2, right column, 2nd row, italic font: e.g., lighthouse project) and requires re-aligning and rethinking relevant ideational tacit or already explicated knowledge (as exemplified in Table 1).
- As these collaborative arrangements and agreements are based on time-critical commitments and deliverables exposed to unpredictable volatile, uncertain, complex, and ambiguous challenges (VUCA environments), a thorough analysis of the strategic options and contingencies are advisable in order to draft a guiding roadmap for the start-up founders' road ahead and for informing its stakeholders. This article shares some aspects of this undertaking.
- The roadmap needs to look beyond the notions of the entrepreneurial start-up space (minimal viable product (MVP), proof of concept (POC)) and to identify distinct stages in the trajectory of an incorporating DPE-start-up from a state of research lab maturity to a potential prospective FAANG status, including its positioning within this current DPE space.

CURRENT LANDSCAPE OF DIGITAL PLATFORM ECOSYSTEMS

A platform sponsor exercises property rights and is "responsible for determining who may participate in a platform-mediated network and in developing its technology" (Eisenmann et al., 2009). By seeking effective value-creating solutions, the sponsor may choose to retain and solve some part of the problem (to be referred to as platform sponsor scope choice (PSSC)) and to open "other parts to autonomous complementors" whose cognition, resources, and capabilities might be limited but may be attracted by the problems' context, complexity, decomposability, and manageability in order to solve it collaboratively. If interdependent components can be generatively created and iteratively recombined to achieve favorable, marketable, or viable outcomes, a sustainable DPE may emerge provided the sponsor succeeds in attracting, indirectly influencing, and orchestrating the complementors' co-creation potentials. The logics and logistics of such an undertaking infer that the complementors

as well as their complements are – prior to their emergence (ex-ante) – 'unknown unknowns' to the DPE sponsor (Murthy & Madhok, 2019).

By clustering current DPEs according to their underlying processes, key market attributes, and value propositions, four configuration types (COMI) have been identified and exemplified (Murthy, 2021), termed:

- Complementary Innovation Ecosystems (e.g., Apple/Android app stores),
- Open-source Ecosystems (e.g., Mozilla Firefox, Linux, LibreOffice, Gimp),
- Marketplace Ecosystems (e.g., Amazon, MTurk, eBay, Kickstarter, Crowdfunding, MOOC),
- Information Ecosystems (e.g., Google's search engine, WhatsApp, Twitter, YouTube, Facebook, LinkedIn, ResearchGate, Wikipedia, dating service platforms).

These empirically validated types offer comparative meta-configurations of their typical PSSCs positioned across a firm-market-continuum (in COMI order). Empirical evidence confirms that the potential impact of the sponsors handling and decision making in regard to access control, interface openness, complement variety, and generic complementarity significantly varies across COMI ecosystems. By considering the interdependencies between these characteristics, PSSCs' configurational arrangements can be further enhanced by integrating their complex causalities and nonlinear relationships for pursuing high-performance strategies (Murthy, 2021). In these contexts, effective information exchanges, retrievals, and alignments are vital for all COMI cases.

In the exchange instances, they need to inform complementors about the sponsors' innovative core products/services/interfaces for (C) producing and trading compatible, optional, value-enhancing complements, for (O) enabling innovative efficient co-creation complements as platform core fixtures or optional enhancements, for (M) providing an open two-sided market space where buyers' demands meet sellers' supplies, and for (I) matching information seekers and providers and easing public or restricted content sharing or endorsements. They further allow for (I) creating social ties or exclusive groups/networks and for (COMI) facilitating the flows to process transactions and feedback among all relevant stakeholders, including registrations, sales, accounts, downloads, user reviews, or suggestions of available alternatives.

In the retrieval alignment instances, DPEs need to best utilize their distributed assets and actors through efficient search and matching processes which may be (C, O) centrally/semi/community directed for known well-structured problems or (I) undirected or orchestrated-directed in unknown or ill-structured circumstances (Murthy & Madhok, 2021).

Although the PKMS-DPE features and objectives differ, the COMI typology, nevertheless, affords helpful openings for conceptualizations and benchmarking presented in the next section as well as assists in informing clients curious about how the PKMS compares to any particular other DPE.

PKMS ROADMAP (INCIPIENT, GROWTH, & MATURITY STAGE)

Having charted a 3-phase-roadmap (Table 2, right rows 3-5), the emphasis needs to shift from an early-start-up perspective to a long-term strategic outlook, including addressing the essential informing and communication requirements specific to a multitude of stakeholders to be encountered.

Since, as mentioned, complementors and complements represent ex-ante 'unknown unknowns', "the wealth and impact of the ideas to be created by a collaborating PKMS community defies prediction, but the rich PKMS support functionalities promise productivity gains derived from better attention management and knowledge retention, superior retrieval based on captured trails and associations, and prevention of redundant and fragmented knowledge, so typical for [conventional] document-centric KM practices. Professionals are also enabled to carry - while moving from one project or responsibility to the next - their particular version of a PKMS with them, presenting them with the

autonomy to develop their personal expertise systematically and sustainably and to voluntarily share it with associates and institutions close to them" (Schmitt, 2019b).

Focus on the Incipient Stage (Problem Definition)

The platform sponsor's responsibilities to develop the DPE technology and affordances, to promote its value capture/co-creation opportunities, and to orchestrate the collaborative processes need to be executed within the more predictable and controllable practical-theoretical space of a firm. As "digital firms have frequently adopted the 'get big fast' logic that the first mover can generate a self-reinforcing cycle of growth through network effects" (by focusing on revenue rather than profit), "many industries [now] have mature profit-seeking firms operating alongside growth-seeking start-ups, creating a dynamic that does not conform to traditional expectations" (Menz et al., 2021).

Following this logic, the scale, scope, and boundaries of a thriving start-up's internal organizational structure quickly expand, and a DPE sponsor is confronted with the collaborative and growth-related challenges more rapidly than conventional SMEs (small-and-medium-sized enterprises). A prior article has explored three renowned stage-growth models and has elaborated on the positive impact a PKMS may impart on a start-up's internal space for navigating "entrepreneurial barriers of organizational development", on guiding and rectifying "the associated tasks and problems of effectively performing and innovating under growing pressures, and [on] communicating with rising numbers of internal and external stakeholders" (Schmitt, 2018).

The PKMS-DPE business plan submitted and approved covers the start-up's incipient stage including the financial, human, and other resource allocations. The tasks and commitments in the incorporated implementation and roll-out plan have been differentiated by defining and sequencing eleven distinct projects (Figure 1, depicted as rounded rectangles labelled A1-A5, B1-B4, and C1-C2).

With the peer-reviewed published textual main bodies approaching a 400k wordcount, the PKMS's rationalization and educational repurposing potential is academically well matured, but it is not well suited – as mentioned - to inform the diverse audiences to be encountered in the entrepreneurial space (e.g., governmental agencies or NGOs; crowd funders, investor, or business angels; recruited or potential complementors; internal staff or external (OKMS/LMS) partners). A key strategy (relevant for all three phases) to address this predicament has been set in motion:

As growth and technological progress is driven by "appreciative humans in pursuit of superior affordances" (Schmitt, 2019a), a multi-level heuristic 'Appreciation and Membership Recruitment Model' has been devised to capture and steadily reinforce their attention by focusing on (1) aesthetic elegance, (2) schematic resonance, (3) contextual relevance, (4) utility, (5) and advancement to, ultimately, (6) initiate membership enactment and (7) motivate retention (Mostert, 2012; Schmitt, 2021b). Each level aligns to sources/propositions of either absorptive capacity-related, generative, functional, economic, psychological, or learning and network values (Gupta & Lehmann, 2005).

An article-in-progress differentiates each of these levels further by adapting the notions of attractive quality (Kano, 2001). The resulting matrix categorizes distinct level attributes for OKMS (resentment, displeasure, liberation) and PKMS (fulfilment, satisfaction, enablers, delighters, and desirables) pitched against each other (as disservices to avoid versus welcome surprises, or as permutations of 'the more/less - the better/worse' provisions). The distinct features allow to plausibly and coherently break-down the PKMS/OKMS attributes, to target the diverse audiences according to their most significant informing needs, and to comprehensively structure the upcoming start-up's promotional efforts (e.g.: blogs, videos, e-books, pitches).

Further academic publications are planned to address the sustainable development goals (SDG), digital intelligences, and non-linear personal (e)learning environments (PLE) in the sponsor's contexts of social entrepreneurship and corporate social responsibility.

Focus on the Growth Stage (Ecosystem Design)

As the sponsor's most important activities and decisions are involving the PKMS community (complementors and consumers (CC)), their effects have to be constantly monitored and, if necessary, tweaked to systemically advance the sources of indirect network effects (INE). INEs are linked to benefits accumulating in the DPE which are membership-related (MB: direct utility from platform offerings) or usage-linked (UB: gains from interacting CCs). Various scenarios exploring symmetric (e.g., Amazon, Expedia), asymmetric (e.g., Firefox, Wikipedia), or absent (e.g., ScholarOne, Zoom) INEs have demonstrated that sponsors (by fine-tuning the PSSCs membership/usage affordances) are able to alter the DPE's CC-specific growth rates and trajectories. PSSC effects are likely to also apply to the PKMS, although its CC and INE dynamics contravene the considered scenarios (Murthy et al., 2020):

A PKMS community member is able to (1) capture and combine knowledge from his/her own external field/desk research as well as from own creative authorship which (2) ensures the retention of one's prior extelligence to enable a creative conversation with one's former self (both MBs). This private knowledge base (3) may be further populated with knowledge assets afforded by the PKMS repository to inspire further advancements (UBs from other complementors). By voluntarily sharing any part of this content, (4) the member becomes a complementor (UB for others) after (5) the sponsor's curation services assure the entropy reduction and associative integrity of the PKMS's cumulatively synthesized repository (MB for the community).

To facilitate a steady growth trajectory, this iterative cycle has to be sustained and further promoted at the micro (individual member's authorship) and macro level (sponsor services) by, for example:

- *UB:* The sponsor, too, may assume a complementor's role by formatting and adding the sponsor's or external open-source content (e.g., this CC-BY-NC-4.0-licensed article) to the PKMS repository. Complements may also include boundary objects (e.g., heuristics, templates, examples, or standards) derived by identifying and decontextualizing reusable parts already stored.
- *MB/UB:* The sponsor's educational agenda includes repurposing the stored PKMS content as learning assets and e-learning modules following a non-linear PLE concept in collaboration with a LMS provider. Essential module snippets would be transferred to the participants' PKMS devices for learning retention.
- *MB/UB:* While the 'Appreciation Model' focusses on membership enrolment, a 'PKM for Development Framework' (PKM4D) addresses membership retention. The heuristic differentiates twelve generic sub-needs (linked to Maslow's extended hierarchy of needs). While each sub-need denotes an increasingly desirable state (exciters & delighters) of personal development (corresponding to particular affordances conferred by the PKMS to its proficient users), the absence of these affordances and associated capabilities signifies detrimental effects for any individual (inhibitors & demotivators) and contributes to various opportunity divides (e.g., access, digital, learning, skills, knowledge, innovation gaps) (Schmitt, 2016).
- *MB:* While social networks provide social basic reputational benefits (based, for example on clicks, likes, reads, downloads, or responses), academic scholarship has adopted a sophisticated research and reputation economy. Based on its advanced negentropy, granularity, generativity, and traceability, the PKMS metrics envisage community members to accrue and explore more refined metrics (e.g., usage, citation, reputation, and validation) (Schmitt, 2020a).

The added value of these complementing sponsor services is supporting each member's autonomy and personal growth aiming for the experienced short-and-long-term benefits to significantly outstrip the perceived inconveniences due to time, effort, and self-discipline invested (appreciation model level 7: motivate retention). This extension of the sponsor's service portfolio is expected to trigger

positive externalities from supply-side (learning by using/doing) and demand-side (agglomerating community network) effects which, ultimately, lead to the quasi-irreversibility of user's loyalty and investment (termed switching costs) (Cantner & Vannuccini, 2012) as well as to the prevalence and persistence of the PKMS-DPE technology over time. As alternative new solutions find it increasingly difficult to challenge the PKMS's dominant design, the PKMS may qualify as a General-Purpose Technology (GPT) (Schmitt, 2019b, 2021b).

Further academic publications are planned to further differentiate PKMS participation versus OKMS appropriation approaches affecting knowledge workers' motivations and absorptive capacities as well as to explore the potential of promise and trust engineering methodologies for contributing to community members' confidence and decision rights so that the PKMS's vision and co-creating configurations are considered beneficial and fair.

Focus on the Maturity Stage (Ecosystem Dynamics)

At this more established stage, relevant PKMS-DPE attributes ought to have caught up to those success factors of today's thriving platforms for attracting participants and ensuring their commitments (as exemplified by first mover advantage, creation of social forums, incentives and subsidies, and superior technology infrastructure (Murthy & Madhok, 2021)). The sponsor's policies must also have been able to institute a "governance mode that mitigates hazards to facilitate efficient search and value creation" (Murthy & Madhok, 2021) by safeguarding against, for example, fake facts or ethical violations, security or privacy breaches, and service delays or interruptions. While membership acquisition (appreciation model) and retention (PKM4D framework) are commencing, the emphasis shifts towards strengthening and expanding the PKMS's operational and storage structures:

In "The Use of Knowledge in Society", Hayek (1945) reminded us that knowledge never exists [so far] in an integrated form concentrated in a single mind but is dispersed incompletely as frequently contradictory fragments among mostly unrelated sources as embrained, encapsulated, and encoded representations. Digital technologies have – as expected - substantially advanced search capabilities and information exchanges, but these benefits have been offset by sparking a never before experienced accelerating information abundance which is increasingly placing the limelight on presently still neglected dilemmas, identified as information entropy or attention poverty, structural holes or knowledge islands/siloes, invisible work and flawed online and publishing realities (Schmitt, 2020a).

PKMS community members as complementors and consumers

Any community member is granted full *interface openness* in regard to the core modules on their decentral autonomous PKMS devices; they are allowed to retrieve (from personal knowledge base (KB) and central repository (CR)), capture, create, modify, classify, combine, store (in KB) and, if voluntarily shared, upload (to CR). The member enjoys the full range of authorship functionalities and retains the *decision/copyrights* for any content personally created that are licensed as open-access once voluntarily shared. By substituting the conventional 'book-age' document-centric paradigm, the authorship and storage processes follow an approach where larger explicated scripts are constructed from reusable quasi-autonomous information structures (textual snippets termed memes) which, subsequently, may be repurposed (as original or modified version), reclassified, associatively referenced, and digitally embedded in further authoring activities by the originator or the persons the content has been shared with, with the latter setting up the stage for creative conversations and the co-creation of value-enhancing complements among community members.

PKMS sponsor as a digital platform orchestrator and innovation facilitator

Setting up the stage for orchestrating these endeavors entails numerous steps, for example:

- PKMS's grass-roots authorship activities do not need to be directly coordinated by the sponsor. Instead, a pre-defined typology of core content entities and permissible

relationship memes (*complement categories*), a standardized memetic record structure (*generic complementarity*), and an architecture of structured interfaces and database designs (*non-generic complementarities*) indirectly control the platform's *information exchanges* and storage practices.

- Complementors' participation and their complements also do not need *direct approval* by the sponsor. However, before shared meme-based content is added to the central repository, hosted, and made accessible to the community, a centralized curation is taking place. This *indirect intervention-by-design* scans the community's newly uploaded content for duplicates within its records or already stored repositories. As identical copies are merged, conflicts of original sources, authors, and timelines might have to be resolved, and relationships need to be consolidated to ensure that the consolidated unique memetic content retains all the associative relationships attributed by the membership. In case of transgressions (e.g., plagiarism, fake or ethical issues) the sponsor may use his prerogative of *decision rights*, and uploaded items may either be flagged or removed (and quarantined to allow for possible reviews or to aid detecting any further potential submissions).
- As members are engaging individually and freely in the DPE's co-creations, their accumulating 'nano-actions', 'micro-behaviors', and feed-forwards may lead to emerging 'micro-macro-effects' affecting the PKMS community in its entirety. The monitoring needs to be part of the *sponsor activities* for potentially eliciting 'macro-micro-feedback' which may affect members' 'micro-states', generativity, and self-organization. As "keeping abreast with and inspired by one's dynamically changing community is demanding and perplexing", the sponsor may also opt to initiate collective 'micro-macro-micro' informing or educational interventions (Mella, 2017; Schmitt & Gill, 2020).
- To exert some influence on the complementors' ex-ante unknown deliverables and timelines, the sponsor may also employ particular *orchestration mechanisms* (e.g., progress reports, personal notifications, crowd-solving competitions, innovation contests, or incentives) to promote the value development/creation of selected complements or design/research areas.

PKMS knowledge base as world heritage of memes' repository (WHOMER)

Any basic content meme stored (e.g., part of this text, citation, or visual) may link to

- 'Close meme relatives' related to positioning (e.g., prior/succeeding or foot/endnote memes),
- Timelines (e.g., prior or successive meme versions),
- Associative connections (e.g., publication/chapter title, author, publisher, figure/table/citations),
- Aboutness (e.g., article review, wordcount, or author's profile),
- Intent (e.g., tasks to do),
- Monitoring (e.g., schedules, to-do-lists, or progress made),
- Statistics (e.g., popularity or usage frequencies/histories),
- Scaffoldings (usually unshared 'invisible work', defined as the "gap between formal representations, including publications, and unreported 'back stage' work" (Star, 2010)).

Conventionally, "disseminating a document just means publicizing a particular static snapshot from a virtual subset of the PKMS repository; it includes a first level of ordered memes (text and figures) together with its first-level relationships (footnotes, citations, and references)" without the information-richer content and traceability the digital platform affords (Schmitt, 2021b).

The 'research carried out' section referred to the poor knowledge accumulation in the information system, KM, and DSR disciplines, and how longitudinal research employing triangulation and projectability approaches (Table 2) can make a difference. Similar positive effects can be expected from

the PKMS-DPE becoming a maturing technology due to its impacts on current neglects and entropic drivers which are significantly harming "the cumulativeness and evolution of scientific extelligence and transdisciplinary scholarship" (Schmitt, 2021a)

Successfully scaling the community membership and creative domain-spanning authorship converts WHOMER into "a steadily growing (expanding community sharing existent and novel content), single (cloud-based), unified (transdisciplinary), negentropic (redundancy-eliminating), concrete, tangible, accessible, and interrogatable archive of a continuously to be updated knowledge heritage" (Schmitt, 2020b). Accordingly, there may be an opportunity to prove Hayek (1945) wrong and to cumulatively synthesize knowledge in an integrated form concentrated in a single space.

Further academic publications are planned to further promote interdisciplinary knowledge organization, decontextualized boundary object creation, and the PKMS's heritage management and thought leadership potential. Other areas will address empirical testing, market research, and the PKMS's synergies with the ISO 56000:2020 Innovation Management Standard and Triple Helix Spaces as well as with technologies like the semantic web, noSQL databases, blockchain, and artificial intelligence.

CONCLUSIONS

Informer-initiated information exchange requests in conventional DPEs usually prompts appropriate real-time informee-informer-feedbacks, responses, or actions. In contrast, this article has presented a PKMS-DPE setting which processes the iteratively and continuously shared knowledge asset contributions of its complementors 'en-bulk' by utilizing a comprehensive curation process. It aims to safeguards associative integrity and feeds back the cumulatively synthesized extelligence to its community members by providing access to an actualized meme-based centralized repository.

The approach is one of the novel key features of the knowledge management system-in-progress which – having reached a level of academic maturity after some years of design science research – is being taken further in a complementing entrepreneurial environment. The article, hence, contributes an additional start-up perspective and linking it to the prior academic research carried out. The article has demonstrated that, in particular, Murthy's recent research (2021) has provided findings as well as new terminologies which allows new DPE venture entrepreneurs to position their concepts against already established viable DPE models.

It further utilizes latest development-stage-related DPE-research to draft projections of the anticipated incipient, growth, and maturity stages facing, undoubtably, difficult-to-predict volatile, uncertain, complex, and ambiguous environments. Although the latter challenges present a significant limitation of this undertaking, publications at this crucial transition stage are rare. Finding appropriate expressions and rationales for informing stakeholders in related start-up process is crucial to reduce communication barriers. Accordingly, this trans-disciplinary projection (as a further PKMS-related triangulating study shown in Table 2) contributes to the informing, knowledge management, design science, and entrepreneurial research spaces and may assist other researchers and practitioners faced with similar circumstances. Further research work has been pointed out throughout the prior section.

REFERENCES

Barykin, S. Y., Kapustina, I. V., Kirillova, T. V., Yadykin, V. K., & Konnikov, Y. A. (2020). Economics of digital ecosystems. *Journal of Open Innovation: Technology, Market, and Complexity, 6*(4), 124. https://doi.org/10.3390/joitmc6040124

Baskerville, R., Baiyere, A., Gregor, S., Hevner, A., & Rossi, M. (2018). Design science research contributions: Finding a balance between artifact and theory. *Journal of the Association for Information Systems, 19*(5), 358–376. https://doi.org/10.17705/1jais.00495

Baskerville, R., & Pries-Heje, J. (2019). Projectability in design science research. *Journal of Information Technology Theory and Application, 20*(1), 3.

Bush, V. (1945). As we may think. *The Atlantic Monthly*, *176*(1), 101–108.

Cantner, U., & Vannuccini, S. (2012). *A new view of general purpose technologies*. Jena Economic Research Papers, Jena, Germany. https://ideas.repec.org/p/jrp/jrpwrp/2012-054.html

Carvajal-Pérez, D., Araud, A., Chaperon, V., Le Masson, P., & Weil, B. (2018). Generative heritage: Driving generativity through knowledge structures in creative industries. Lessons from Cuisine. *15th International Design Conference*. https://doi.org/10.21278/idc.2018.0318

Cohen, E. B. (2009). A philosophy of informing science. *Informing Science: The International Journal of an Emerging Transdiscipline*, *12*(1), 1-15. https://doi.org/10.28945/425

De Sordi, J. O., de Azevedo, M. C., Meireles, M., Pinochet, L. H. C., & Jorge, C. F. B. (2020). Design science research in practice: What can we learn from a longitudinal analysis of the development of published artifacts? *Informing Science: The International Journal of an Emerging Transdiscipline*, *23*, 1–23. https://doi.org/10.28945/4493

Dresch, A., Lacerda, D. P., & Miguel, P. A. C. (2015). A distinctive analysis of case study, action research and design science research. *Revista Brasileira de Gestão de Negócios*, *17*, 1116–1133. https://doi.org/10.7819/rbgn.v17i56.2069

Eck, A., & Uebernickel, F. (2016). Untangling generativity: Two perspectives on unanticipated change produced by diverse actors. *ECIS*, ResearchPaper35.

Eisenmann, T. R., Parker, G., & Van Alstyne, M. (2009). Opening platforms: How, when and why? *Platforms, Markets and Innovation*, *6*, 131–162. https://doi.org/10.2139/ssrn.1264012

Elia, G., Margherita, A., & Passiante, G. (2020). Digital entrepreneurship ecosystem: How digital technologies and collective intelligence are reshaping the entrepreneurial process. *Technological Forecasting and Social Change*, *150*, 119791. https://doi.org/10.1016/j.techfore.2019.119791

Etzkowitz, H., & Ranga, M. (2015). Triple helix systems: An analytical framework for innovation policy and practice in the knowledge society. In J. Mitra & J. Edmondson (Eds.), *Entrepreneurship and knowledge exchange* (pp. 117–158). Routledge.

Giebel, M. (2013). Digital divide, knowledge and innovations. *Journal of Information, Information Technology, and Organizations*, *8*, 1–24.

Gill, T. G. (2015a). *Informing science volume one: Concepts and systems*. Informing Science Press.

Gill, T. G. (2015b). *Informing science volume two: Design and research issues*. Informing Science Press.

Gupta, S., & Lehmann, D. R. (2005). *Managing customers as investments: The strategic value of customers in the long run*. Pearson Education India.

Hayek, F. A. (1945). The use of knowledge in society. *The American Economic Review*, *35*(4), 519–530.

Hein, A., Schreieck, M., Riasanow, T., Setzke, D. S., Wiesche, M., Böhm, M., & Krcmar, H. (2020). Digital platform ecosystems. *Electronic Markets*, *30*(1), 87–98. https://doi.org/10.1007/s12525-019-00377-4

Hevner, A. R., March, S. T., Park, J., & Ram, S. (2004). Design science in information systems research. *Management Information Systems Quarterly*, *28*(1), 75-105. https://doi.org/10.2307/25148625

Johri, A., & Pal, J. (2012). Capable and convivial design (CCD): A framework for designing information and communication technologies for human development. *Information Technology for Development*, *18*(1), 61–75. https://doi.org/10.1080/02681102.2011.643202

Kano, N. (2001). Life cycle and creation of attractive quality. *Proceedings of the 4th QMOD Conference, Linkoping, Sweden*, 12–14.

Mariano, S., & Awazu, Y. (2016). Artifacts in knowledge management research: A systematic literature review and future research directions. *Journal of Knowledge Management*, *20*(6), 1333–1352. https://doi.org/10.1108/JKM-05-2016-0199

Mella, P. (2017). The unexpected cybernetics life of collectivities: The combinatory systems approach. *Kybernetes*, *46*(7), 1086–1111. https://doi.org/10.1108/K-02-2017-0058

Menz, M., Kunisch, S., Birkinshaw, J., Collis, D. J., Foss, N. J., Hoskisson, R. E., & Prescott, J. E. (2021). Corporate strategy and the theory of the firm in the digital age. *Journal of Management Studies*, *58*(7), 1695–1720. https://doi.org/10.1111/joms.12760

Mostert, M. (2012). *Systemic leadership learning: Learning to lead in the era of complexity*. Knowres Publishing.

Murthy, R. K. (2021). *Essays on platform sponsor scope: Implications for ecosystem emergence and growth.* [Doctoral Dissertation, York University, Toronto, Ontario]. https://yorkspace.library.yorku.ca/xmlui/bitstream/handle/10315/38699/Krishna_Murthy_Ramya_2021_PhD.pdf

Murthy, R. K., Levesque, M., & Madhok, A. (2020). *Disentangling the impact of platform sponsor scope on platform growth*. https://doi.org/10.2139/ssrn.3758129

Murthy, R. K., & Madhok, A. (2019). *Towards a more comprehensive understanding of emergence of platform based ecosystems*. https://doi.org/10.2139/ssrn.3758116

Murthy, R. K., & Madhok, A. (2021). Overcoming the early-stage conundrum of digital platform ecosystem emergence: A problem-solving perspective. *Journal of Management Studies*, *58*(7), 1899–1932. https://doi.org/10.1111/joms.12748

Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization Science*, *5*(1), 14–37. https://doi.org/10.1287/orsc.5.1.14

Nonaka, I., Toyama, R., & Konno, N. (2000). SECI, Ba and leadership: A unified model of dynamic knowledge creation. *Long Range Planning*, *33*(1), 5–34. https://doi.org/10.1016/S0024-6301(99)00115-6

O'Raghallaigh, P., Sammon, D., & Murphy, C. (2011). The design of effective theory. *Systems, Signs & Actions*, *5*(1), 117–132.

Padhi, P. K. (2018). A quest for BGSS pervasive phenomenon model. *International Journal of Community Development and Management Studies*, *2*, 087–103. https://doi.org/10.31355/24

Peffers, K., Rothenberger, M., Tuunanen, T., & Vaezi, R. (2012). Design science research evaluation. *International Conference on Design Science Research in Information Systems*, 398–410. https://doi.org/10.1007/978-3-642-29863-9_29

Pirolli, P., & Card, S. (2005). The sensemaking process and leverage points for analyst technology as identified through cognitive task analysis. *Proceedings of International Conference on Intelligence Analysis*, *5*, 2–4.

Rahimi, E. (2015). *A design framework for personal learning environments* [PhD Thesis, Delft University of Technology, The Netherlands].

Rippa, P., & Secundo, G. (2019). Digital academic entrepreneurship: The potential of digital technologies on academic entrepreneurship. *Technological Forecasting and Social Change*, *146*, 900–911. https://doi.org/10.1016/j.techfore.2018.07.013

Rylander, A. (2009). Design thinking as knowledge work: Epistemological foundations and practical implications. *Design Management Journal*, *4*(1), 7–19. https://doi.org/10.1111/j.1942-5074.2009.00003.x

Schmitt, U. (2015). Putting personal knowledge management under the macroscope of informing science. *Informing Science: The International Journal of an Emerging Transdiscipline, 18*, 145-175. (Also presented at InSITE 2015: Informing Science + IT Education Conferences, Jul 1-5, Tampa, Florida, US). https://doi.org/10.28945/2161

Schmitt, U. (2016). Personal knowledge management for development (PKM4D) framework and its application for people empowerment. *Procedia Computer Science*, *99*, 64–78. https://doi.org/10.1016/j.procs.2016.09.101

Schmitt, U. (2018). Supporting the sustainable growth of SMEs with content- and collaboration-based personal knowledge management systems. *Journal of Entrepreneurship and Innovation in Emerging Economies*, *4*(1), 1–21. https://doi.org/10.1177/2393957517739773

Schmitt, U. (2019a). Designing decentralized knowledge management systems to effectuate individual and collective generative capacities. *Kybernetes*, *49*(1), 22–46. https://doi.org/10.1108/K-03-2019-0215

Schmitt, U. (2019b). Knowledge management decentralization as a disruptive innovation and general-purpose-technology. *Proceedings of the 20th European Conference on Knowledge Management*, *2*, 923–932. https://books.google.co.bw/books?id=G3-3DwAAQBAJ

Schmitt, U. (2019c). Decentralizing knowledge management: Affordances and impacts. *Electronic Journal of Knowledge Management*, *17*(2), pp114-130. https://academic-publishing.org/index.php/ejkm/article/view/1135

Schmitt, U. (2020a). (Neg)entropic scenarios affecting the wicked design spaces of knowledge management systems. *Entropy*, *22*(2), 169. https://doi.org/10.3390/e22020169

Schmitt, U. (2020b). A back-casting knowledge management vision for a digital platform ecosystem in support of thrivable communities of knowledge workers. *Journal of Digital Innovation for Humanity*, 92–109. https://doi.org/10.31355/67

Schmitt, U. (2020c). Scalability of generative knowledge management systems: Designing for individuals' and institutions' mutual benefit. *Kybernetes*, *50*(10), 2701–2725. https://doi.org/10.1108/K-05-2020-0324

Schmitt, U. (2021a). Projectability and heritage management of design knowledge: A grass-roots artefact perspective of a longitudinal research project for knowledge management system innovation. *Sustainability*, *13*(23), 13033. https://doi.org/10.3390/su132313033

Schmitt, U. (2021b). Reframing a novel decentralized knowledge management concept as a desirable vision: As we may realize the memex. *Sustainability*, *13*(7), 4038. https://doi.org/10.3390/su13074038

Schmitt, U. (in press). Validating and documenting a new knowledge management system philosophy: An ISO 30401:2018-KMS standard case study. *Knowledge Management Research & Practice (KMRP).*

Schmitt, U., & Gill, T. G. (2020). Gifts, contexts, means, and ends differing: Informing task scenarios to serve knowledge workers' needs in dynamic complex settings. *Informing Science: The International Journal of an Emerging Transdiscipline*, *23*, 119–145. https://doi.org/10.28945/4667

Schmitt, U., & Saadé, R. G. (2017). Taking on opportunity divides via smart educational and personal knowledge management technologies. *ICEL 2017 - Proceedings of the 12th International Conference on e-Learning*, 11. https://books.google.co.bw/books?id=2R8zDwAAQBAJ

Schuster, R., Wagner, G., & Schryen, G. (2018). Information systems design science research and cumulative knowledge development: An exploratory study. *ICIS 2018 Proceedings, 3.* https://aisel.aisnet.org/icis2018/design/Presentations/3

Scott, E., Govender, T., & van der Merwe, N. (2016). The x-factor of cultivating successful entrepreneurial technology-enabled start-ups. *Informing Science: The International Journal of an Emerging Transdiscipline*, *19*, 303–324. https://doi.org/10.28945/3580

Secundo, G., Rippa, P., & Cerchione, R. (2020). Digital Academic entrepreneurship: A structured literature review and avenue for a research agenda. *Technological Forecasting and Social Change*, *157*, 120118. https://doi.org/10.1016/j.techfore.2020.120118

Simon, H. A. (1996). *The sciences of the artificial.* MIT Press.

Star, S. L. (2010). This is not a boundary object: Reflections on the origin of a concept. *Science, Technology, & Human Values*, *35*(5), 601–617. https://doi.org/10.1177/0162243910377624

Vom Brocke, J., Winter, R., Hevner, A., & Maedche, A. (2020). Special issue editorial–Accumulation and evolution of design knowledge in design science research: A journey through time and space. *Journal of the Association for Information Systems*, *21*(3), 9. https://doi.org/10.17705/1jais.00611

Yin, R. K. (2009). *Case study research: Design and methods* (Vol. 5). Sage.

AUTHOR

Ulrich Schmitt studied Management & Industrial Engineering (TU Berlin), Computer Applications (Cranfield: MSc, University Basle: PhD), and Science & Research Management (Speyer: PGC). His professional career started as IT & Management Consultant (London, Basle), commenced as Professor and Vice President at two Independent German Universities, Vice Rector (Namibia), and Dean of the Graduate School (Botswana). Currently, he is a Professor Extraordinaire at University of Stellenbosch, Business School and Founder of the Knowcations® Start-up in Port Louis, Mauritius.
https://www.researchgate.net/profile/Ulrich-Schmitt
https://www.linkedin.com/company/knowcations