Knowledge Management and Organizational Learning 12

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The Future of Knowledge Management

Reflections from the 10th Anniversary of the International Association of Knowledge Management (IAKM)

Springer

Knowledge Management and Organizational Learning

Volume 12

This series is introduced by the International Association for Knowledge Management (www.IAKM.net) with an aim to offer advanced peer-reviewed reference books to researchers, practitioners and students in the field of knowledge management in organizations. Both discussions of new theories and advances in the field, as well as reviews of the state-of-the art will be featured regularly. Particularly, the books will be open to these contributions: Reviews of the state-of-the art (i.e. syntheses of recent studies on a topic, classifications and discussions of theories, approaches and methods, etc.) that can both serve as a reference and allow opening new horizons Discussions on new theories and methods of scientific research in organisational knowledge management Critical reviews of empirical evidence and empirical validations of theories Contributions that build a bridge between the various disciplines and fields that converge towards knowledge management (i.e.: computer science, cognitive sciences, economics, other management fields, etc.) and propose the development of a common background of notions, concepts and scientific methods Surveys of new practical methods that can inspire practitioners and researchers in their applications of knowledge management methods in companies and public services.

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Editors

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Introduction

The International Association for Knowledge Management (IAKM)

In 2008, Knowledge Management was attracting increasing interest among scholars and practitioners. After a couple of decades of pioneering studies and seminal books (a nonexaustive list includes not only reputed names such as Nonaka, Davemport, Prusak, Spender, Edwards, but also many others), it became clear that, if not an official "discipline," at least a new field of study was emerging, whose key topic was *knowledge management* with all related theoretical and practical implications. In these first decades, many international conferences, scientific journals, research projects, and university courses focusing on knowledge management had appeared. A growing interest, attendance, and contribution came from all over the world.

At that time, in the frequent discussions among scholars and practitioners who regularly met at conferences or published in the same journals, there was awareness of the need to make a step forward and establish the grounds of a proper scientific "discipline," just like the others. However, there was also awareness of the potential risks of this. In fact, *knowledge management (KM)* was and still is a multidisciplinary field, where contributors come from disparate fields—from computer science to sociology, from management to psychology, from economics to political sciences. Although there was some convergence toward the common use of popular notions, definitions, classifications, or models (just to mention some, the SECI model by Nonaka and Takeuchi, or the distinction between tacit and explicit knowledge, or the definition of Communities of Practice), each scholar had his own perspective on knowledge management. Therefore, there were divergent interpretations even of the same notion or its application. In short, the development of KM as a new scientific field looked like not only a fascinating and stimulating, but also a very challenging, enterprise.

However, the realization of this complex situation was the propellent that led to the foundation of the *International Association for Knowledge Management (IAKM)*. Some of us, who regularly at KM Conferences, started discussing the idea that we may create a "platform" to facilitate the interaction and cooperation of all scholars and practitioners interested in the development of KM as a scientific discipline or, at least, as a recognized branch of management, with its own area of action, theoretical definitions, practical application models. After the 10th European Conference on Knowledge Management, held at the University of Padova, some of us began the journey that, in 4 years of debates, exchanges of ideas, emails, drafts of documents, led to the foundation of IAKM. A pioneering group (Meliha Handzic, Remko Helms, Jose Maria Viedma Martì, Ettore Bolisani) met at the University of Utrecht in 2011 and wrote a first draft of the *Manifesto* which was transformed, after one year, in a draft of *Statute* and *Memorandum of Understanding*. The 11 founding members—Remko Willem Helms, Meliha Handzic, Aino Kanerva Kianto, Alexeis Garcia-Perez, Tatiana Gavrilova, Sandra Muriel Moffett, Ettore Bolisani, Peter Heisig, José Maria Viedma Marti, Enrico Scarso, and Monika Petraite—representing different universities and nationalities, finally signed their name on the official founding documents on 16 April 2012 at the University of Padova.

As can be read in the official articles (see www.iakm.net), the objective of the Association is to promote the development of knowledge management as a scientific discipline by generating awareness and knowledge of KM, providing a reference to researchers and professionals, promoting education, and favoring networking between individuals and groups interested in KM research and in its scientific development.

From the beginning, it was clear that there were some practical issues that needed to be faced and some crucial decisions had to be taken (e.g., Shall we create a formal or an informal community? Will it be a totally non-profit group, or will it also provide some "commercial" services? Will it have a fee? What services, digital platforms, and modality of associations will it include? What structure and style will it have?). In some cases, these decisions were difficult and debated or had contrasting results, and in any case it was a sort of trial-and-error approach. But, despite the awareness of the risks (and some skepticism about its future even of some members!), there was a lot of enthusiam regarding this new enterprise. Now we can happily affirm that IAKM is not only "live and well," but has also an established role in the KM community of researchers.

This volume of the Book Series "Knowledge Management and Organizational Learning" is our way to celebrate its 10th anniversary. The Association now counts more than 100 members on all continents, with a constant growth over time. The majority are academics, but there are also some practitioners. The main recognized value of participating is the possibility of networking and establishing partnerships with others. Today, the number of joint projects, coauthored papers, co-organized conferences and events, and other forms of collaboration in the academia and outside is innumerable. In summary, we are proud to say that the project is a success. And the book series is probably the most concrete and visible result of a decade's work.

The Book Series Knowledge Management and Organizational Learning

The book series Knowledge Management and Organizational Learning (see https://www.springer.com/series/11850) was initiated by IAKM a decade ago as an integral part of the association's mission of helping the development of KM as a scientific discipline. It aims to serve as a reference point for researchers, practitioners, and students interested in the field of KM.

What inspired the book series was not an adherence to a particular school of thought or ideological position, but rather a vision of KM as a playground where there is a lot to research, discover and innovate, where curiosity, dialoge, and openness to disagreement are the key ingredients.

The stated goal is to collect in one place the most relevant ideas, theories, and practices related to managing knowledge and learning at individual and collective levels across global regions and idustries in for- and non-profit sectors.

So far, 11 volumes have been published that address a variety of topics by different authors who provided their expert views of interest for KM research and practice. The first introductory volume (vol. 1) assessed the state of KM at the time, provided a critical review of the past, and set the scene for the following volumes by formulating ideas for the possible future advances in the field. The volumes that followed branched off in different directions. Some volumes provided in-depth investigation of selected KM aspects, including knowledge discovery (vol. 2), social knowledge networks (vol. 3), knowledge strategies (vol. 4), knowledge flows (vol. 10), and knowledge needs (vol 11). Other volumes examined KM in broader contexts, going beyond traditional organizations into other disciplines and fields of study and application, including project management (vol. 5), sharing economy (vol. 6), arts and humanities (vol. 7), adult learning (vol. 8), and industry 4.0 (vol. 9).

The series has been successful in attracting a substantial number of readers interested in our work, as evidenced by the Springer download statistics. We hope that these people will equally enjoy the present volume that celebrates our achievements so far and allows for the opening of new horizons.

This Volume

The economic disruptions generated by the Covid pandemic impacted the business environment and the life of people all over the world. Intangibles became the dominant resources and their management requested new creative solutions. Knowledge management (KM) made a significant jump toward its maturity and adoption by a larger number of companies. However, KM needs a different mindset to understand the complexity of the real life and make intelligent decisions. The new normal business environment imposes new challenges and visions for creating wise companies and further developing their KM.

This book offers some possible answers to these new challenges and visions for knowledge management coming from experts, most of whom are members of the

International Association for Knowledge Management (IAKM). The book contains 15 chapters with topics covering a wide spectrum of issues which are specific to knowledge management, elaborated by 28 contributors, from 18 countries: Austria, Bosnia and Herzegovina, Canada, China, Columbia, Costa Rica, Ethiopia, Finland, Germany, Italy, Poland, Romania, Russia, Spain, Taiwan, Thailand, UAE, and UK. It is an impressive effort to integrate all these ideas into a generative conceptual framework.

The book is structured into three parts, which reflect three perspectives on knowledge management: a complexity approach (part 1), a human approach (part 2), and a technology approach (part 3). In the first part, Constantin Bratianu reveals the complexity dimensions of KM like nonlinearity, intangibility, subjectivity, and entropy. Ettore Bolisani, Enrico Scarso, and Tomas Cherkos Kassaneh analyze the pervasive identity of knowledge management in the last decade. Kimiz Dalkir identifies some key milestones in the evolution of knowledge management and looks toward its future. Aino Kianto, Sladja Cabrilo, and Henri Hussinski scrutinize the future of the intellectual capital in order to identify some unexplored horizons. Peter Heisig closes this part of the book with some reflections on the core of the discipline and the future outlook for knowledge management.

The second part of the book focuses on some significant aspects of the human side of knowledge management. Alexander Kaiser and Hector Martinez explore the spiritual dimension of knowledge management and its impact on leadership and employees. Delio Castaneda examines how knowledge managers approach motivation of people and its impact on organizational performance. Clara Cubillas-Para, Juan Gabriel Cegarra-Navarro, and Anthony Wensley show how the dynamics between learning and unlearning may become a future challenge for knowledge management. Malgorzata Zieba focuses on knowledge risks and how emotions impact them. Elena-Mădălina Vătămănescu and Elena Dinu investigate the role of knowledge dynamics and innovation in knowledge networks.

The third part of the book contains topics that reveal some challenges coming from technology. Alexeis Garcia-Perez and Mark Sallos analyze the phenomenon of digital transformation and the resilience of the firm, focusing on cybersecurity and its impact on knowledge management. Meliha Handzic and Vedad Mulavdic perform a broadening of the knowledge management horizon by presenting the case of distant reading. Dmitry Kudryavtsev, Tatiana Gavrilova, Giovani Schiuma, and Daniela Carlucci perform a comprehensive analysis of the methods used for knowledge visualization and their impact on decision making. Eric Tsui challenges us to learn from the future with the support of advanced knowledge management systems. Vincent Ribiere proposes a journey into the metaverse and challenges us to think how to integrate this technology into knowledge management systems of the future.

We believe that this collection not only properly celebrates the first decade of life of our Association, but also offers a clear picture of the state of the art of KM, seen from the perspective of researchers who are active in this field, and opens a window on the prospective future and the current challenges. We hope that this can provide food for thought to all those interested in KM and especially the young generations of researchers.

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Part I

Knowledge Management: A Complexity Perspective

Approaching the Complexity of Knowledge Management

Constantin Bratianu

Abstract

Knowledge management is an intrinsic part of the managerial process and not a substitute for it. It is that part that is focused on managing intangible resources like knowledge, ideas, brands, and many other similar entities. Although this assertion is clear and looks like an extension of classical management, many knowledge management projects failed and generated a question mark about the future of knowledge management. Management developed based on the basic ideas coming from engineering and on the paradigm of measuring. The assertion "What gets measured gets managed" became almost a norm in management thinking. But knowledge is intangible and contextual. Measuring knowledge is almost impossible by using the measuring systems designed for tangible objects, and that is a huge barrier to understanding and practicing knowledge management. There is a need to change the management paradigm to accommodate intangible resources, and that means approaching the complexity of knowledge and knowledge management. The purpose of this chapter is to reveal some of the most important barriers between classical management and knowledge management and how we can find ways to overcome them, that is, to identify some new models for explaining the complexity of knowledge, knowledge dynamics, and knowledge management concepts. That means revealing new metaphors for understanding the multidimensional concept of knowledge and how to interpret its dynamics at the individual, team, and organizational levels. The chapter focuses on the theory of knowledge fields and knowledge dynamics from a thermodynamics perspective.

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1 Introduction

The idea of the present chapter came to my mind some years ago when I was listening to a keynote speaker at an international conference on knowledge management and intellectual capital. The keynote speaker was working in management consulting and was trying to convey the idea that knowledge management was a fad. His arguments were based on failures in implementing some knowledge management projects in companies. However, he made no serious analysis of the possible causes of those failures or even some evaluations of the feasibility of those implementations. His conclusion was that knowledge management had no future as a new domain of research and practical application in companies.

My experience and studies in strategic thinking and strategic management, coupled with those in information theory, could not accept such a conclusion. However, I had to accept the evidence of those project failures, and I started to search for their possible causes. I found that the main reason for those failures is the *complexity* of knowledge management and the *error* in extending the theory and practice of management directly to knowledge management without understanding its specificity and the new requirements. I shall try to explain in the present chapter some basic differences between management and knowledge management and the errors many researchers and managers commit even today in discussing and applying knowledge management in business.

Frederick Winslow Taylor (1911), a pioneer in industrial management, published in 1911 his book *The Principles of Scientific Management*. The main ideas of management science were transferred from engineering because Taylor was a mechanical engineer. The image of the industrial organization at that time was that of a machine. “Although the image may not be explicit, we are talking about a set of mechanical relations. We talk about organizations as if they were machines, and as a consequence, we tend to expect them to operate as machines: in a routine, efficient, reliable, and predictable way” (Morgan, 1997, p. 13). Taylor introduced the idea of decomposing any activity into tasks that can be performed by individuals and then measuring the time of executing those tasks in order to find ways of reducing that time and increasing productivity. That was the responsibility of managers. They were supposed to define those tasks and to plan them in advance such that the workers could have everything well-defined. “This task specifies not only what is to be done but how it is to be done and the exact time allowed for doing it. … Scientific management consists very largely in preparing for and carrying out these tasks” (Taylor, 1998, p. 17). That was possible if managers could replace the old rule-of-thumb with the science and practice of measuring everything related to production.

That measuring idea created the corollary “What gets measured, gets managed” that is used even today. Thus, the emergence of knowledge management encountered from the very beginning the question "How to measure knowledge?" The difficulty of answering this question led many researchers and managers to try to extrapolate the known measuring methods used for tangible objects to intangible ones through some proxies. The results were disappointing. Therefore, knowledge and knowledge management need new approaches concerning the metrics used for evaluating organizational performance.

Introducing the measuring principle, Taylor was able to increase for many industrial contexts workers' efficiency and productivity. These concepts are defined for industrial management based on a linear logic and countable items. Even today, many managers are obsessed with increasing the value of efficiency and productivity in order to increase production output. However, knowledge and knowledge management are based on nonlinear logic and hard-to-count intangible items. Any extension of linear logic to knowledge management resulted in unacceptable erroneous results.

Knowledge is an abstract concept without any direct relation to some physical objects. Thus, understanding the concept of knowledge depends on our metaphorical thinking (Lakoff & Johnson, 1980, 1999) and the capacity to interpret the results. Many authors used simple metaphors and transferred toward the knowledge concept the attributes of tangibility and linearity, which led inevitably generated unacceptable errors. That is not a limitation of knowledge management but of the capacity of people to apply metaphorical thinking correctly in defining the knowledge semantics. Furthermore, knowledge dynamics is the driving force of any knowledge management process and practice, and its interpretation depends on understanding cognitive science (Damasio, 2012; Friedenberg & Silverman, 2016) and thermodynamics (Atkins, 2010).

Knowledge management proved to be much more complex than classical management, and both researchers and managers should reveal the new attributes of that complexity and explain them (Gleick, 2008; Senge, 1999; Stacey, 2001; Stacey et al., 2000). Only by understanding these new attributes can we design and implement successful knowledge management projects. I shall try in this chapter to evidence some of these new attributes and explain their relevance in understanding the complexity of knowledge management.

2 Understanding Knowledge from a Managerial Perspective

Understanding knowledge was a concern from ancient times. Aristotle (1999) considers that there are five states of the soul which can control action and truth. "Let us say, then, that there are five states in which the soul grasps the truth in its affirmation or denials. These are craft, scientific knowledge, prudence, wisdom, and understanding: for belief and supposition admit of being false" (Aristotle, 1999, pp. 87–88). Craft knowledge or *techne* is that knowledge showing how to do something in a production process. "Every craft is concerned with coming to be, and the exercise of the craft is the study of how something that admits of being and not being comes to be, something whose principle is in the producer and not in the product" (Aristotle, 1999, p. 88). Scientific knowledge or *episteme* is objective knowledge. "For we all suppose that what we know scientifically does not even admit of being otherwise" (Aristotle, 1999, p. 88). Prudence or *phronesis* is a higher-order knowledge because it integrates both knowledge and decision-making guided by human values of being good or bad. "Prudence is a state of grasping the truth, involving reason, concerned with action about things that are good or bad for human being" (Aristotle, 1999, p. 89).

According to Russell (1972), Plato considered knowledge as a result of thinking, ignoring perception. Truth should be the same for everybody. That is a condition for knowledge to be objective and not subjective. "It follows that we cannot know things through senses alone, since through senses alone we cannot know that things exist. Therefore knowledge consists in reflection, not in impressions, and perception is not knowledge" (Russell, 1972, p. 153). Descartes developed further this idea of rational and objective knowledge arguing that thinking is the basic attribute of our existence. "I am not more than a thing which thinks, that is to say a mind or a soul, or an understanding, or a reason, which are terms whose significance was formerly unknown to me. I am, however, a real thing and really exists; but what thing? I have answered: a thing which thinks" (Descartes, 1997, p. 142).

Recognizing the importance of experiential knowledge in our thinking, Polanyi (1983) introduced the *tacit dimension* of knowledge. "I shall reconsider human knowledge by starting from the fact that *we can know more than we can tell*" (Polanyi, 1983, p. 4). Experiential knowledge is the knowledge we learn from our direct experience, and it is subjective knowledge because each individual experiences life in a different way, although there is always a core of that knowledge that is almost the same for most of us. Nonaka and Takeuchi (1995) derived from the tacit dimension of knowledge the concept of *tacit knowledge*, as personal knowledge. Tacit knowledge is latent or potential knowledge (Holden & Glisby, 2010). "Tacit knowledge is highly personal and hard to formalize, making it difficult to communicate or to share with others. Subjective insights, intuitions, and hunches fall into this category of knowledge. Furthermore, tacit knowledge is deeply rooted in an individual's action and experience, as well as in the ideals, values, or emotions he or she embraces" (Nonaka & Takeuchi, 1995, p. 8).

At this point we must understand the epistemological perspective of knowledge (Audi, 2011; Russell, 2009). From a philosophical perspective, knowledge is *a justified true belief*. Thus, *truth* and *justification* are the key terms in making the difference between a simple belief and knowledge. According to Russell (2009), "Truth is a property of beliefs, and derivatively of sentences which express beliefs. Truth consists in a certain relation between a belief and one or more facts other than the belief. When this relation is absent, the belief is false" (p. 135). To transform a true belief into knowledge, one needs justification. That means using some thinking mechanism to find arguments for justifying one's beliefs. "If we learn enough about knowledge and justification conceived philosophically, we can better search for them in matters that concern us and can better avoid the dangerous pitfalls that come from confusing mere impressions with justification or mere opinion with knowledge" (Audi, 2011, p. 11).

From a managerial perspective, *knowledge* is considered a *valuable resource* of an organization. It is a strategic resource that contributes decisively to achieving competitive advantage (Bolisani & Bratianu, 2018; Liu, 2020; Massingham, 2020). Thus, from a managerial perspective, the focus is on understanding knowledge as a resource and leveraging it efficiently to achieve organizational performance and competitive advantage. The basic assertion that "knowledge is defined as justified true belief" (Nonaka & Takeuchi, 1995, p. 86) remains. Only the meaning of justification is changed because knowledge is a resource in a given contextual framework. According to Nonaka and Takeuchi (1995), "Justification involves the process of determining if the newly created concepts are truly worthwhile for the organization and society" (p. 86). The usefulness of knowledge should be aligned with the vision, mission, and strategic objectives of the organization.

Changing the paradigm of understanding knowledge implies metaphorical thinking because knowledge is an abstract concept and has no direct relationship with the tangible resources of a given organization (Andriessen, 2006, 2008; Lakoff & Johnson, 1980, 1999). As Andriessen and Boom (2007) remark, "Knowledge is not a concept that has a clearly delineated structure. Whatever structure it has it gets through metaphor. Different people from different cultures use different metaphors to conceptualize knowledge. They may be using the same word: however, this word can refer to totally different understandings of the concept of knowledge" (p. 3). The diversity of metaphors used for explaining the concept of knowledge created different interpretations, which generated many discussions in constructing the knowledge management domain. Even for the same type of metaphors, there were variations in transferring attributes from the source domain toward the target domain.

Performing a semantic analysis of all the metaphors used for explaining knowledge, we can form three main clusters. The generic metaphor for the first semantic cluster is *knowledge as objects*. Different physical objects are placed in the source domain, and some of their attributes are transferred to the target domain. Thus, knowledge is conceived as an object with physical attributes like being tangible, having forms and dimensions, and linear behavior. The following example show clearly how knowledge can be treated as an object: "Just as food and manufactured goods can be packaged and sold, there are ways to package knowledge for commercial benefit, using the intellectual property laws" (Sullivan, 1998, p. 67). Using this metaphor, managers consider that knowledge can be accumulated, stored, retrieved, distributed, and exchanged like any other goods. Like in the classical management, knowledge can be counted, owned, controlled, and managed (Andriessen, 2008; Borgo & Pozza, 2012; Davenport & Prusak, 2000). However, knowledge is intangible and nonlinear, and all of these interpretations ignore those attributes.

The second semantic cluster contains the following generic metaphors: *knowledge flow* and *knowledge as stock-and-flow* (Bolisani & Oltramari, 2012; Bratianu & Paiuc, 2022; Nissen, 2006). These metaphors are used especially for explaining the concept or *organizational knowledge* that represents an integration of individuals' knowledge working within a team or an organization. An excellent explanation of such a metaphor is provided by Bolisani and Oltramari (2012): "We can denote knowledge stock as the amount or 'level' of knowledge possessed at a particular time in an organization, while knowledge flows identify knowledge that is transferred from one economic player to another. According to this interpretation, knowledge flows can affect the amount of knowledge stocked by the two players" (p. 280). These metaphors have been easily accepted by most researchers and authors because they are intuitive and the notion of *flow* had been used many times as a basis for other metaphors in science, like in heat transfer and electricity. However, a fluid is a tangible entity and its dynamics is based on Newtonian logic.

The third semantic cluster contains the *knowledge as energy* metaphor (Bratianu, 2011; Bratianu, 2013a; Bratianu & Bejinaru, 2019). This metaphor changes the paradigm of understanding knowledge because energy is not a tangible object. It is an intangible physical reality. Moreover, energy manifests in several forms, like mechanical energy, thermal energy, electrical energy, or nuclear energy. Similarly, knowledge can manifest in several forms. The theory of knowledge fields based on this metaphor defines three fundamental fields of knowledge: rational, emotional, and spiritual. Knowledge from each of these fields can be transformed into knowledge of any other field in concordance with the thermodynamics principles. Rational knowledge is the explicit knowledge we use currently in everyday life, in education, in science, in business and economics, and in technology. It is the knowledge that can be expressed using a natural or symbolic language (Davenport & Prusak, 2000; Nonaka & Takeuchi, 1995; Pinker, 2008).

Emotional knowledge is the knowledge we obtain from our direct experience with the environment. It is an experiential knowledge processed in our cognitive unconscious. It is wordless or body language knowledge (Damasio, 1999, 2012; Hill, 2008; Kolb, 2015). Emotional knowledge is creating in time our tacit knowledge together with spiritual knowledge. Emotional knowledge plays an important role in decision-making and it is action oriented (Hill, 2008; Kahneman, 2011).

Spiritual knowledge contains our values and ideals reflecting our aspirations for a better life and for meaningful work (Bratianu, 2015; Maxwell, 2007; Rocha & Pinheiro, 2012). According to the pyramid of Maslow, spiritual knowledge is the driving force for self-actualization, a state of mind defined by a set of values and a universe of meanings. "We know today that human beings are by definition primarily creatures of meaning and value (that is, of 'self-actualization'). We need a sense of meaning and driving purpose in our lives. Without it we become ill or we die" (Zohar & Marshall, 2004, p. 17). Spiritual knowledge contributes to the creation of working spirituality for any organization and to define its vision and mission. Spiritual knowledge becomes more important for the knowledge workers who need to put their work into a spiritual framework, as remarked by Drucker (2008) in his seminal book *The Age of Discontinuity: Guidelines to Our Changing Society*, "Knowledge workers cannot be satisfied with work that is only a livelihood. Their aspirations and their view of themselves are those of the 'professional' or the 'intellectual'. If they respect knowledge at all, they demand that it becomes the base for accomplishment" (p. 289).

The *energy metaphor* opens new interpretations for knowledge from a managerial perspective, which go beyond all the other metaphors and their limitations given by tangibility and linearity. The theory of knowledge fields approaches the complexity of knowledge management and offers new horizons for understanding and leveraging organizational knowledge.

3 Linearity as a Barrier to Understanding the Complexity of Knowledge Management

Classical management is developed on Newtonian logic that is based on reversible processes and linear thinking (Bratianu, 2009, 2015). Linear thinking is omnipresent and represents the key mechanism of our thinking model through which we see and understand the external world. It is so deeply implemented in our minds through education that we may consider it as being the only option we have to discover the world we are living in. Linear thinking is based on the three main assertions: (a) the output of a linear process is proportional to its input, or the results of a linear activity are proportional to the efforts made during that activity; (b) any linear activity can be decomposed in sequences which follow one after another without any overlapping; and (c) in linear processes, the superposition principle is valid. Linear thinking is so pervasive because society is always looking for simplifying approaches to complex problems. Our language is linear because when we speak or write, we create sentences where one word follows another word. The time we measure with a clock is a linear process, and all the measuring systems for physical objects are based on linear correlations.

The key mathematical operations we perform with physical objects are the algebraic operations: addition, subtraction, multiplication, and division. They define the mathematical concept of *a linear space*. It can be demonstrated that any scalar field satisfies the requirements of a linear space. Let us consider for exemplification the *commutative* property of addition:

$$a + b + c = b + a + c, \text{where } a, b, \text{and } c \text{ are some scalars in the space } S. \quad (1)$$

Now, let us consider a knowledge space K, with the variables John, drinks, and whisky. Let us apply the same relation and see what happens:

$$\text{John} + \text{drinks} + \text{whisky} \neq \text{whisky} + \text{drinks} + \text{John} \quad (2)$$

It is clear that *the knowledge space* does not satisfy the requirements of the linear space, which implies that the knowledge space is not a linear space. The knowledge space is a nonlinear space. Thus, when we work with knowledge, we should be able to find adequate representations and methods which are nonlinear. Complexity is characterized by nonlinear entities and correlations. In a nonlinear correlation, the output is not proportional to the input anymore. However, our linear thinking is so powerful that it is needed a serious effort to understand and to apply nonlinear thinking. In knowledge management, nonlinear thinking helps us to understand how it is possible with a small input to get a large output, like in the Pareto principle.

Knowledge is nonlinear, and any attempt to use it as a linear entity ends in erroneous results. If for rational knowledge people may have doubts, emotional and spiritual knowledge are clearly nonlinear entities like emotions, feelings, and values. Learning to think in a nonlinear way constitutes an important effort to approach knowledge management complexity. For instance, in business, a manager uses linear thinking when paying a worker based on his activity per hour and nonlinear thinking when the same manager is paying somebody for his expertise in solving a problem. In this latter case, the solution is possible due to the expert knowledge one has, and it is not proportional to the number of working hours. However, as Gladwell (2005) remarks, "We live in a world that assumes that the quality of a decision is directly related to the time and effort that went into making it" (p. 14). That is the barrier that keeps managers from addressing knowledge management issues with linear thinking and one of the main reasons why so many knowledge management projects failed.

Experience is a result of our experiential learning. We use experience both consciously and unconsciously in a nonlinear way. Gladwell (2005) explains how our unconscious uses experience to find solutions for new problems through the *thin-slicing* approach: "Thin-slicing refers to the ability of our unconscious to find patterns in situations and behavior based on very narrow slices of experience" (p. 24). That is very fast thinking with good enough results. As Gladwell (2005) posits, "decisions made very quickly can be every bit as good as decisions made cautiously and deliberately" (p. 14). That finding demolishes the old and linear idea that the time needed for a decision is proportional to the degree of complexity of the given problem. Intuition that is based on this thin-slicing approach is a well-known shortcut to the cognitive process. Not all of our intuitions lead to adequate results, but their contributions remain important, at least as fast searching engines for possible solutions.

4 Using Linear Metrics for Measuring Nonlinear Fields of Knowledge and Their Catastrophic Results

Knowledge is the main component of *intellectual capital* (Andriessen, 2004; Edvinsson & Malone, 1997; Ricceri, 2008). One of the most cited definitions of intellectual capital was formulated by Stewart (1999): "Intellectual capital is the *sum* of everything everybody in a company knows that gives it a competitive edge" (p. XI, italics added). As you can see, the author uses linear thinking, considering that the organizational intellectual capital represents the summation of all individuals' intellectual capital. That is a grave error that, unfortunately, has been perpetuated in many papers until today. When there is a group of individuals, the collective intellectual capital can be obtained through *integration*, not summation. Integration is performed by *integrators*. In any organization, the nonlinear integrators are represented by managers, organizational culture, and leaders (Bratianu, 2013b). Managers integrate mostly rational knowledge and only tangentially emotional knowledge. Organizational culture integrates mostly emotional knowledge and spiritual knowledge. From a dynamic perspective, organizational culture is an integrator, but it is simultaneously a result of a self-integration process of individuals' emotional and spiritual knowledge and of traditions of that organization. Leaders are the most powerful integrators because they integrate rational, emotional, and spiritual knowledge.

Intellectual capital (IC) is a potential of organizational knowledge and the fundamental question is how to measure and report it (Andriessen, 2004; Edvinsson & Malone, 1997; Dumay, 2016). Many authors, without a deep understanding of knowledge and intellectual capital, extrapolated accounting thinking models and produced all kinds of metrics for intellectual capital, which produced grave errors and misinterpretations. "These contemporary IC measurement frameworks are reifying IC in the same manner in which tangible assets are portrayed within accounting, which is akin to attempting to make the intangible tangible. This is what the author defines as an 'accountingisation' of IC" (Dumay, 2009, p. 205). To illustrate the dimension of errors in measuring intellectual capital, I shall consider the case of the *knowledge balance sheets* (KBS) in Austrian public universities (Federal Law Gazette, 2006; Habersam et al., 2013, 2018). In its attempt to give more autonomy to the state university, the Ministry of Education, Science and Culture decided to ask universities to report annually on their intellectual capital by using KBS.

The Federal Law Gazette of the Republic of Austria, issued on 15 February 2006, Part II, published the 63rd Regulation of the Federal Ministry of Education, Science and Culture on Intellectual Capital Reports (Intellectual Capital report Act—ICRA). The objective of ICRA is defined as follows: "The intellectual capital report aims at presenting, evaluating and communicating intangible assets, performance processes and their consequences and serves as a qualitative and quantitative basis for generating and entering a performance agreement." ICRA uses the canonical model of intellectual capital composed of human capital, structural capital, and relational capital. The law defines the indicators to be considered by universities for evaluation.

For *human capital*, the law indicates the following indicators: staff per university, number of awarded teaching qualifications (habilitations), number of appointments to the university, number of appointments from the university, number of academic/art staff who have completed a temporary stay abroad amounting to at least 5 days (outgoing), number of incoming academic/art staff, and number of participants in programs for continuing education and personal development. It is easy to remark that the law uses proxies for measuring human knowledge, but these proxies are far from reflecting the quality and the quantity of the collective knowledge of a given university. It is an unfortunate misinterpretation of the way one can measure human capital that represents the integration of all individuals' knowledge working in that university. The results cannot be trusted, and all of those indicators can measure anything but not human capital. Using linear metrics for measuring nonlinear knowledge fields may generate some catastrophic results.

For structural capital, the law defines indicators like funding for measures promoting equal opportunities for men and women and affirmative action for women (euro), funding for measures advancing gender-specific education and research/

development and promotion of the arts (euro), number of staff active at special institutions, and so on. The final indicator is "floor space" (in square meters). At least, these indicators were in the first version of the law. Some of them were removed completely in the second version. After many debates, the 53 performance indicators defined in the first version of ICRA were reduced to 26 and further to 24. However, the problem of using such kind of tangible indicators to measure intangibles remains a serious handicap to understanding knowledge and intellectual capital. Therefore, to pretend that "floor surface" is a measure of intellectual capital shows how catastrophic could be conceived the university intellectual capital. As Alvesson and Spicer (2016) would say, that is a *stupidity paradox*. "We were worried that all this stupidity was detracting from the core purpose of our institutions: to educate students, develop new knowledge and contribute to the wider community" (Alvesson & Spicer, 2016, p. X).

The example of this case is just one out of many others we can find in real life. The question we ask is why these failures happen? Is knowledge management or intellectual capital management just a fad, or is it the incapacity of people to approach their complexity? Or, it is another phenomenon we cannot understand. Albrecht (2003) explains that one of the reasons those phenomena appear is the absolutization of the economic metric in evaluating business performance. "Western business thinking—particularly in America—as codified in most widely circulated business magazines, business news broadcasts, management books, and conference programs, seems to have shifted steadily in recent years toward the impersonal and inhuman view of the enterprise. At the extreme of this view, assets are simply assets—including human beings" (Albrecht, 2003, pp. 4–5).

Another failure in applying knowledge management is that related to understanding and using the concept of *productivity*. For Taylor (1998), productivity was a key concept and metric used in increasing production and the companies' profit. Productivity is the ratio between the production output and the time needed for that production. Thus, it is a simple linear indicator measuring the number of products realized within a certain unit of time. It is designed specifically for industrial work and workers. If that economic indicator is designed specifically for industrial management, how can we extrapolate it to knowledge management? That is a key question formulated among the first authors by Drucker (1999). "The knowledge-worker productivity is the biggest of the twenty-first century management challenges. In developed countries it is their first *survival requirement*. In no other way can the developed countries hope to maintain themselves, let alone to maintain their leadership and their standards of living" (Drucker, 1999, p. 157). Knowledge creation and knowledge processes have a high degree of nonlinearity. If we linearize them and use to measure the knowledge production with the productivity indicator, we may end with another stupidity paradox, measuring the number of words or sentences produced per minute or per hour by a knowledge worker, or even worse, the number of ideas generated per hour. It is almost similar to measure the productivity of a teacher by the number of students attending his class and not the quality of his teaching activity. Drucker (1999) asserted clearly that "Productivity of the knowledge worker is not—at least not primarily—a matter of the *quantity* of output.

Quality is at least as important" (p. 142). But quality needs nonlinear metrics because it is a nonlinear attribute of any process.

If industrial managers had to explain the workers how to perform their tasks, knowledge managers should give more autonomy to the knowledge workers and to transfer to them the responsibility of finding solutions for performing their tasks. That requires a change in attitude not only on the part of knowledge workers but also on the part of knowledge managers. In addition, it requires a change in their thinking, from the linear mode to the nonlinear one. Changing the linear thinking paradigm into the nonlinear thinking is not so easy, but it can be done by intentional unlearning and relearning (Cegarra-Navarro & Wensley, 2019).

We have to accept that knowledge management is different than industrial management because of its complexity involving nonlinearity and intangibility. That leads us to the question of why blaming knowledge management for all those failure instead of accepting its complexity and changing the metrics to evaluate knowledge and knowledge processes. That can be done by extending the semantics of some known indicators or creating totally new indicators to fit the complexity of knowledge management. Stam (2007) took the first option and researched how the meaning of *productivity* can be adapted to the new intangible context. Recognizing the importance of this indicator for measuring knowledge production, Stam (2007) explains, "If one accepts as true that knowledge has become our main source of relative advantage and intellectual capital is the new wealth, then the process of transforming this resource into wealth has become the new challenge. Within this research, the process of transforming knowledge into value is referred to as *knowledge productivity*" (p. 5).

5 Knowledge Dynamics: Changing the Paradigm from Newtonian Logic to Thermodynamics

A less known limitation in applying successfully knowledge management is the Newtonian perspective in understanding and managing knowledge dynamics (Bratianu & Bejinaru, 2020; Bratianu & Paiuc, 2022; Kianto, 2007; Nissen, 2006; Nonaka et al., 2008). In a general sense, *dynamics* means motion or variation of a variable in time and space. We all learned from physics that a variable might change in time from quantitative or qualitative viewpoint. Accumulation of water in a reservoir is a variation in time of its quantity. Looking at a river for some time, we see how the structure or the quality of the flow changes in time. Having these kinds of images in our everyday life, it is easy to create metaphors for knowledge dynamics in this Newtonian perspective. In addition, the variation in time of knowledge is a result of the process of learning and accumulation (Bereiter, 2002).

In the first stage of metaphorical thinking of *knowledge* and *intellectual capital*, authors used a static view of these entities, because the main metaphors were based on the idea that knowledge is similar to physical objects, and intellectual capital was conceived as a stock. The interpretation of intellectual capital as a stock was explained by Bontis (1999) as a result of the fact that many researchers came from the accounting domain. Even in the famous iceberg metaphor explained in detail by Nonaka and Takeuchi (1995), everything was static. When the first authors introduced the idea of *dynamics*, there were different views which created confusion (Kianto, 2007). Finally, the debate was between a *static* and a *dynamic* views of the intellectual capital. The static interpretation is associated with the resource-based view of knowledge (Barney, 1991), while the dynamic interpretation is associated with the dynamic capabilities of the firms (Teece et al., 1997). "The static asset approach adheres to the cognitivist perspective on knowledge, which assumes knowledge can be managed with tight procedures, policies and defined action. It is also closer to the resource-based-view of the firm, where the main interest is in acquisition and protection of valuable, rare, inimitable and nonsubstitutable resources. The capability view, in contrast, is related to the constructionist view of knowledge, which assumes that knowledge cannot be completely controlled but can only be managed by creating enabling conditions" (Kianto, 2007, pp. 345–346).

When knowledge is conceived as a stock, then a simple mechanistic view of knowledge dynamics is given by the motion of the physical support of that stock in space. Consider, for instance, that people move frequently through their departments of companies. They carry with them their own knowledge. It is a motion in space that can be described by the second law of Newtonian dynamics.

A more advanced view is based on the metaphors *knowledge as flow* and *knowledge as stock-and-flow* (Bolisani & Oltramari, 2012; Nissen, 2006; Nonaka et al., 2008). According to these metaphors, knowledge is conceived as a fluid that flows in rivers as a result of gravity forces, or in piping systems as a result of a pressure difference created by pumps. This mechanical analogy inspired Nissen (2006) to define *knowledge flows* as follows: "To the extent that organizational knowledge does not exist in the form needed for application or at the place and time required to enable work performance, then it *must flow* from how it exists and where it is located to how and where it is needed. This is the concept of knowledge flows" (p. XX). The concept of *knowledge flow* received a large acceptance from researchers because it is intuitive and easy to comprehend. However, we should recall from fluid mechanics that any flow is determined by a pressure field in industrial systems or the gravitational field in nature. Unfortunately, in the knowledge flow theory, there is no such analysis for specifying the driving forces of the flow. Unlike the mechanical forces in fluid flows, in knowledge flows there are psychological, social, structural, legal, and managerial forces. Revealing these forces should be a target for further research in the knowledge flow theories.

Szulanski (1995, 1996) introduces the analogy between the knowledge transfer and the communication theory developed by Shannon (1948) and remarked that in any transfer of knowledge from a source to a receiver, there are some barriers which reflect inertial forces and different perturbations. Inspired by von Hippel (1994), he called the phenomenon generated by those forces and perturbations *stickiness*. "The notion of internal stickiness connotes the difficulty of transferring knowledge within the organization" (Szulanski, 1996, p. 29). The concept of stickiness relates the internal and external factors which influence organizational knowledge dynamics, as well as motivational factors with the technology factors involved in knowledge transfer. His research reveals that "knowledge-related barriers—recipient's lack of absorptive capacity, causal ambiguity, and the arduousness of the relationship between source and recipient—are most important impediments to knowledge transfer within the firm" (Szulanski, 1996, p. 37). Therefore, even when we use the concept of knowledge flow in explaining knowledge dynamics within an organization, the flow of knowledge encounters internal and external factors which create stickiness (Szulanski, 2000).

The first author to go beyond the Newtonian paradigm of knowledge dynamics is Ikujiro Nonaka who proposed a dynamic theory of organizational knowledge creation (Nonaka, 1994). Nonaka focused on the dynamics between tacit knowledge and explicit knowledge at the individual and organizational levels and proposed a cycle for organizational knowledge creation composed of four processes: socialization, externalization, combination, and internalization. "A 'spiral' model of knowledge creation is proposed which shows the relationship between the epistemological and ontological dimensions of knowledge creation. This spiral illustrates the creation of a new concept in terms of a continual dialogue between tacit and explicit knowledge" (Nonaka, 1994, p. 15). The model is based on the idea that knowledge is born in the mind of individuals and then developed through social interactions within teams and organization. The model contains four processes: socialization (S), externalization (E), combination (C), and internationalization (I). The SECI model introduced in the literature a new paradigm for knowledge dynamics, and it was accepted by many researchers and practitioners due to its simplicity and intuitiveness (Nonaka, 1994; Nonaka & Takeuchi, 1995; Nonaka et al., 2008). In their new book on the wise company, Nonaka and Takeuchi (2019) introduced explicitly the time dimension. *socialization* is the process of tacit knowledge exchange between people working together in a team. That exchange is done by imitation, like in any experiential learning (Kolb, 2015). *Externalization* is the process of transforming tacit knowledge into explicit knowledge at the individual level. That transformation is possible by using a metaphorical thinking and a natural or symbolic language. *Combination* is the process of expressing explicit knowledge within a social context, like a team, and developing that knowledge through combining different participants' contribution.

Adopting a thermodynamics perspective, Bratianu (2011, 2013a), and Bratianu and Bejinaru (2020) proposed a new paradigm for knowledge dynamics based on the idea that any form of knowledge (rational, emotional, and spiritual) can be transformed into another form of knowledge. This idea is supported by cognitive science as well (Damasio, 1999, 2012; Kahneman, 2011). LeDoux (1999) posits clearly: "The conversion of emotions into thoughts has allowed emotions to be studied using the tools and conceptual foundations of cognitive science" (p. 70). That means the transformation of emotional knowledge into rational knowledge into our brain and making possible for knowledge dynamics to contribute in the decision-making (Ariely, 2011; Bratianu et al., 2021; Hill, 2008). The difficulty of understanding this new perspective of knowledge dynamics comes from the fact that emotional knowledge is processed mostly by our cognitive unconscious. We are aware only of the final results and its consequences. Kahneman (2011) remarks that an idea can be expressed in many ways, including the transformation of rational knowledge (i.e., thought) into emotional knowledge (i.e., body emotional state). "I will adopt an expansive view of what an idea is. It can be concrete or abstract, and it can be expressed in many ways as a verb, as a noun, as an adjective, or as a clenched fist" (p. 52). That is a result of the fact that cognition is embodied, and we are thinking with the whole body, not only with the brain. Because we do not have access to the unconscious processes, we do not know how much we know. The known-unknown matrix evidence that dynamics between what we know (rational knowledge) and what we don't know we know (emotional knowledge).

A convincing psychological experiment for showing how transformation of one form of knowledge into another one happens, and how knowledge dynamics influences decision-making, is told us by Kahneman (2011). The experiment was done in a British university, in the tea room, where students for years used to consume tea, coffee, or some snacks and paid according with a price list by putting their money in a "honesty box." One day, without any explanation, above the price list appeared a poster showing two big eyes staring at the students. The poster was there for one week. Next week, the poster with eyes was replaced with one showing flowers. For 10 weeks, these two types of posters were alternating. Each day, somebody from the experiment's team counted the money from the "honesty box." Results showed that students paid almost three times more in the "eyes weeks" as they did in "flowers weeks." As concluded by Kahneman (2011), "Evidently, a purely symbolic reminder of being watched prodded people into improved behavior" (p. 58). The emotional knowledge created by the eyes was transformed into spiritual knowledge informing the brain of the watching phenomenon. Then, spiritual knowledge associated with adequate behavior transformed into rational knowledge for making the correct payment in the honesty box. The simplicity of this experiment revealed the whole knowledge dynamics process.

The knowledge dynamics model introduced by Bratianu (2011, 2013a) opens new directions for understanding and explaining the consumers' behavior and their contribution to the behavior economy (Ariely, 2011; Hill, 2008). In addition, the new paradigm is in concordance with Kotter's theory of leading change (Kotter, 1996, 2008). Organizational change is a complex process that implies vision from leaders and a great effort from employees. For a successful change, leaders must create a critical mass for driving the change and a motivational system for employees to work hard under the pressure of uncertainty. The old model for organizational change was based on rational knowledge and the following logic: (a) give people analysis; (b) data and analysis influence how we think; and (c) new thoughts change behavior or reinforce changed behavior. The new model proposed by Kotter (1996) is based on a totally different logic: (a) help people to see; (b) seeing something new hits the emotions; and (c) emotionally charged ideas change behavior or reinforce changed behavior. Thus, spiritual knowledge contributes to the creation of change vision; emotional knowledge triggers the change and rational knowledge closes the circle with decision-making. There is a continuous transformation from one form of knowledge into another one such that knowledge dynamics finally becomes the driving force of any organizational change.

6 The Challenge of Managing Knowledge Entropy

Understanding and managing knowledge entropy become a new challenge for researchers and practitioners because it needs a change in the paradigm of managing organizational entropy. The concept of *entropy* was created by Clausius in 1865 to help him explain the transformation of mechanical work into heat and to formulate the second law of thermodynamics (1865). Boltzmann further developed the concept of entropy by offering a statistical interpretation for it (Atkins, 2010). Shannon (1948) developed the mathematical theory of communication and defined the concepts of *information* and *information entropy*. Information reflected a message sent through a communication channel as a packed of electrical signals, without any meaning attached to it. Information entropy reflects the probability distribution of those electrical signals within the sender database. Shannon (1948) developed the mathematical expression for computing that probability distribution and reached the same formula like that developed by Boltzmann which suggested him to call it *information entropy*.

Because it is a powerful concept, *entropy* is used today in many science domains and with many interpretations and misinterpretations (Basurdo-Flores et al., 2018; Ben-Naim, 2012; Georgescu-Roegen, 1999; Kovalev, 2016). The concept is fundamental for the second law of thermodynamics because it describes the thermodynamic state of any system. The second law of thermodynamics can describe a generic transformational process, making it a universal law (Atkins, 2010). The concept of entropy was associated with the idea of order or disorder within a system from the very beginning because of the image we have with the gas molecules in a cylinder with a moving piston. However, the dynamics of molecules is chaotic and based on a probability distribution, not on a deterministic behavior. Commenting on the Boltzmann work, Chalidze (2000) underlines that Boltzmann "showed that entropy is a measure of disorder in the system, that a multi-particle system has a tendency to develop to a more probable state, and such a more probable state is a state of higher disorder" (p. 11). Although order and disorder are complementary concepts and relative one to each other, the idea of correlating entropy with the state of order within a system is used in many activity domains.

Management was conceived from the very beginning as a mechanism to introduce order in disordered industrial processes (Morgan, 1997; Massingham, 2020; Taylor, 1911). Order based on deterministic thinking came from considering an organization as a machine and from the need of managers to control everything in their area of responsibility. More order, better control, and easier measurements. Therefore, we may consider that management was created to introduce order into a disordered organization aiming at a full control of all the activities. The result of such management is always reducing the entropy of the system. The practice demonstrated that in an organization with reduced entropy, the knowledge creation and innovation are severely limited because people who work in a psychological climate of fear become less creative. That is why in the innovative organizations the classic management of "command and control" based on a strict vertical hierarchy started to change into a flat hierarchy with increased degrees of liberties for workers. That is especially true in the knowledge-intensive organizations, where the proportion of knowledge workers increased significantly by comparison with the industrial workers (Drucker, 1999, 2008; Liu, 2020).

Thinking of organizational knowledge as a multidimensional field, it is rather difficult to imagine how to introduce order into it and to control something that does not belong to you. The aim of knowledge management is not full control of people but creating a psychological climate for stimulating their minds to create knowledge and to leverage it intelligently. Thus, knowledge management aims at increasing organizational entropy and not at reducing it. It looks like a paradox of management, but it reflects the different structures of the industrial and knowledge-intensive organizations.

The question now is how one can measure the entropy state of an organization, or the state of the organizational knowledge. Inspired by the information entropy of Shannon (1948), Bratianu (2019) introduced the concept of *knowledge entropy*. It measures the probability distribution of organizational knowledge at a given time. Organizational knowledge is dynamic due to all processes of knowledge creation, knowledge acquisition, knowledge storage, knowledge sharing, knowledge loss, and knowledge use for creating new products and services. If we consider that knowledge is distributed randomly within an organization, with a probability distribution $p_1, p_2, p_3, \dots p_n$ where n is the total number of employees, then we can express the knowledge entropy of the whole organization by using the Shannon formula:

$$KE = -C \,\Sigma\, p_i \log p_i \tag{3}$$

where we noted with *KE* the value of knowledge entropy and with *C* a constant which is an arbitrary positive number chosen to adjust to a certain framework scale. Computing knowledge entropy can help managers to understand how far is the organizational knowledge structure from the optimum state and how can they change the actual state to approach the optimal one. For instance, evaluating the organizational knowledge distribution, a manger can understand how nonuniform it is and how low the knowledge entropy is with respect to the optimal state. Then, the manager can initiate a series of knowledge processes to change the distribution of organizational knowledge and increase its entropy. That will lead to better state of innovation and performance. Therefore, knowledge entropy can become a valuable instrument for knowledge managers to understand and change the organizational knowledge distribution.

7 Conclusions

Knowledge management evolved together with the development of the knowledge economy and the significant increase of intangible resources in organizations. Many projects of implementing knowledge management failed in the beginning because managers extended the well-known managerial practices to the new knowledge processes, which are completely different than those found in industrial management. In the case of the industrial management, managers operate with tangible objects and make decisions based on deterministic and linear thinking. In the case of knowledge management, resources are intangible, and decision-making should be based on nonlinear and probabilistic thinking. Thus, any extension from the physical world to the world of intangibles leads to unacceptable errors.

Knowledge management imposes a new world of meanings and values and requires a new approach for understanding knowledge processes and how to deal with knowledge workers. That is a complexity approach based on nonlinear thinking and intangible attributes of knowledge. That means to change the metaphors used in explaining knowledge and knowledge dynamics and to change linear thinking into nonlinear one. All of these changes meet some barriers created by our education and social life based on linearized solutions and simplified thinking models. However, these barriers can be overcome and knowledge managers can think in a different way and make decisions driven by knowledge dynamics instead of rationality.

The new theory of knowledge fields opens new opportunities for understanding knowledge, knowledge dynamics, and all the specific processes of knowledge management. The present chapter spotted only the main issues related to this requested paradigm change, but the complexity of knowledge management should be further uncovered and adapted to the complexity of business environment and the new needs of knowledge workers.

Knowledge dynamics becomes the new driving force of knowledge management and knowledge entropy the new attractor for organizational development. Managing knowledge entropy aims at increasing the level of organizational entropy in order to create a better psychological context for innovation and sustainable development. Instead of controlling every task of every worker like in Taylor's scientific management, knowledge managers should motivate knowledge workers to use most of their tacit and explicit knowledge in creating new product and services. Knowledge sharing is the key process of changing the organizational knowledge distribution and increasing the knowledge entropy of the whole organization.

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The Pervasive Identity of Knowledge Management: Consolidation or Dilution?

Ettore Bolisani, Enrico Scarso, and Tomas Cherkos Kassaneh

Abstract

It is a widespread opinion that knowledge management (KM) is a strongly interdisciplinary field of study. Over the years, this characteristic has become more marked, and it is now possible to identify more than one hundred different definitions of the term coming from distinct subject areas, e.g., business management, accounting, education, human resources, information, computer science, healthcare, and library science. The number of papers related to KM has grown notably, and they now amount to tens of thousands. Looking at the literature, KM appears to be a pervasive concept that can be applied to any human activity, and conversely, any dimension related to human activity affects the adoption of KM. Although multidiscipinarity is not necessrily a negative characteristic, there is a risk that the concept itself of KM becomes misunderstood or used in a generic way and may lose its original significance. In other words, the proliferation of works that refer to KM is a positive signal but also raises the question of whether the discipline is consolidating or diluting its identity. The paper stimulates a discussion on this by going a little deeper into the abovementioned pervasiveness.

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An analysis of various reviews of the literature on KM is done to verify if KM is conceptualized and applied in a common way or if it is splitting into different but increasingly inconsistent streams.

Keywords

Knowledge management · Identity · Meta-review · Scientific discipline · Recognition

1 Introduction

Since its origins, knowledge management (KM) has been considered a highly multidisciplinary field (O'Leary & Studer, 2001). Over the years, this characteristic has increased along with the considerable growth in the number of articles. The journals specifically devoted to KM have climbed the citation ranking rather rapidly. However, this led to some fragmentation of the field. KM is now a widely used term, as can be easily understood by considering that one of the most important citation databases (Scopus) now includes up to 76,000 papers with the keyword "knowledge management," classified in very different subject areas ranging from computer science to business and management, from social sciences to arts and humanities. Girard and Girard (2015) identified more than 100 different definitions of KM that are adopted in papers of 23 different areas, not only management and IT (the two "elective" fields where KM was originally introduced) but also accounting, education, healthcare, human resources, information science, and library science.

This may be normal since the idea itself of managing knowledge can be applied to every human activity and dimension (social, technological, psychological, etc.). On the other hand, if the notion of KM is used so widely, the risk is that it is interpreted and used in different ways, or it may become a sort of generic "umbrella" term where each scholar or professional just picks up what sounds useful for their specific purpose. For the discipline, this can be a problem because it can result in a kind of "dilution" of the meaning of KM itself. So, after more than three decades of KM studies and the confirmed popularity of the term in the literature, the question is whether KM is consolidating or losing its identity from a scientific and disciplinary perspective.

The purpose of this paper is to stimulate a discussion on this issue by thoroughly examining the ubiquitous use of KM concepts, notions, and definitions in the literature. This analysis is based on a critical examination of some recent reviews of the literature on KM. The goal is to verify how KM is conceptualized and applied in the different fields; to examine whether a consistent adoption of the notions, models, and definitions can be found; and to understand whether these notions are aligned with those proposed in "real" KM studies and especially those studies that are generally considered onsistent with the recognized foundations of the field. Finally, a discussion is presented of how the KM research community can help strengthen the meaning and identity of KM as a scientific field.

2 KM: A Brief History

Although the term knowledge management was probably coined by Wiig (1986), the real start of this stream of studies can be traced back to 30 years ago, and more precisely in 1993 when the first conference specifically devoted to KM was organized (Prusak, 2001). The first and very often recalled definitions of the term date back to the late 1990s and are the following: “Knowledge Management is the process of capturing, distributing, and effectively using knowledge”(Davenport, 1994); “knowledge management is an approach towards the systematic, explicit and deliberate creation, renewal and application of knowledge in order to augment the knowledge-related efficacy of organizations” (Wiig, 1997); and “knowledge management refers to identifying and leveraging the collective knowledge in an organization to help the organization compete” (von Krogh, 1998). In their paper, which represents another milestone of the discipline, Alavi and Leidner (2001) consider KM a process consisting of various subprocesses: (1) creation, (2) storage/retrieval, (3) transfer, and (4) application.

All the mentioned definitions assume that KM is a set of activities/processes that can, or better must, be carefully managed. As Wiig et al. (1997) underline, “Knowledge management does not carry its name accidentally. Management normally means that something has to be managed. In other words, we have a set of management activities directed towards dealing with an object.” It can be rightly said that KM was born as a response to the need to better manage what was increasingly recognized as the company’s main strategic resource, namely, knowledge (Spender & Grant, 1996). A few years later, some scholars began to wonder if KM was an ephemeral fad destined to disappear quickly (Swan et al., 1999; Ponzi & Koenig, 2002). Even a famous KM scholar, Davenport (2015), affirmed: “…knowledge management is not dead, but it is gasping for breath.” Negative predictions about the future of KM, although later disproved by its evolution (Hislop, 2010; O’Leary, 2016), were mainly based on the idea of KM just as a new technology, thus neglecting its organizational implications.

History has debunked these predictions, and we can affirm that KM is still alive and its strategic importance for the management of organizations, and the need to properly plan KM activities, is now fully recognized (Bratianu, 2022; Bolisani & Bratianu, 2018). But its “survival” is also the effect of a constant evolution (O’Leary, 2016). For instance, Serenko (2013) identified four generations of KM. The first is based on management-driven, technocentric processes (to identify, codify, and store knowledge already possessed by employees); the second recognizes the value of human factors in relation to the multidimensional nature of knowledge that goes beyond a purely rationalistic interpretation (Bratianu & Bejinaru, 2019, 2020) and highlights issues, e.g., tacit-explicit knowledge conversion, organizational intellectual capital, culture, and importance of personal initiatives; the third generation reconciled the differences between the first and second generations and focused on strategic perspectives, social learning, ethical-social innovation; and the fourth generation deals with the increasing complexity of the knowledge domain by developing new metaphors, paradigms, and tools. Bencsik (2021) foreshadows the coming of a new generation, with the use of artificial intelligence as a KM supporting tool.

If this continued evolution prevented KM from dying, it also leads to the following questions: Are we still talking about the same original concept, or has KM notably changed over the years? Does the term still indicate something specific and especially denote a clearly identifiable discipline, or has it become a buzzword or an umbrella term (Al-Shahrani, 2019)?

In this regard, it is worth recalling that Prusak (2001) speculated that KM could take the same direction as the "quality movement": quality management and all the related methods turned out to be so deeply ingrained in practices and organizational routines that they became a sort of "invisible ingredient" of management. Instead, this did not happen for KM. However, companies and practitioners still have an interest in KM, as demonstrated by the existence of many Associations of KM practitioners and also by the attention that the American Productivity & Quality Center (APQC) gives to KM as a specific management area. But as will be illustrated in the next section, this is not necessarily good news: the use of the concept has spread so widely in the academia and in the practice that it can now be considered pervasive.

3 KM as a Scientific Discipline and Its Future

The discussion about the nature of KM as a scientific discipline and its future is not new and the positions are different. Some scholars believe that KM is and should be developed as any other scientific discipline and try to identify the basic foundations or "pillars" on which it has been developing (Stakovski, 2005; Edwards, 2015). But for others, things are not so clear. A possible reason is that KM can be seen by nature as a multidisciplinary and interdisciplinary field (Alajmi & Alhaji, 2018) whose theoretical core is built on different—and more "established"—scientific fields, ranging from library and information science to computer science, from organization science to strategic management, from accounting to psychology. For Serenko (2013, 2021), the community of KM researchers should fully recognize and embrace this interdisciplinary nature: "Scholars should realize that the KM discipline may successfully exist as a cluster of divergent schools of thought under an overarching umbrella and that the notion of intradisciplinary coherence and consistency should be abandoned" (Serenko, 2021, page 1911). This can bring some "instability" to the KM field but may not necessarily be a limit: "the field's pluralism is a virtue that positivistic and scientific approaches lack; it enables talk of value-creation" (Spender, 2015; p. 19).

In any case, pluralism brings about some implicit risks. For instance, Handzic (2017) concludes that KM may evolve into different trends, namely, an extension (increasing depth and breadth of current research), a specialization (creating subdomains within larger KM paradigm), or a reconceptualization (revisiting the fundamentals and restructuring the entire discipline). The author cannot predict which trend is more likely to occur and, while arguing that its disappearance may not be in sight, she adds that "KM is not yet a coherent academic field."

An apparent issue is that, on the one hand, being "knowledge" at the core of any human activity, its "management" has implications for countless and very different fields. On the other hand, as happens, there are too many authors who publish a single article with some relation to the concepts of KM, which, using Serenko's words (2021), "is a truly disturbing sign." The existence of a discipline requires that there be scholars who can claim to be "experts" in that discipline. So, can we really speak of a consistent scientific discipline when so many scholars published just one paper on KM? Is one paper enough to be recognized as a KM expert? And if everyone is an "expert," does that discipline really exist?

An analysis of publications that have some relationship with the KM field can shed light on this issue and can provide interesting insights. Our purpose is to stimulate a discussion about whether the increasing pervasiveness of KM and the widespread use of some of its popular models, notions, and concepts can cause (or is causing) a progressive loss of identity of the discipline. Awareness of this risk may be important for the research community who believes that KM can and must have a future.

4 A Literature Analysis

To understand the future of KM, it is important to reflect on its past and present. Our goal is to verify how KM is conceptualized and applied in the different fields and to examine if there is a consistent adoption of KM notions, models, and definitions.

An accurate and complete answer to this question would require a massive analysis of thousands of papers, which is impossible. Even a pure bibliometric analysis, in principle less demanding, would be extremely difficult or infeasible (Farooq, 2021) and in any case would not serve our scope. Therefore, a more practicable approach was followed here. First, some quantitative data on the published papers are drawn from citation databases. Second, a sort of "meta-review" of the literature is conducted (Serenko & Bontis, 2013). This consists of retrieving and analyzing existing literature reviews or bibliometric analyses of KM-related publications. A meta-review can aggregate and summarize the findings of previous independent investigations. As recalled by Hennessy et al. (2019), since they integrate existing syntheses, meta-reviews can be considered the top of the "evidence pyramid" and can have great impact on research, practice, and policy.

More precisely, the first step of the analysis aimed to examine the increasing popularity of the term knowledge management, and consequently of the related concepts, in the scientific literature. We use the Scopus database where we search for the indexed articles with the term "knowledge management" or "KM" in their keywords. This database was adopted because it is one of the most popular and widely used citation databases. In addition, it provides simple elaborations of the collected data that can be of use for some analysis. Given our interest in a general picture of the phenomenon and not in too specific details, we limited our search to the previous two keywords and did not consider terms such as "knowledge transfer," "knowledge sharing," and similar, which refer to more particular aspects of KM.

In the second step of the analysis, the focus was more directly on reviews and bibliometric studies. We searched in the same Scopus database for publications with "knowledge management" and with "literature review" or "bibliometric" in the title. The documents retrieved were selected according to some criteria illustrated in the next section and finally read to get a general idea of their content and findings.

5 Results

5.1 Quantitative Analysis

The first step of the analysis (search on Scopus for documents having "knowledge management" or "KM" in their abstract) was conducted on November 8, 2022, and produced a considerable amount of 79,017 articles. Incidentally, including a popular term in the KM literature, "knowledge sharing," would have added about 6000 more documents.

Figure 1 shows the annual trend of the number of papers since 1995 (in this year Nonaka and Takeuchi published their seminal study, and we assume this as a turning point for the KM field). The number of articles started to grow around the year 2000 and reached the peak in 2009, when more than 6000 documents were published. In the following 3 years, a decrease is apparent and after that a stabilization with an average number of 4000 papers per year.

Table 1 classifies the type of document. A little less than two-thirds are conference papers, an extremely higher number than other management disciplines.

Figure 2 shows the distribution of the articles in the subject areas. Scopus classifies each "source" (i.e., journal, conference, book) into one or more subject areas. For instance, the *Journal of Knowledge Management* is in the subject area of "Business management and accounting," while the VINE Journal of Information and Knowledge Management Systems is in both "Business management and

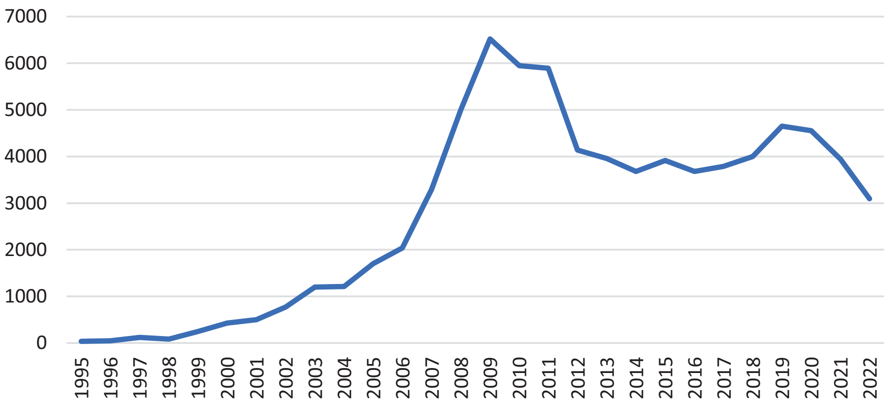

Fig. 1 Annual number of documents retrieved (source: Scopus database)

Table 1 Type of documents

	Number	%
Conference paper	48,864	61.84
Journal article	26,382	33.39
Review	1922	2.43
Book chapter	995	1.26
Other	854	1.08

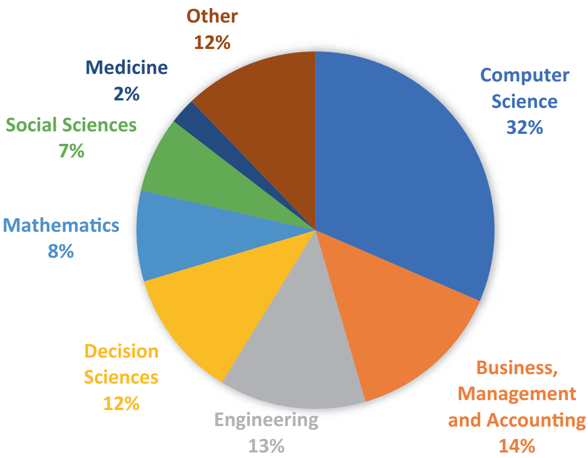

Fig. 2 Subject areas of publication source

accounting" and "Social sciences." It is notable that KM papers were published in sources belonging to different subject areas. "Computer science" (a crucial area for KM) is still prevalent but covers only one third of the papers.

5.2 Meta-review

The second step of our analysis was to discuss the possible effects of the pervasiveness of KM on its identity as a discipline. With this purpose a meta-review analysis was made. This consisted of the examination not of single papers but of reviews of the literature. We searched in Scopus for articles with "literature review" and "knowledge management" in their title. The search was conducted in November 2022 and produced 121 documents. After deleting duplicates (i.e., papers presented at conferences and then published in journals), non-English documents, and nonrelevant articles, 113 publications remained. Table 2 shows the distribution of documents by type of source.

More than half of the documents (78) appeared in non-KM sources, and 66 articles (58.4%) were published in academic journals (39.4% of these in KM journals). We also searched in Scopus for bibliometric studies (documents with "knowledge management" and "bibliometric" in title). Forty-two documents were found, and

Table 2 Distribution by type of source (literature reviews)

Source	Number	%
KM journal	26	23.0
Non-KM journal	40	35.4
KM conference	7	6.2
Non-KM conference	32	28.3
Chapters of KM book	2	1.8
Chapters of non-KM book	6	5.3

Table 3 Distribution by type of source (bibliometric studies)

Source	Number	%
KM journal	10	28.6
Non-KM journal	15	42.8
KM conference	1	2.9
Non-KM conference	7	20.0
Chapters of KM book	1	2.9
Chapters of non-KM book	1	2.9

after deleting duplicates, non-English papers, and irrelevant papers, 35 documents remained. Table 3 shows the distribution by type of source.

Again, more than half of the documents (23) were included in non-KM sources. Most of them (25–71.4%) were published in academic journals and ten in KM journals.

In summary, although we limited our search to the title with knowledge management as keyword, we retrieved 145 documents, which is a significant number. An analysis of the content revealed a wide variety of articles. Consequently, a preliminary classification was made (Table 4):

- General papers that analyze the state of the art in general of the KM literature or of specific KM journals.
- Context-oriented papers that analyze the literature about specific KM implementations in a determined context, where the emphasis is put on the peculiarity of the challenges in that context (e.g., KM in healthcare, in education).
- Articles that examine the factors affecting the success of KM implementation (excluding technology-related factors).
- Papers that examine technology-related aspects, KM technologies, or KM systems.
- Papers with a specific management focus, which analyze how KM can support specific management areas or business goals (e.g., use of KM in supply chains, in human resources management, for innovations).

Table 4 Classification of the documents analyzed by macro-themes

Theme or focus	Literature reviews	Bibliometric studies	Total	%
General	5	20	25	16.9
Context	42	5	47	31.8
Influencing factors	9	0	9	6.1
Technological aspects	14	4	18	12.1
Management focus	38	6	44	29.7
Other	5	0	5	3.4
Total	113	35	148	100.0

5.2.1 General Papers

We found 5 literature reviews and 20 bibliometric studies. The first two were all aimed at reviewing the entire KM literature, two were published in KM journals, and the other three were presented at conferences. Bibliometric studies generally considered papers indexed in reputed citation databases like Scopus or Web of Science and analyzed the whole literature (11) or just KM journals (9). Most (17) of these studies were published in journals (specifically, 8 in KM and 9 in non-KM journals). Bibliometric studies are quite popular now because, due to the rapidly increasing number of papers published on KM, it is sometimes difficult to do detailed qualitative analyses and, in any case, it is even difficult to keep the pace of the rapid changes in this literature (Farooq, 2021).

Two main points clearly emerge. The first is that the number of papers referring to KM has been increasing significantly since the early years. The second point refers to the interdisciplinarity of the field, which all reviews and bibliometric studies substantially confirm.

The first bibliometric analysis was published in 2002 by Ponzi, who studied the intellectual nature and interdisciplinary of KM by considering 158 papers published between 1994 and 1998. He detected four dimensions that constitute the "intellectual structure" of the KM field: knowledge management, organizational learning, knowledge-based theories, and role of tacit knowledge in organizations. He concluded that the interdisciplinarity of KM mainly referred to other management fields, while computer science was less important. However, in a later bibliometric analysis, Gu (2004) still confirmed the interdisciplinary nature of KM but, in contrast to Ponzi's analysis, found that KM was overwhelmingly associated with computer science. More recently, Tsai and Yang (2010) considered 1939 documents published between 1989 and 2009 and identified different subject areas: management; information science and library science; computer science, information science; operation research; and business. An interesting result of this analysis is that around 90% of the retrieved authors published only one article on KM, suggesting that they were just "occasionally" interested in KM. This result was confirmed by Farooq (2021).

Akhavan et al. (2016) found a much larger number of papers (3198) published between 1980 and 2014, probably because they also used different variants of keywords around the term "knowledge"; this may signal that articles in KM do not necessarily use "knowledge management" as a keyword, even though their topic is exactly that. They also found, since 2008, a predominance of business and economics as the main subject areas of the papers, while in the earlier years, it was computer science. This potentially indicates the progressive establishment of KM research as a standalone stream within the business domain.

However, although one or the other prevails over time, computer science and business, economics, and management remain the main reference subject areas of KM publications (Centobelli et al., 2022). Gaviria-Marin et al. (2019) considered a very large time period (between 1961 and 2015) and retrieved 42,795 documents, 37.66% in the computer science area and 30.76% in the business and economics area. By restricting the analysis of the articles in the business and management area, they found that three journals were the most productive, i.e., *Journal of Knowledge Management*, *International Journal of Technology Management*, and *Knowledge Management Research and Practice*, but the first and third emerged only in the final quinquennium. Keyword analysis revealed a great diversity of referenced concepts: knowledge transfer, knowledge sharing, innovation, and organizational learning were the most used. This means that, progressively, research has started to become less generic and more specialized.

A group of studies included only the paper published by KM journals. Particular attention has been paid to the *Journal of Knowledge Management* (JKM), a recognized reference (Serenko & Bontis, 2013). Gaviria-Marin et al. (2018) analyzed 1068 publications on JKM. They noticed that the most recurring keywords ("knowledge management" excluded) have changed over the past two decades, from more generic keywords (e.g., innovation, intellectual capital, information) to more specific ones (e.g., knowledge sharing, knowledge transfer, knowledge creation, tacit knowledge). They also found that the articles included in JKM mainly cited works of the business and management subject area; conversely, the "external" articles citing articles in JKM were mostly KM-related journals. Chaudhuri et al. (2020) replicated the same analysis over an extended period and confirmed these results. In addition, they identified 12 very different groups of recurring research topics, confirming the vitality and diversity of KM research, but also its high fragmentation. Farooq (2022) also analyzed JKM and discovered that the number of keywords has continued to increase in the examined period (2005–2012) and almost doubled from 2005 to 2012. The same happened to the author appearance, in relation to the number of papers. Interestingly, a thematic map developed by the author shows that some themes emerged, then disappeared, and then reemerged.

The *Journal of Information and Knowledge Management* (JIKM) has different characteristics from the JKM. Alajmi and Alhaji (2018) and Nasrallah et al. (2022) found that the JIKM has other contributing authors and countries of their origin. An analysis of keywords revealed that this journal has a prevalence of articles on KM technology and information management. Consequently, the "external" citations come mainly from computer science journals. Finally, the JIKM has few highly productive authors, and the frequency distribution of the authors' productivity does not conform to Lotka's law (1926) that states that, in an established scientific discipline, most contributions come from a small number of authors.

Islam and Widen (2021) analyzed the *VINE Journal of Information and Knowledge Management Systems* (VJKMS), a journal with a long tradition established in 1971. This journal is more oriented to the technological side of KM: knowledge-based systems and information management are two of the most used keywords, while others (e.g., innovation) are absent. Schiuma et al. (2020) examined *Knowledge Management Research and Practice* (KMR&P), showing that the Journal is broad in scope and publishes articles with a strong multidisciplinary approach, although there is also a clear orientation to business management. Like the JKM, the typical themes have changed during the years, and the current focus is on marketing, communities of practice, supply chain management, absorptive capacity, business strategy, and relational capital. The *Electronic Journal of Knowledge Management* (EJKM) was analyzed by Sahoo et al. (2017) who discovered that this journal better fits Lotka's law (1926), with fewer authors; however, these are still the large majority.

5.2.2 Context-Oriented Papers

These studies focus on the KM literature that addresses specific contexts of application. Some focus on specific industries (e.g., health, construction, engineering, tourism, etc.) and others on specific companies (for instance, SMEs rather than big enterprises), or nations. We will limit our analysis to the three most investigated application contexts.

Health Sector

The importance of an effective management of knowledge in health sector, even before the emergence of the field of KM, has been underlined in many literature and bibliometric analyses. There is, however, a fragmented picture, due to the very different approach and focus these studies adopt. The Revere et al. (2007) analysis included 31 articles published from 1991 to 2005, and given the period, it is not surprising that these were published only in journals of medicine and health. In addition, the articles make use of heterogeneous data and methods and mostly focus on information rather than knowledge management. Other reviews (Wills et al., 2010; Rocha et al., 2012) found a large majority of the research conducted on the possible use of IT to support clinical activities. Pflugfelder (2020) addresses a more specific topic (KM in ambulatory care) but also found that papers were mostly published in healthcare journals and authors generally published only one article on the topic. Rosário et al. (2020) also selected articles from 2009 to 2019, mostly published in non-KM journals (but, surprisingly, neither in healthcare management journals) and generally received no citations. The analysis identified four key research lines, very specific to the health sector, but in general, this review confirms that the literature on KM in healthcare is diverse and fragmented. Hujala and Laihonen (2021) also found at least six different research lines on the effects of KM on health management and social care and found a large part of papers in non-KM journals. Similarly, in a recent study by Kosklin et al. (2022) on KM in the healthcare management in which they considered only 16 documents between 2008 and

2018, they still found that all the articles were not published in KM journals; they also confirmed the absence of a structured and consistent body of research.

Higher Education

Ismail and Abdullah (2016) analyzed 71 articles and identified 39 best practices referring to different dimensions, both "soft" and "hard" (from organizational culture to technology, psychology to knowledge audit, etc.). They underlined the lack of integration of the two aspects into a single model and concluded that the use of KM in higher education is still immature. Secundo et al. (2019) focused on "entrepreneurial universities," and they also concluded that KM is an increasingly important research area in that field, but fragmented and dominated by unrelated research. Many different perspectives are adopted and on quite specific dimensions. A large majority of the papers they found were published in non-KM journals.

Quarchioni et al. (2022) focused on KM journals and confirmed that the research on KM in higher education is fragmented and loosely focused due to the overlap of KM with several other disciplines, the heterogeneity of theoretical perspectives on knowledge, and the highly differentiated contexts of higher education. Especially, only 27% of the sampled articles used explicit and well-defined theoretical frameworks to interpret results and typically focus on a specific topic without relying on agreed conceptualizations.

Knowledge Management in SMEs

The first reviews about KM in SMEs date to the work of Durst and Edvardsson (2012), who focused on 36 empirical papers, mostly published by high-ranked KM Journals. All articles were well connected with the KM discipline, but the authors concluded that they provided only fragmented insights into the topic. Similarly, Massaro et al. (2016) analyzed 89 papers in KM journals and also found a fragmented literature on KM in SMEs, and mostly unrelated research, with some confusion about the notion itself of SMEs where KM is applied, which made comparison hard. In particular, the authors concluded that the articles do not address the managerial implications of their study, which may make KM research on SMEs irrelevant.

Cerchione et al. (2016) confirm the growing trend of publications on the topic and also the variety of approaches, methodologies, and models, often integrated from different research areas of management, with a substantial multidisciplinary approach. Durst et al. (2022) considered 180 articles from 2012 to 2022 in 75 different business or management journals, about half of them in leading KM journals. They found many different (19) theoretical approaches, especially the knowledge-based view (18), the dynamic capability theory (14), the resource-based view (11), and the absorptive capacity theory (10), while the SECI model was employed only in two cases. In another recent review, Saratchandra and Shrestha (2022) found similar results, although they addressed a particular topic, i.e., the role of cloud computing in SME KM. The authors found 157 articles from 2010 to 2021 published mostly in non-KM journals and noticed that these papers are based on many (more precisely, 42) different theoretical approaches: only the SECI model (Nonaka & Takeuchi, 1995) was rather diffused, while most of the others were used only once.

5.2.3 Influencing Factors

Nine reviews analyze the literature that focuses on one or more factors that affect the success of KM, excluding technological ones (examined in the next section), in particular: intellectual property (IP) for knowledge protection (Ali & Tang, 2022), organizational performance (Mufti & Sari, 2021), organizational climate (Choudhury & Das, 2021), use of social networks (Chedid & Teixeira, 2021), spirituality (Rocha & Pinheiro, 2019), sociotechnical factors (Ochmann et al., 2019), and artifacts (Mariano & Awazu, 2016).

Specifically, Mariano and Awazu (2016) analyzed 101 articles in Serenko and Bontis' (2013) list of KM journals from 1997 to 2015 and evaluated the role of artifacts in the KM field to identify directions for future research. It resulted that KM systems, knowledge sharing, and digital archives were the major research themes connected to artifacts, along with other related concepts such as learning, knowledge transfer, and knowledge creation. It also showed that empirical work is twofold compared to conceptual contributions and most papers are based on an organizational level of analysis. According to this study, the reviewed articles lacked cumulativeness and consistency with the current KM debate.

Choudhury and Das (2021) reviewed articles that focused on the influence of organizational climate on KM, especially through the effective flow of tacit knowledge. The various factors of organizational climate that influence both tacit knowledge sharing and knowledge management are assessed by considering the studies published from 1968 to 2020. These factors come from various sources in the literature and are teamwork, trust, leadership, organizational structure, reward system, employee interactions, and motivation. The review also provided evidence of a positive relationship between tacit knowledge sharing and organizational climate. However, many selected papers were published in non-KM journals. Recently, Ali and Tang (2022) examined intellectual property as an aid to knowledge protection in their review article. They also argue that the IP problem is not adequately framed in the examined KM literature, although it must be noticed that the sampled articles are almost entirely published in non-KM journals, which may signal the lack of basic comprehension of KM. Generally speaking, confusion among the different forms of protection, the knowledge content of IP, and the difference between patents and IP in general emerges in this analysis.

5.2.4 Technology-Related Factors

Fourteen reviews of the literature and four bibliometric studies examine the articles focusing on one or more KM technologies (or KMS). Liao (2003) conducted a literature review of 234 articles (from 1995 to 2002) to discover how KM technologies and applications have developed in the specified period. Based on his analysis, KM technologies are classified into seven categories, i.e., KM framework, knowledge-based systems, data mining, information and communication technology, artificial intelligence/expert systems, database technology, and modeling. The article also discussed the contribution of various applications to KM, although it should be noted that this sector has changed rapidly since the time of this review. In any case, an interesting contribution is that the study highlights how the articles on KM technologies and applications may depend on their authors' backgrounds, expertise, and problem domains. Finally, the author suggests that technologies are "not everything" in KM and that approaches from social sciences approaches are also important.

Jackson et al. (2020) reviewed the managerial factors that influence the success of KM systems. They collected 54 articles from 2014 to 2018 that appeared in KM journals and identified some main categories of factors, namely, formal processes, company culture, top-down support, motivation, clear goals, and quality of KMS. In the paper, KMS are considered as part of an information system, and while the two notions are not the same, they are supportive and used by some authors interchangeably. The study also states that there is a general lack of consensus on how KMSs adapt to the new "knowledge explosion" embraced by the booming hype of "Big Data."

Di Vaio et al. (2021) conducted a systematic literature review and bibliometric analysis of 46 articles focusing on KMS, digital transformation, and the impact on transformation processes published in the last three decades (1990–2020). They examined the articles with the "abstract top 20 words" and observed that, surprisingly, the word "innovation" has the highest occurrence index followed by "management," and only after these we find "data" or "digital." Although the paper studied the links between digital innovation and KM, in the background there are many other concepts, i.e., open innovation, sustainability, business performance, and business model. In addition, some technologies (like Big Data analysis) are included in the KMS category, but there is no explanation for that. Only 35% of the articles are published in KM journals (the review itself was not published in a KM journal). This may explain why there are some misunderstandings about the basic notions of KM.

The only bibliometric analysis is that by Noor et al. (2020), which focused on social media as a platform for KM. They identified 234 articles in the period 2009–2019. The annual growth rate was initially low but has increased rapidly since 2013. All the retrieved papers were in the subject categories "computer science" and "management." JKM was identified as the most influential journal. Furthermore, based on the co-occurrence analysis of keywords, four prominent themes emerged, indicating an explicit contribution of social media users to KM through Big Data, knowledge sharing and innovation, enterprise 2.0, and social capital. The thematic analysis done in the study confirmed that social networks are no longer just a platform for socialization but are being recognized as a source of user-generated data (big data) for KM in digital ecosystems.

5.2.5 Specific Management Focus

A total of 38 reviews and 6 bibliometric studies focused on the connection between KM and some specific areas of management or business goals. Again, the situation is quite fragmented. In fact, the literature that mentions KM as a possible ingredient for business success is huge, and this explains why some scholars decided to focus their attention on specific management areas. The connection between KM and "innovation management" is quite popular in the examined reviews: Purwanto et al.

(2021) investigated KM for innovation capability; Nappi and Kelly (2021) and Kurniawati et al. (2019) focused on the relationship between KM, innovation, and performance indicators; Batista et al. (2017) on KM for innovation in large companies; and Costa and Monteiro (2016) on KM processes for innovation.

Another frequently addressed area is that of supply chain management, which was a topic of great interest especially some years ago (Martin et al., 2006). Again, each review adopts different perspectives. For instance, Outahar et al. (2013) considered the studies of KM processes in the supply chain, while Pérez-Salazar et al. (2019) especially focused on knowledge transfer, and Marra et al. (2012) examined how KM is applied in SCs from two different perspectives (i.e., a human-based KM or a tech-based KM).

Some recent reviews have focused on KM for (agile) software development (De Aguiar Beninca et al., 2015; Wnuk & Garrepalli, 2018; Al Hafidz & Sensuse, 2019; Indumini & Vasanthapriyan, 2018; Mejía et al., 2019; Ouriques et al., 2019), others on KM for Human Resource Management (Chalikias et al., 2014; Ferreira et al., 2022) and accounting (Shakeeb et al., 2020), or on the importance of KM for project management (Favoretto & de Carvalho, 2021). In some cases, the examined topic is very specific (for instance, KM and public-private partnership (Cifolelli et al., 2021) or disaster preparedness (Kusumastuti et al., 2021)); in others, it appears very contingent and appropriate for a specific temporal context (such as in the case of Industry 4.0 (Sartori et al., 2022) or the issue of sustainability (Szczekala & Stadnicka, 2022)).

6 Discussion and Conclusion

Our meta-review confirms that KM still attracts the interest of scholars and, in general, is not a temporary fad. It is also very pervasive because we find a lot of publications on KM in various journals and subject areas. A relevant part of the KM literature is published in many different non-KM journals or conferences, although it is not infrequent that a journal publishes just one paper on KM. Similarly, there is a substantial despecialization of authors: the large majority of them only occasionally were really interested in this field, because they published only one paper. Although there are an increasing number of reputed KM journals and conferences, most of the studies, especially those having a specific management focus, are published in non-KM sources.

There is also an extension of the treated topics. There is an increase in the number of keywords used by authors, especially related to KM processes on the one hand and to management keywords on the other. This is also happening in KM specialized journals. For instance, the JKM, still a reference point for KM scholars, now clearly embraces a multidisciplinary approach, with a high fragmentation of the topics and subject areas covered, with a substantial increase in the number of keywords and author appearances (in relation to the number of papers). Quite surprisingly, one-third of JKM articles do not have the term “knowledge management” in their title, keywords, or abstract. As for the other KM specialized journals, the situation is quite variegated. Some tend to focus on specific topics (for instance, there are journals more oriented to technology for KM, others to management) or geographical areas of author origin. Anyway, it is still the case that a vast majority of the authors have published only one paper.

Computer science, which was and is still important, is no longer the prevailing subject area of publication. The technological aspects of KM seem to be a sort of separate field, with many papers published in journals of the computer science area. However, these studies seem to suffer from a sort of "original sin": their analysis often tends to assimilate knowledge management with information management and leads to a limited vision of knowledge management systems, which are considered just simply a part of company information systems.

As for papers dealing with managerial aspects, scholars tend to focus on specific issues, which are addressed by adopting KM concepts and notions that are considered relevant and appropriate for their specific analysis, but without an overall vision of KM. In addition, they often present unresolved confusion between different concepts and overlap notions or models that, instead, are generally clearly distinguished by specialized KM scholars.

Some literature streams are becoming a sort of separate field, where only some parts of KM models or concepts are adopted, for specific purposes and sometimes with idiosyncratic results. For instance, KM in the health sector is researched mostly by healthcare experts, and studies are almost completely hosted by non-KM journals; a particular attention is given to IT tools for specific information needs of healthcare practitioners. Similarly, papers on KM in higher education are highly fragmented, typically focus on specific topics or problems, make little use of KM theoretical frameworks, and again are mostly published in non-KM journals. Very fragmented, although more connected with specific KM topics and theories, is the literature on KM in SMEs, which also has a strong business orientation. Studies focusing on KM enabling or influencing factors also show a lack of common notions or references.

The analysis of articles that focus on a specific management aspect confirms that KM, as a general "umbrella topic," is still very popular, with hundreds of collected citations. In addition, most of the studies examined in these reviews are published in non-KM journals and conference proceedings, and, in fact, the reviews themselves generally appeared in non-KM sources. This means that at least, the general "idea" of KM has gone well beyond the community of specialized KM researchers, but, on the other hand, the concepts and notions typical of the KM literature are rarely used in a comprehensive and consistent way. Generally, the authors of the various articles "pick up" only what they consider relevant and appropriate for their specific and, sometimes, narrowly focused analysis. Sometimes, there is also some unresolved confusion between different concepts (for instance, the classifications of KM processes used in papers are sometimes inconsistent) and even fields that are, instead, generally considered different in the KM literature (for some papers, KM and intellectual capital substantially overlap).

In summary, the results of our analysis seem to confirm that KM is a really a pervasive subject of study. Its models, definitions, concepts, and key questions have penetrated many other scientific areas and applications and are considered or adopted by hundreds of studies by researchers working in many different fields, published in KM and non-KM journals and conferences. Undoubtedly, this multidisciplinary characteristic is part of its nature (the issue of managing knowledge crosses all human activities). On the one hand, it is an added value that makes KM studies interesting and stimulating. On the other hand, it cannot be neglected that this raises some questions. First, for too many scholars, KM is perceived as an area where they can simply "pick up" what they can use and apply to their specific purposes of analysis. This means that in most cases, there is a sort of "de-responsibilization": many authors of papers that apparently focus on KM do not feel it necessary to adopt proper definitions and approaches to KM, to consider and cite existing specialized literature, and to contribute to the advancements of the KM field.

We may say that the huge number of publications referring to KM has contributed to spreading this term which is now known and used by a lot of researchers. However, this does not lead to a recognition of KM as a scientific discipline or, at least, an established field of study. Instead, the risk that KM dilutes and becomes just a "buzzword" is concrete and is not counterbalanced by the efforts of the community of specialized KM researchers. On the contrary, these may even contribute to watering down this discipline when they feel the need to avoid the rigid boundaries that are typical of a recognized scientific discipline.

Therefore, what suggestions can be made to the KM scientific community to help contrast this risk? This is difficult to say. It may be proposed that all scholars that feel part of this KM research community start a reflection on its future and, at the same time, set the grounds for a formal scientific recognition. A new wave of discussions and sharing may begin. All the work done in the last decades, i.e., specialized journals, conferences, book series, scientific associations, research projects, etc., should be publicly promoted. New authored or collective books declaring "the grounds" of the discipline (just like the one we are contributing too), summarizing its pillars, and prospecting its future should be welcomed. The boundaries of the discipline, its current limits, points of strength, and weakness should be made explicit. Maybe all this will reduce the risk that soon or later all of us will need to change our favorite topic of study.

A final comment is necessary. The conclusions reported here are based on a study of the literature that is not without limitations. As mentioned in the beginning, a systematic review or a bibliometric analysis of all the literature on KM was obviously unfeasible, given the thousands of published articles and, above all, the particular aim of our analysis. This is why we adopted a meta-analysis approach: to analyze (and read) a manageable number of articles; we restricted our search, which is a limitation of the study and should be considered by readers. On the other hand, the goal was to stimulate a debate more than to provide a definitive answer to a complex question.

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Key Milestones in the Evolution of Knowledge Management: What Is Next?

Kimiz Dalkir

Abstract

The history of knowledge management (KM) is often categorized into three early eras: the first era focused on tools and technologies to ensure valuable knowledge was shared and preserved. The second era emphasized knowledgeable people and how to better connect them. The third era brought the focus to bear on content and the findability of valuable knowledge. What came next? World events such as 9/11 and the COVID-19 pandemic intensified awareness of and need for effective KM. The introduction of the knowledge management standard, ISO 30401, in 2018 is a more recent key milestone. What is next? More holistic and more inclusive KM is one important direction for the field. KM scalability beyond individuals, groups, and organizations spreading to interorganizational and societal KM is another important direction for the evolution of KM. Finally, more research needed to better integrate artificial intelligence (AI), support remote work, cope with increasing information overload, formulate key KM competencies and training approaches, as well as leverage KM to enhance innovation (in addition to improving efficiency). This essay discusses and integrates a number of perspectives and key studies from the KM community but presents a predominately personal view and position on the future evolution of KM.

Keywords

History of KM · Evolution of KM · KM Trends · Future of KM · Holistic KM · Scalable KM · Inclusive KM

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1 Introduction

This chapter is an essay that summarizes selected key milestones in knowledge management to date together with a description of remaining critical challenges. This review draws upon published works that have addressed the history and the future of KM together with the author's own observations as someone who has been in the field for over 25 years, as a KM practitioner, KM educator, and KM researcher. The state of "health" of KM is diagnosed and key trends are identified. The chapter concludes with a discussion of major research priorities to be addressed in the near future in order to ensure that KM is a sustainable endeavor, one that can improve organizational learning from the past, improve current operational efficiencies, and also catalyze increased innovation and creativity in organizations.

1.1 A Brief History of KM

Knowledge management has been around for a very long time although the term itself arrived in the late 1980s. The actual activities of sharing and preserving knowledge have of course been around for many centuries, but the deliberate and systematic management of knowledge assets dates back about 30 years. KM was first recognized (and criticized) as a professional practice and then migrated into academia to become a discipline. The term "knowledge worker" was first proposed by Peter Drucker in 1959 to refer to "high-level workers who apply theoretical and analytical knowledge, acquired through formal training, to develop products and services" (Drucker, 1959, p. 93). This definition highlights the fact that although we have been managing knowledge for many centuries by identifying, sharing, and preserving valuable knowledge, KM refers to a more formal and deliberate approach to leveraging knowledge assets.

The need for KM was historically more of a push than a pull, with many practitioners justifying the resources needed in order to attain the benefits of KM. However, there were also catalysts that mobilized KM responses. For instance, an organization undertook reactive KM approaches when a valuable knowledge worker announced they were leaving. Knowledge continuity management (KCM) should be a proactive planning approach, but it was often a reactive response. The events of 9/11 similarly brought KM into a reactive focus when it became very clear that government agencies had not been able to connect the dots. Vital information concerning the terrorist attacks had been identified, but they remained in organizational silos and were not shared and therefore were not acted upon. More recently, the COVID-19 pandemic made it very obvious that knowledge continuity and KM were very much needed when knowledge workers worked remotely.

In the 1990s, organizations began to realize that knowledge was an important asset. There was increasing focus on better managing knowledge for organizational success in the 1990s, especially following the publication of Nonaka and Takeuchi's book, *The Knowledge Creating Company: How Japanese Companies Create the Dynamics of Innovation* (1995):

> "Historically, KM has been thought of primarily in terms of the knowledge base itself: today, by contrast, the emphasis is now more on the provision of knowledge rather than its accumulation. Traditionally therefore the goal was to get hold of an organisation's knowledge and centralise it in a single repository. Now the interest has switched to solutions such as indexing services and enabling access to information, wherever it is sited[1]"

Handzic (2017) traced the origins of KM to major organizational theories, namely, the resource-based view of the firm and the knowledge-based view of the firm. The former focused on internal organizational resources for success, while the latter recognized knowledge assets as the most valuable organizational assets. These theories in turn led to the concept of organizational learning in order for organizations to thrive and survive. Finally, Nakash and Bouhnik (2021) conclude that:

> "The goal 20 years ago was to find knowledge. Today, the challenge is to accurately find the right knowledge." (p. 35)

In parallel with these high-level evolutionary eras, some key milestones in the KM development timeline include the events of 9/11 when it became very clear that while valuable knowledge was available, it was scattered across different organizational siloes and we just could not connect the dots in time. As a result, KM became an urgent concern and we saw the formation of a knowledge network of intelligence workers connecting and collaborating more, using, for example, Intellipedia (Dalkir, 2017). Another key milestone was the ISO 30401 KM standard (ISO, 2019), which served to "legitimize" KM and also increased the level of awareness of KM processes in organizations. Finally, a third disruption began with the COVID-19 global pandemic starting in 2020 and still ongoing at the time of writing. KM is once again very well placed to add value to the digital workplace and remote working during the COVID-19 pandemic.

1.2 Where Does KM Stand Today?

As discussed in the previous section, while KM has not been around for very long, it has undergone significant and really, constant change. At first, many in the field found themselves "selling" KM and having to explain what it was and why it provided added value. People who ended up working in KM roles rarely had formal credentials and few were dedicated KM professionals. The academic KM discipline has now become part of curriculum of many higher education institutions, and as a result, we see KM professionals with formal degrees. The author has been asked to provide an updated edition of her KM text every 5 years since the first edition was published in 2005. The revisions and updates for each edition were based on feedback from the international KM community which continues to be highly engaged. The fourth edition will be published in May 2023 which attests to a

[1] https://www.contactcenterworld.com/view/contact-center-article/the-evolution-of-knowledge-management.aspx

sustained demand as well as rapid changes in the field which necessitates frequent updates. The KM profession can also be found in all industry sectors around the world. Larger organizations are more likely to have a formal KM team and dedicated KM staff, while smaller ones may have KM roles as part of the job description of their staff.

Nakash and Bouhnik (2021) interviewed key KM experts and found that KM is alive and well and that there has been "significant growth and impressive evolutionary development since it was founded" (p. 29). They note there have been claims in the past (really since the early days of KM) that KM is declining or that it is even "dead." The authors also point out that KM literature has been, for the most part, highly positive with few critical assessments and little reporting of failures. Ahmed (2017) reviewed the KM literature from 2003 to 2016, and he found that the emphasis in the published literature shifted from IT-centric papers to more human-centric KM works. In parallel, an emphasis on decision-making and learning evolved into a focus on KM strategy and improving business processes. In addition, there was increasing emphasis on tacit knowledge over time, whereas the focus was on explicit knowledge in earlier publications. Finally, his study showed that the primary KM discipline was computer science, but this was replaced by other disciplines such as management over the time period studied.

So where does KM stand today? It appears that KM is neither dead nor dying. This can be seen by the increasing number of publications, both in the academic scholarly press and practitioner publications. Nakash and Bouhnik (2021) note that this increase is exponential in nature. Similarly, there has been an increasing number of KM conferences around the world, KM graduates, and KM courses. Another example is the study by Koç et al. (2019), who looked at the *Journal of Knowledge Management* over 10 years to identify major themes. They found that at first much was written about KM as a management fad, but this was then replaced by publications that situated KM as more of scientific discipline than a management fad. While a large number of publications consist of single case studies, this does demonstrate a focus and strong interest in KM applications to real-world problems.

The overall level of skepticism about whether or not KM is a legitimate field of scholarly study as well as a legitimate area of professional practice appears to have waned over time. For instance, Wilson's (2002) "The nonsense of KM" challenged the legitimacy of KM and whether it was any different than information management (IM). While there have not been any similar direct existential challenges to KM, there were pronouncements that KM was dead or dying (e.g., Davenport, 2015). One response is provided by Nakash and Bouhnik (2021), who investigated perceptions of KM experts concerning publications about the demise of KM. Their research study asked 15 international KM experts to weigh in on whether they felt KM was a bygone item and how the expression of such sentiments affected them. The authors found a strong unified voice that KM was alive and well and that it will continue to thrive. The authors did point out the lack of critical KM publications and stated their concern that painting an overly positive image of KM may prove problematical over time.

In addition to excessive optimism, other KM challenges still remain, even if most do not believe that KM is fatally injured. Organizations still tend to be reactive rather than proactive in terms of their KM operational processes and strategies. This may change as the pandemic is still ongoing and it looks like some form of hybrid work model will persist in most organizations. There was and continues to be a great deal of knowledge lost, in particular tacit knowledge, due to people resigning or retiring. This continues to happen at a fairly high rate as knowledge workers reconsider how they want to spend their time and what work/life balance is acceptable. Job mobility was already fairly high especially with younger workers and now there appears to be a strong preference for jobs where they can work remotely. What does this imply for KM? Knowledge sharing, preservation, and continuity will be among the top ongoing challenges for most organizations (e.g., Burley, 2020).

Prior to the pandemic, other major KM trends were identified, and several will be highlighted here. In 2015, Peter Heisig conducted a global study to identify future research needs in KM. There were 222 KM experts from 38 countries; 16 industries, government, international organizations, and NGOs; and 16 different academic disciplines. One finding was that the scope of KM was not restricted to a given organization but that its reach extended beyond to connect with other organizations but also with the KM societal ecosystem. This ecosystem includes the public and private sector as well as individual knowledge workers. This supports the notion of *scalable KM* that can be done at multiple levels, such as personal KM (individual), knowledge networks (groups), organizational, knowledge cities or regions, and societal. In 2021, Nakash and Bouhnik found that KM experts expect KM to be even more relevant given that organizations are increasingly global in scope, which supports the notion of a more *holistic KM*. The ability to communicate, collaborate, and share tacit knowledge remotely and/or asynchronously is a growing challenge. This challenge is no longer limited to intraorganizational KM but extends out to interorganizational KM (Dalkir, 2017).

A second crucial challenge remains in how we define KM. We still lack consensus on such key components such as the definition of the term KM itself, the set of core KM professional competencies, and where the academic and organizational home of KM should be. Nakash and Bouhnik (2021) note that there is a disconnect between academia and the field which likely results in theory not being applied to KM practice. These ambiguities result in difficulties that continue today. Expectations of KM, and the management of these expectations, likely had a great deal to do with the current state of KM we are faced with. KM appeared first as a new business practice and then entered the higher education landscape. Both environments have clear expectations. KM did not easily fit into existing organizational structures and can still be found in the IT or HR department, in specific business units, as well as in more strategic areas. Similarly, in universities, KM can be found in the department of management, computer science, information studies, and communication among others.

Perhaps we need to shift our perspective—and our expectations—when it comes to what is next for KM. Instead of emphasizing what makes KM unique and different, e.g., a focus on experiential tacit knowledge and how to share and preserve it, it might more sense to highlight similarities with other disciplines and organizational processes. One example is change management. It is difficult to envision successful KM implementations that do not initiate organizational changes. A more useful perspective of KM, to complement the notion of scalable KM, could be more *inclusive KM*. Instead of clearly distinguishing between mutually exclusive categories such as knowledge, information, data, records, archives (and perhaps wisdom?), KM can pave the way to intelligently manage all these resources. Instead of KM vs IM, the field of KM can encompass a spectrum of managing information and knowledge. There are of course pros and cons to such an approach, but KM cannot float above all other organizational components without any connection nor without a solid foundation to rest on. Successful KM almost always needs to enlist a wide range of people, technologies, organizations, and processes. An inclusive perspective—and expectation—of KM could help us enter the next KM era.

Another key element when reviewing the major milestones in KM is to trace the evolution of understanding the very concept of knowledge, namely, from viewing knowledge as an object, to viewing knowledge as a fluid flow, to the thermodynamic conceptualization of knowledge (Bratianu & Bejinaru, 2019, 2020). While there have been extensive theories of knowledge stemming from the fields of philosophy and epistemology, as well new economic conceptualizations of knowledge in management theories, the authors propose the metaphor of thermodynamics for a theory of knowledge that is more compatible with KM.

The use of metaphors has been proposed by authors such as Andriessen (2008) as knowledge is by its very nature a highly abstract concept. Bratianu and Bejinaru (2019) note that the type of metaphor used for knowledge has also undergone significant evolution. One of the first metaphors was knowledge as a financial object such as stocks, bonds, or assets of some kind. Next, knowledge sharing made use of the metaphor of knowledge as a fluid that flowed through the organization. Szulanski (2000), for example, spoke of "sticky knowledge" that stayed anchored in one place, or within one person, and was difficult to dislodge and thus to share.

Bratianu and Bejinaru (2019, 2020) discuss a new metaphor, knowledge as an energy field. The energy metaphor is a powerful one that views knowledge as a field, knowledge as energy transformations and as energy flows throughout an organization. This perspective leads to systems thinking applied to KM and allows for such components as entropy management, knowledge dynamics modeling at individual, group, and organizational levels (Bratianu & Bejinaru, 2019) as well as complexity management. The view of knowledge as energy with a nonvisible energy field is much better placed to deal with the key attributes of knowledge and therefore KM: knowledge is intangible, knowledge flow is nonlinear, knowledge is a diffused element that can exist in different forms within an organization, and knowledge is dynamic. Knowledge is complex, multifaceted, and multidisciplinary and is constantly changing and transforming from one form into another. A metaphor anchored in the domain of physics that calls upon the metaphor and potentially the laws of thermodynamics stands a better chance of conceptualizing knowledge and KM than more earlier, more simplistic metaphors.

Selected KM trends are discussed in the next chapter to show what the next generation of scalable, holistic, and inclusive KM might look like.

2 Selected Key KM Trends

Although by no means an exhaustive review, a few key trends were selected for discussion here. They include more intelligent tools (e.g., AI, big data, analytics), information overload (e.g., improved searching and finding), KM academic education and professional training, and KM for innovation and creativity objectives (in addition to the KM objective of efficiency through reuse). Each is addressed below.

2.1 Artificial Intelligence (AI), Big Data, and Analytics

A number of authors note that the top three topics for the future of KM are:

> "evolving KMS capabilities and features, big data, and adoption of new technologies." (Koç et al., 2019, p. 893)

> "The evolution of knowledge management refers to the ongoing improvement of how organizational knowledge is collected, utilized, and deployed. Moving into the 21st century, it's clear that the next stages of evolution will revolve around artificial intelligence (AI) and machine learning (ML)." (Hopkins, 2020)

> "We find that the future of KM lies in developing automated mechanisms for knowledge flow that rely on machine learning tools, artificial intelligence, and advanced cognitive abilities." (Nakash & Bouhnik, 2021, p. 29)

The KM toolkit includes more intelligent tools that will enable users to analyze a much larger volume of content. For instance, many knowledge organization efforts are hampered by prodigious amounts of legacy content that has been accumulated over time. More intelligent tools such as automated taxonomy software can help make sense of this legacy data. KM is an excellent candidate for Big Data and data mining approaches (Dalkir, 2021a). Another example is that of chatbots that can provide users with an experience mimicking that of interacting with another human rather than a technology (Clark, 2020). ChatGPT[2] demonstrates a quantum leap in the quality of human-computer conversational interactions, and while it can be used for less ethical purposes such as doing your homework for you, such interactive conversational interfaces hold great promise for next-generation KM systems. It makes sense to think of KM tools as an evolving toolkit that can add and/or replace tools as new, improved ones become available. There is no actual dedicated KM tool. Scalable, holistic, and inclusive KM can include a range of tools that are

[2] https://openai.com/blog/chatgpt/

applicable at all levels (from personal to global) and that include tools developed in other disciplines for different purposes. KM needs to be vigilant in monitoring innovations in new technologies and integrate them into the KM toolkit where appropriate.

2.2 Information Overload

In addition to using intelligent technologies to sift through vast amounts of content, as discussed in the previous section, there is also a need to increase the search and findability of diverse types of content. Knowledge workers need to be able to find what they are looking for more quickly and more easily. Garfield (2018) emphasizes that a major role for the KM group will remain the "filtering out the noise and delivering just what is most needed." Behme and Becker (2021) also add that intelligent interfaces and information filters should deliver value to individuals, teams, and the organization as a whole. They also need to find expertise (i.e., knowledgeable people). Content should not be exclusively document or text-centric but also include multimedia content such as images, videos, interactive maps, and so on (e.g., Fallman, 2020). Finally, users should be able to use their preferred language in searching and be able to search for multilingual content (Dalkir, 2017). Inclusive KM is one that considers and accommodates different preferences of users in order to optimize knowledge access, sharing, and application.

One of the best ways to deal with information/knowledge/content overload is through unified search. Also referred to as federated searching, this refers to knowledge workers being able to use a single interface to search without having to worry about which server the content is located on. Unified search means users can through all knowledge bases, repositories, FAQs, and discussion forums as long as the information architecture was designed and implemented in a very comprehensive manner. To further add value, intelligent or AI-based searching, such as the chatbots discussed in the previous section, allow users to use natural language to ask for the content they need.

The future will also likely hold an ever-increasing information overload. Organizations cannot be efficient or effective when they have so much content in so many different systems—and no way of preventing this content from proliferating. Knowledge workers are quickly becoming unable to locate specific items needed for their work, let alone analyze this content for patterns and insights. Knowledge has never been so far removed from actions and decisions—which is what KM is all about. Valuable knowledge is located in just too many places, and it is simply not possible to search and find it all. KM—and IM—will need that ideal environment where access is personalized, customized, and packaged so that users can make use of to get their jobs done. It is possible to continue to make tools smarter, so that they "know" who we are, what we are working on, and what we are trying to do—all, ideally, in real time. KM needs something like a GPS to help get us to the knowledge sites we need (and suggest others we might want to visit). Ideally, smart tools will aggregate and even mine the content we need and help us apply and share it with our peers. This would include aggregating tacit knowledge as well (e.g., by pointing to people).

2.3 KM Education and Training

In the academic sector, there are many KM programs and degrees. They tend to be in many different faculties and departments.

> "KM is usually integrated into existing academic curricula in advanced degree programs such as information science, library science and business management schools." (Nakash & Bouhnik, 2021, p. 30)

There are also many KM seminars, professional training classes, and certification organizations. While this is problematic, it may also present an opportunity for KM:

> "Most recently, scholars have started to call for convergence between KM and other disciplines in order to broaden research interests and opportunities in academia and enhance their value to practice." (Handzic, 2017, p. 14)

One analogy is that of information or digital literacy. It is possible to create specific courses and even degrees around this concept, but really, this is something that every student should learn. Most universities offer information literacy workshops to students, and some have made it mandatory. We all live in a digital world and need to acquire the necessary skills to navigate this world. Online misinformation has added yet another challenge, and literacy training has to include this as well so that we are equipped to identify and not share fake content. It can be argued that KM, again at all levels ranging from individual or personal KM (PKM), up through group, organizational, interorganizational and societal, or global KM, is a similarly universally required skill. And like literacy, a skill that should be acquired sooner rather than later. In Canada, for example, learning how to find (and properly cite) valid content on the Internet is taught as early as elementary school. The suggestion is not to replace KM educational programs but to complement them in a more inclusive perspective of KM and one that can venture "out of the box" of traditional academic courses.

KM also does not have an obvious organizational home. KM can be its own business unit or it can be found in HR, IT, or strategic business units. Similarly, KM professionals may be full-time dedicated KM workers or KM may be just part of their overall role and responsibilities. The introduction of the ISO 30401 KM standard has certainly increased the visibility (and also, in part, the urgency) of KM. In both academic and professional KM training, there has been increasing integration of some of the content from the ISO 30401 KM standard. For instance, Johannessen (2017) sees great potential in including some of the guidelines around KM governance and leadership in courses and professional training. Again, an alternate approach might be to envision KM as part of all business units.

An analogy here might be that of quality assurance or professional ethics. KM is not really only the purview of the KM team. It is not possible to succeed without the active participation of all knowledge workers. Therefore, KM awareness, at a minimum, should be part of onboarding or training program and KM should really have some presence throughout all organizational units while being coordinated by a core KM team. The KM team should in turn be inclusive and ideally have broad representation from across the organization. KM governance needs to be a balance between top-down guidance and bottom-up support and contribution (e.g., Dalkir, 2021b). For instance, Burley (2020) noted that more C-level decision-makers are getting involved in both developing and assessing KM strategies.

In some ways, KM has become a victim of its own success. There are many different flavors of KM and little agreement on a core set of KM competencies nor core elements of a KM curriculum. There is excellent work being done in this area such as KMSA[3] (the South Africa KM skills competency framework) as well as by KM4Dev[4] (Knowledge Management for Development). There are numerous KM professional and scholarly associations as well as events such as conferences. While this attests to a healthy level of interest and engagement, it also appears to be a form of "the cobbler's children going without shoes" or, that we are not practicing good KM. The challenge lies in not necessarily standardizing but perhaps better connecting the numerous organizations and informal groups to help evolve the KM discipline and practice into a more mature and cohesive stage.

2.4 KM for Innovation and Creativity

Finally, the emphasis in KM has been almost exclusively on improving efficiency through reuse. In parallel, there is a need to better understand the role KM can play in innovation. However, KM can also contribute to the innovation life cycle in a very significant manner. A number of authors (e.g., Pugh & Stewart, 2013; Lee & Chen, 2012; Heisig, 2015; Handzic, 2017) note that KM and innovation should really be much better connected. Schmitt (in Handzic (2017), "proposed advancing KM towards individualization and innovation" (p.14).

KM professionals tend to be very efficient at "silo-busting" as they move in and out of various organizational silos in order to carry out their jobs. KM methods are very effective in capturing stories and mental models in general but especially from talented creators. They are well versed in methods of tacit knowledge elicitation, sharing, and preservation and could therefore play significant roles in catalyzing and facilitating innovative and creative activities.

KM should be very closely integrated with not only change management but also innovation management. More inclusive KM is one that addresses both traditional KM objectives, namely, improved operational efficiency through reuse of valuable knowledge and increased innovation and creativity. The first objective maps onto

[3] https://www.kmsa.org.za/

[4] http://www.km4dev.org/

incremental innovation and single loop learning: improving existing processes. The second maps onto radical or disruptive innovation and second order learning, namely, should we continue with these processes or can we do things differently?

> "For innovation to happen, visionary ideas and creative leaps need to be turned into disruptive realities." (Handzic, 2017, p. 20)

3 What Is Next for KM?

KM will continue to evolve and grow in a number of ways. Three selected areas are further discussed here: how to make KM more holistic and inclusive; how to make KM more scalable so it can help during disruptions; and areas in which more KM research is needed.

3.1 More Holistic and Inclusive KM

Holistic knowledge management can be viewed from a number of different perspectives. KM is applied across business units within a given organization, across different professions, different organizational cultures (and microcultures within the same organization), as well as a multitude of national cultures (geographical scope). Valuable knowledge may exceptionally be "located" within a single knowledge worker, but more often than not, expertise or experiential knowledge may reside within multiple people. In fact, this knowledge may not be limited to those currently employed so KM can also be perceived as not necessarily fixed in the present time. Those who have left an organization may still remain connected to the knowledge network. In addition, KM also needs to "connect" with future unknown users of this knowledge.

With even just these parameters, it is clear that KM cannot be successfully achieved in a piecemeal fashion. Holistic KM can be thought of as a knowledge ecosystem that has a series of permeable boundaries. The complex and multifaceted nature of KM is likely the reason why there is no universal academic nor organizational chart placement. It is also at least partially responsible for the lack of consensus over what to call KM and how to compile a set of "standard" KM competencies. It can be argued that when KM first became recognized, much effort was spent trying to clearly distinguish it from existing concepts, such as information management. Perhaps the time has come to not try to stand out as something that is very different but instead build more bridges to create a holistic and inclusive view of the field of KM. It is hardly feasible to envision implementing KM as a standalone undertaking as successful KM rests on a number of organizational prerequisites such as a knowledge-friendly culture and a solid IT and IM infrastructure. The focus can shift to highlighting how KM complements and reinforces other organizational functions instead of requiring that everyone pick a side.

One approach undertaken with colleagues was to integrate KM models that had different roots: communities of practice, intellectual capital, and organizational learning among others into one integrated or holistic KM model (Evans et al., 2015). There is a need for interdisciplinary KM to evolve out of multidisciplinary KM so that different historical roots and perspectives can be cohesive rather than simply additive (or proposing alternative views of KM). Heisig's (2015)) study found that KM experts advocate for a more interdisciplinary approach that can integrate disciplines such as sociology, organizational behavior, and economics among others. KM needs to be approached as a complex and multidimensional endeavor.

In a similar vein, much remains to be done to make KM more inclusive. Durst (2021) advocates strongly for rKM, or responsible KM where diversity, equity, and inclusivity are included in all KM activities. This would include how we define who an expert is or what valuable knowledge should be managed and leveraged. Greer and Egan (2019) recommend ways in which KM can ensure there is diversity in terms of the people involved as well as structural diversity in terms of the KM tools involved.

> "Desired organizational performance outcomes can be enhanced by including diverse knowledge and perspectives in knowledge sharing practices throughout the organization." (p. 119)

An excellent example of the former is found in a study by Needham et al. (2020). The researchers undertook a tacit knowledge elicitation exercise in order to identify valuable knowledge regarding the management of wildlife in a specific geographic region. They not only included all levels of government policy makers, decision-makers, scientists, and transportation, forestry, and other experts but also interviewed people who have lived on this land for decades. This group included hunters, farmers, and residents who had first-hand knowledge of how wildlife populations and migrations changed over time as well as how the land changed (e.g., sea level changes, climate changes). In many cases, both groups validated some knowledge, while in other cases the local residents were able to correct some of the valuable knowledge to better manage wildlife in the region (e.g., where to place roads so as to not jeopardize habitats and migration corridors). Unfortunately, the researchers were not able to include the participation of the indigenous residents which would have optimized the diversity of tacit knowledge greatly. While a step in the right direction, there is still a long way to go right from the very first knowledge processing step: what criteria do we use in identifying experts? For instance, we should include frontline healthcare workers as well as epidemiological experts for global pandemic knowledge management.

How can KM better support diversity, equity, and inclusion (DEI)? Lauren Trees of the APQC[5] (2022) notes that "most organizations are still in the early stages of connecting KM and DEI." The potential is quite substantial and DEI should really be integrated throughout the knowledge processing cycle, beginning with

[5] American Productivity and Quality Centre https://www.apqc.org/

knowledge elicitation from diverse sources as illustrated in the Needham et al. example but also throughout knowledge sharing, preserving, and using/reusing. In terms of knowledge sharing, for example, one important example is that of language. Can knowledge workers contribute and access valuable knowledge content in their own language? As discussed in the introductory section, is it possible to move beyond the text and document-centric format of language and include multimedia content? Is the content accessible to all including those with disabilities?

In addition, some users are more likely to be disadvantaged when it comes to KM processes. For instance, Valentine et al. (2017) discusses those who are newly hired and who have not yet had time to establish good knowledge networks. This was particularly challenging for those who were hired during the pandemic and could only communicate and collaborate with colleagues remotely.

> "Individuals on the periphery of organizational knowledge-sharing networks, due to inexperience, location, or lack of social capital, may struggle to access useful knowledge at work." (Valentine et al., 2017)

The ongoing pandemic highlights the importance of being able to collaborate effectively and the importance of being inclusive. Tacit knowledge sharing in particular is difficult to do using remote meeting tools and when there has not been sufficient time to develop trust in your peers. Durst (2021) also pointed out that the digital divide became exacerbated during the pandemic as not everyone was able to work or learn remotely. Lower socioeconomic groups, women, and those who were hired during the pandemic were the most disadvantaged. For instance, not all students had the space, technology, or even an Internet connection during remote learning. All evidence also points to completely or partially remote work becoming the new norm (e.g., Behme & Becker, 2021; Clark, 2020).

Trees (2020) highlights another important scenario where DEI should always be present: where knowledge elicitation touches upon sensitive content. One example is eliciting stories or lessons learned on less than fully successful events. The importance of having a facilitator who can set out rules of conduct to ensure a safe space in which to candidly discuss the event is of utmost importance. Boyes (2019) further extends the call for DEI in KM by noting the need to decolonize KM, mirroring the movement to decolonize archives (e.g., Smith, 1999, 2012).

As Greer and Egan (2019)point out, KM is predominately human-centered:

> "At its core, KM and its success is almost entirely people dependent and relies on individual engagement and organizational culture to spawn and advance tacit insights that can be transformed into explicit knowledge." (p. 124)

Human-centric KM must therefore be respectful and responsible by ensuring DEI is part and parcel of all KM activities. Diversity management can be added to change management and innovation management in the KM toolkit for success.

3.2 More Scalable and Sustainable KM During Disruptions

One is the level of granularity or scale; KM can be carried out for individuals (personal KM or PKM), groups, organizations, interorganizational groups, and at a global or societal level. This need for scalable KM became very apparent during the pandemic. Few organizations, if any, were prepared for the pandemic. COVID-19 caused a significant disruption as most employees had to suddenly start working from home. KM found itself at front and center stage as everyone had to share knowledge and collaborate remotely (Fouad, 2020). The continuity of organizational processes and knowledge continuity were put at risk. The term "business continuity" refers to the ability of an organization to resume its operations after a disruptive event. There is typically a business continuity plan that outlines how to access backups so that normal operations can resume. Knowledge continuity is a term that is somewhat analogous to business continuity. Knowledge continuity management (KCM) is a plan that is put into place, typically to ensure knowledge is not when someone leaves (e.g., Hajric, 2021). Anticipated departures due to retirement are the easiest to handle in KCM as there is plenty of advance notice to ensure valuable, predominately tacit, knowledge is shared with current employees (e.g., seminars, mentoring) and also preserved for future reuse by often unknown users (e.g., documented job guides).

However, both business and knowledge continuity plans appear to be better suited for discrete events such as a natural disaster (e.g., an earthquake) and not for more prolonged disruptions such as the global pandemic, which is now in its third year. Ammirato et al. (2021) found there was a significant difference between KM activities during a natural disaster such as an earthquake and a global pandemic. Natural disasters tend to be discrete events with a beginning and end in time, whereas a pandemic required sustained KM over several years, while at first it was similar to a crisis as everyone had to pivot quickly to working, learning, and living from their homes. In the early stages, most were convinced this would only be for a week or so. No one predicted the sheer longevity of the drastic change in circumstances. Business continuity is best suited for such early, fairly short-lived crisis situations. Knowledge continuity is best suited for long-term planning when we know ahead of time roughly when each knowledge worker is expected to retire. What is missing is something in between: a long-term sustainable management of knowledge that can be used by individuals, groups and teams, organizations, organizational ecosystems, and society as a whole.

Ideally, a more continuous and more proactive form of knowledge continuity management is needed. Organizations have been mostly reactive when a critical employee leaves and they realize that their knowledge is not widely shared by others. Durst (2021) calls for more emphasis on evaluating knowledge at risk of being lost. This can be due to a number of situations such as the departure of knowledge workers as discussed but also when knowledge is not shared or when knowledge is not updated quickly enough. The author sent out "a plea for responsible and inclusive knowledge management at the world level." KM should not only do more for the pandemic but, more generally, take on a world or societal scope. The disruptions caused by the COVID-19 pandemic and its ongoing repercussions show the need to scale KM up to a societal or global level. Another example of a global KM objective would be climate change.

> "The experts also expect KM to support the trends that are happening in the employment market, providing a digital work environment and remote work infrastructure." (Nakash & Bouhnik, 2021, p. 35)

Durst (2021) labels this worldwide perspective on KM as responsible KM where the processes of knowledge creation, sharing, and preservation are scaled up to the societal level with the objective of improving society for the greater good of all. What is needed is KM that:

> "goes beyond organizational/national/etc. boundaries and acknowledges that only a collaborative and inclusive approach involving different and diverse partners of equal standing is capable of addressing present and future challenges."

In addition to providing knowledge continuity during disruptions and sustainable KM for remote collaboration, KM needs to be more scalable. Handzic (2017) notes that if KM is too specific, then its value will be too limited. For instance, what worked for the private sector may not work for the public sector and what helped a SME may not be scalable up to a large multinational organization. The author uses the term "social KM" to denote managing knowledge that "addresses developmental objectives of regions or the entire global community, beyond one organization's competitive advantage" (p. 20).

KM should not only be scalable (down for SMEs and up for societal KM), but KM should be much more inclusive in its approach to continuity and sustainability. An active approach is needed to ensure that knowledge is gathered from all and that it is representative of the diversity of knowledge and knowledge workers. A good knowledge capture plan should ensure that we have thought about including knowledge of people of varying seniority, profession, education, age, gender, ethnic background, language, and organizational/national culture to name but a few. This will require more upfront effort of course, but we can use the analogy of taxonomies to illustrate the value added. A multifaceted taxonomy is one that offers multiple facets or perspectives on a given knowledge item. This takes longer to build than a single hierarchy but, in turn, provides users with the ability to search using any one of these facets to find this valuable knowledge. Diversity, equity, and inclusivity need to be strongly woven into the fabric of each and every KM activity in order to ensure the quality of knowledge and to ensure that everyone can benefit, not just a select group.

Finally, Ahmed (2017) also identifies the need for multilevel KM research, in which all three levels of the individual, the group, and the organization are addressed. Most studies to date tend to look at only one level, and this will only provide a glimpse into part of the KM processes that are taking place. This recommendation can be further extended to look at interorganizational knowledge management activities and global or societal knowledge management. Future KM research avenues are discussed in the next section.

3.3 More Research on KM

Following on the need for more holistic and more scalable KM, there is a need for KM research methods that are more holistic, inclusive, and scalable as well. There is little KM research that makes use of longitudinal studies and that looks at levels beyond the organization (e.g., interorganizational and societal KM) as well as including more critical studies that report negative as well as positive outcomes of KM (e.g., Ahmad & Karim, 2019). Others such as Ammirato et al. (2021) identify the lack of action research, while Heisig's (2015)) study noted the predominance of case study research in KM.

In addition to a greater diversity of research methods, KM research should target high priority topics such KM for hybrid work, KM for innovation, KM for climate change, and KM for sustainability and knowledge continuity during disruptive events. For instance, Ammirato et al. (2021) conducted a systematic literature review on KM during natural disasters and pandemics. They found that while there is literature on KM in natural disasters, little exists for longer-term disruptive events such as a pandemic. They note issues of tacit knowledge loss and interrupted knowledge continuity at a societal level such as the dissemination of health information (and misinformation) from scientific experts and decision-makers to citizens. Another example from Apte et al. (2022) discuss how more research is needed on how KM can contribute to more organizational innovation.

4 Concluding Thoughts

The KM journey has followed a unique path. KM started out as a business practice and then migrated into academia. There is still much debate over how well KM theory is applied to KM practice, but both perspectives are needed. KM is a complex endeavor that is multilevel, multidisciplinary, and a continuous dynamic process of organizational learning and improvement. KM is both internally and externally focused. KM needs to not only leverage internally leveraged knowledge (such as internal best practices and lessons learned) but also look outward to the extended networks of knowledge workers and organizations to learn, to innovate, and to ultimately contribute to the broader societal KM goals. KM serves at least two masters with an objective to increase efficiency through knowledge reuse and also facilitate innovation.

KM is a constantly evolving academic discipline and professional practice. It cannot be otherwise given that individuals, groups, organizations, and society itself must be constantly learning in order to improve. Out-of-date, no longer valid needs to be weeded out. The "best by" or expiry date of most knowledge will be quite short. The dynamic nature of knowledge dictates that KM must be in a state of dynamic equilibrium or have just enough balance between reuse for efficiency, single-loop learning for improved processes, and disruptive innovations that lead to double-loop learning to completely rethink how things are done.

While the journey continues and KM continues to evolve, a number of challenges remain. The very term still lacks consensus and, some argue, leads to confusion. Nakash and Bouhnik (2021) propose rebranding KM as there are many misconceptions around the term. Some have a very narrow and exclusive definition of KM, while others have too broad and all-encompassing perceptions. It is also still difficult to measure the value of KM, while it is all too easy to measure the cost of resources needed to manage knowledge. Some argue that KM should have its own distinct territory, and much effort and debate has gone into identifying why, for example, KM is not IM. Some authors, including this author, always advocated for invisible KM (e.g., Kay (2003), in Handzic (2017)). If it is not possible to clearly delineate what is and what isn't knowledge vs. content management, this is not necessarily a negative outcome. For instance, Cervone (2016, in Handzic (2017):

> "warns that in some cultures, KM has diffused to the point where it is no longer considered a separate thing, but a natural part of how people organise work" (p. 15).

KM that has become part of all knowledge workers' responsibilities is the ultimate goal. When KM is taken for granted along with quality assurance and business continuity plans, then KM has arrived. A large part of the rationale here is that KM is not a task that can be checked off a to-do list. Knowledge, by definition, is always changing and evolving. The majority of best or proven practices will be overwritten by newer and better prescriptions to provide the opportunity to continuously learn, improve, and innovate. No individuals, community, organization, nation, or economy can survive let alone excel managing its knowledge. KM will continue to help leverage value from knowledge assets, particularly valuable tacit knowledge, and ensure knowledge workers are represented and able to work in a safe, trusted, and diverse workplace. In this way, KM will continue along its evolution and its sometimes-bumpy journey as to help prepare for future opportunities and also future disruptions.

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Futurizing Intellectual Capital Theory to Uncover Pertinent and Unexplored Horizons

Aino Kianto, Sladjana Cabrilo, and Henri Hussinki

Abstract

The need to understand the criticality of knowledge and related resources has led to scholarly discussions, and the intellectual capital (IC)-based view of firms has gained increasing importance in the contemporary management literature. Manifold impacts of IC on organizational performance have been widely evidenced, and management mechanisms for various IC dimensions can be found in most established organizations. As research is a strongly path-dependent activity, IC research naturally leans on classical frameworks and conceptualizations constructed a decade or even several years ago. However, large-scale changes in companies' operating environments, such as digitalization, the sustainability crisis, and the COVID-19 pandemic, and related forced move to remote work demand new knowledge resources. In this paper, we strongly argue that normative approaches for conceptualizing IC and its performance relevance would benefit from updating. Furthermore, the new post-pandemic world of work requires novel understandings of IC. To spur new thinking and offer ways forward, we develop a theoretical model that indicates selected ideas for a revised understanding of IC and its role in organizational viability. We suggest important new issues to be examined in terms of various IC elements, organizational performance dimensions, and moderators of relationships among these dimensions. The paper contributes to IC research by constructing a revised model of IC that

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can be used to generate topical research models to be further developed and tested in theoretical and empirical studies.

Keywords

Intellectual capital · Future · Digitalization · Remote work · Open innovation · Sustainability

1 Introduction

The need to understand the cruciality of knowledge and related resources has permeated scholarly discussions; subsequently, the intellectual capital (IC)-based view of firms has gained a strong position in the contemporary management literature. Complementing the overall knowledge management literature, IC focuses on the knowledge-related resources that are applied in organizational value creation processes (e.g., Edvinsson & Malone, 1997; Bontis, 1998; Inkinen et al., 2017). The manifold impacts of IC on organizational performance have been widely surveyed and evidenced, and management mechanisms for various IC dimensions can be found in most established organizations.

In recent times, work life as we know it has undergone fundamental transformations. The spread of COVID-19 brought a major challenge to companies that had simultaneously been facing global competition and environmental uncertainty. Companies had to not only prevent the spread of COVID-19 through social distancing but also find effective ways to maintain performance. Remote work was found to be a good way to achieve both goals during the pandemic (Liu et al., 2021). Considering that there are more than three billion Internet users in the world and increasing numbers are using digital technologies to work remotely (Donnelly & Johns, 2021), the need for workers to adopt skill sets to meet the requirements of digitalization and future jobs (Habraken & Bondarouk, 2017), and the rise of crowdsourcing platforms and co-creative networks for innovation and prosperity, the main question in this paper is as follows: Do we need to redefine knowledge-based resources that contribute to organizational value-added process and consequently to reconceptualize the IC framework?

Most IC research has leaned on the classical tripod of IC components, a foundation laid down by the first-generation gurus of the field (e.g., Bontis, 1998; Edvinsson & Malone, 1997; Sveiby, 1997; Roos et al., 1997). This tripod divides value-generating knowledge assets into human, structural, and relational capital, that is, the value vested in an organization's personnel, its internal structures and processes, and its relationships. Even though this conceptualization has been challenged by some (e.g., Cabrilo & Dahms, 2020; Inkinen et al., 2017), it still remains the cornerstone of the IC-based view of the firm and is judiciously followed by most researchers in this field. As research is a strongly path-dependent activity, it is natural that IC research leans on classical frameworks and conceptualizations and that most IC studies tend to adhere to the classical conceptualizations of IC components originally constructed several decades ago.

However, this may be problematic since large-scale changes in companies' operating environments and work life, in general, are likely to demand new knowledge resources. In this chapter, we make a strong argument that normative approaches for conceptualizing IC and its value relevance would benefit from updating. We further suggest that the new post-pandemic era calls for novel understandings of IC. Thus, it is important to rethink the nature and content of IC in the presence of current realities and how that may affect our theorizing of IC.

This paper proposes generalized propositions as provocations for debate and future research. To spur new thinking and to offer ways forward, we develop a theoretical model that points out selected ideas for a revised understanding of IC and its role in organizational viability. In particular, we suggest that the required changes to IC theory stem from five interrelated issues—digitalization, remote work, gig work, open innovation (OI), and crowdsourcing—and strive toward sustainability through ethical leadership, green IC, and organizational resilience. Based on these, we suggest important new issues to be examined in terms of various IC elements, organizational performance dimensions, and moderators of relationships between those. We believe our ideas can shed light on the revised concept of IC and its performance effects in the digital economy and the new post-pandemic world of work.

2 IC-Relevant Changes in Companies' Operating Environment and Work Life

Work life is facing many large-scale changes due to ecological, political, and economic uncertainties. To remain competitive in the face of digitalization, diversifying work arrangements, sustainability crises, and the need for continuous renewal and innovation, organizations require new resources and capabilities (Colbert et al., 2016; Habraken & Bondarouk, 2017). In the following section, we discuss major changes that may impact the nature of IC in our times.

2.1 Digitalization

In Industry 4.0, also referred to as Smart Industries, digital technologies have increasingly changed the organization and nature of work (Colbert et al., 2016; Habraken & Bondarouk, 2017). Technological developments create greater work flexibility and mobility, which can benefit both workers and organizations (Ludivine, 2017). At the same time, these present challenges, as new technologies are dramatically changing employment and work features across many fields of work (Cooper & Lu, 2019; Felstead & Henseke, 2017). Digital technology enables an increasing fragmentation of work, facilitating complex employment relationships (direct and subcontracted), the growing use of part-time and shift work, and the individualization of the employment, or smaller and more isolated work units, such as virtual teams (Donnelly & Johns, 2021). In a digitized world where work is crowdsourced to freelancers through online platforms and collaboration occurs across geographical, functional, and hierarchical borders (Lepofsky, 2016), many aspects of IC may need updates.

Increasing robotization and automation demands workers to develop digital competences and adopt new skill sets required to work in new jobs created (Habraken & Bondarouk, 2017). Furthermore, the rise of crowdsourcing platforms and online organizations that organize work by sourcing tasks to their members who are independent contractors or so-called gig workers that are "hired" on-demand (Nakatsu et al., 2014) also fundamentally changes work relationships.

Another valuable personnel competence related to digitalization can be labeled as data literacy. Data literacy is crucial not only for the people directly involved in data curation and data analytics, such as data engineers, data scientists, and data analysts, but throughout an organization (Gupta & George, 2016). For instance, top-level management needs to understand what data the organization possesses in order to develop an intuition of which types of business decisions could be supported with the analyzed data. However, top-level management cannot make all decisions; thus, also middle management and operative-level employees should be trained to understand data and make decisions based on them (Arunachalam et al., 2018).

Proposition 1 Digital competence is an important aspect of human capital in digitalized work life.

In the digital era, organizations must not only cope with disruptive technologies and innovation but also adapt their business philosophy and models, including mindset (organizational and individual), culture, and competences, to the digital way of working (Murawski & Bick, 2017). Creating an open culture that embraces independent and on-demand workers allows organizations to benefit from their ideas and engage them in innovation and value creation (Smith, 2020). A digital organizational culture supports digital capabilities and innovation performance (Zhen et al., 2021).

Proposition 2 Open digital and data-driven culture is an important facet of structural capital in digitalized work life.

Since data have recently gained ground as a key competitive resource for many businesses, it is important to ensure that their utilization is guided by real business needs. This can be achieved by establishing a collaboration between data analytics and business experts (Akter et al., 2016; Mikalef et al., 2019). Without such cross-functional collaboration, organizations may end up doing analytics and business in different silos instead of conducting business analytics. Organizations can further increase the level of data utilization by providing easy access to data throughout the organization (Kristoffersen et al., 2021). A centralized data platform where all relevant business data are transferred and stored in an architecturally sound design can be integrated with different analytics tools and applications. Related to this, the organization should provide employees with adequate analytics tools which they can easily use to perform daily analytics tasks (Akter et al., 2016; Fosso Wamba et al., 2017). This strengthens the organization's data-driven culture, in general, and allows analytics personnel to focus on more demanding tasks that better suit their expertise (Gupta & George, 2016; Mikalef et al., 2019).

Proposition 3 Business analytics, data platforms, and analytics tools and applications are key elements of structural capital for knowledge-based value creation.

2.2 Remote Work

The term *remote work*, sometimes also referred to as telework, locationally distributed work, or virtual work, can be defined as any work that is detached from traditional fixed places of work (Felstead & Henseke, 2017). Remote work is not a product of the COVID-19 pandemic but has gained its momentum and proved its significance as a result of the pandemic's catalytic effect (Liu et al., 2021), becoming a necessity for organizations globally (Donnelly & Johns, 2021).

What used to be a personal choice before the COVID-19 outbreak, where someone chose to work as a high-skilled professional outside an office to better balance work and life and reexamine their priorities, has become a necessity after the pandemic, as people of diverse gender, age, professional backgrounds, and social class worldwide have had to switch to remote work literally overnight (Mahadevan et al., 2022). Remote work has increased in scope and relevance, and the profile of a remote worker has changed and diversified (Mahadevan et al., 2022). This will likely remain an important way of working in the future because workers have experienced the benefits of working from home.

There are certain established concepts in the human resource management literature, such as flexible work arrangements (Berkery et al., 2017), gig work (Boons et al., 2015; McDonnell et al., 2021; Williams et al., 2021), virtual teams (Adamovic, 2018), and digital nomads (Hannonen, 2020), all of which present new ways of working outside the boundaries of organizations and have been related to the larger phenomenon of *remote work*. Externalization of employee work has been mostly seen as a negative trend from an employment perspective, as work relationships become more fluid and short time (Hollister, 2011) and somehow *less under traditional control*. The restrictions of managerial control under remote work arrangements are compensated by employees' self-management and leadership skills.

Self-leadership (Manz, 1986) is a process through which people influence themselves to achieve the self-direction and self-motivation necessary to behave and perform in desirable ways. It is a broader concept of self-influence that encompasses self-control, self-regulation, and self-management. It draws on intrinsic motivation theories (e.g., Ryan & Deci, 2000), social cognitive theory (Bandura, 1986), and positive cognitive psychology (Seligman & Csikszentmihalyi, 2000) to understand sets of behavioral and cognitive strategies designed to shape individual performance outcomes (Houghton & Neck, 2002; Neck & Houghton, 2006). Self-leadership theory posits that even though external contexts and activities influence behavior, actions are ultimately controlled internally by an individual and focus on how people manage and lead themselves (Stewart et al., 2011). The theory includes self-imposed strategies for managing the performance of tasks of low intrinsic motivational potential and self-influence that capitalizes on the *natural* or intrinsic motivational value of task activity (Manz, 1986). Three distinct but complementary categories of self-leadership influence its outcomes: behavior-focused strategies, natural reward strategies, and constructive thought pattern strategies (Prussia et al., 1998). In remote work arrangements, self-leadership is an important skill for both internal and external human capital and should be included in the associated research models.

Proposition 4 Self-leadership is an important aspect of human capital in remote work contexts.

2.3 Gig Work

In today's digital economy, the traditional full-time employed labor force seems to be decreasing, and a growing number of workers, especially high-skilled professionals, prefer to work as autonomous and independent self-employed freelance contractors (Vaiman et al., 2011). Contingent work is a form of *nonstandard* employment that involves the hiring of workers on *contingent* or *fixed-term contracts* (Connelly & Gallagher, 2004). Organizations worldwide benefit from contingent work by saving on labor and related costs (Smith, 2020) and becoming more agile and able to respond to changes rapidly.

Gig work is composed of short-term jobs (gigs) and presents a type of contingent work that typically falls outside the boundaries of an organization. Digital platforms connect gig workers directly with customers (Harris, 2017); therefore, gig workers are classified as independent contractors rather than employees (McDonnell et al., 2021; Halliday, 2021). In the gig economy, organizations do not hire workers but rather mediate an exchange between gig workers and customers, through a system where tasks and resourcing are managed by the algorithm (McDonnell et al., 2021). In this new economic system, workers are not engaged in *jobs* and have no long-term connections with a company but are hired on demand for *gigs* under flexible arrangements as independent contractors, working only for a defined time to complete a particular task. After job completion, they have no more connection with their employer (Friedman, 2014).

However, as gig workers have no traditional employment relationships with organizations (Friedman, 2014; Halliday, 2021), managing this workforce can be a great challenge. These on-demand *hired* workers may not feel connected to the organization and may not have the same loyalty as full-time employees because they do not belong to any organization. Therefore, further analysis needs to be conducted regarding the implications of contingent work on organizational structure, leadership and talent management, organizational culture, and trust, as well as to reexamine specific organizational theories and models, such as knowledge-based theory (Grant, 1996) and IC.

Thus, the question here is how to consider the knowledge, skills, and experience of workers with zero-hour contracts, which do not require a minimum number of working hours by an employer as a part of organizational intellectual (human) capital. We argue that irrespective of their formal employment status, workers who create value for a company should be counted as its human capital. However, there have been opposite views, for example, in financial accounting, an asset is any resource owned or controlled by an economic entity, and following this definition, remote workers who are not fully owned or controlled by a company do not represent its human capital. In any case, it is important to rethink concepts and theories that are affected by the externalization of work and other changes in the nature of work, including the concept of IC, which is the main aim of this paper.

Proposition 5 Gig work and other contingent work should be acknowledged as an important aspect of human capital.

2.4 Open Innovation and Crowdsourcing

Recently, OI and crowdsourcing have been hot issues in the innovation management literature (Cricelli et al., 2022). There has been a successive change in the way innovation has been viewed through time. The innovation paradigm has shifted from *closed innovation* to *open innovation*, *networked innovation* models, and now to participative innovation, which is an integral characteristic of open innovation 2.0. (Chesbrough, 2003; Curley & Salmelin, 2018). As innovation is the most typical performance variable in IC research (Inkinen, 2015), this novel innovation paradigm should also entail changes in the IC field.

OI, as introduced by Chesbrough (2003), is an innovation practice that strives to provide much richer knowledge flows and make innovation quicker, easier, and more effective through exchanging knowledge and ideas via collaborative and open-network environments (Curley & Salmelin, 2018). It is characterized by sharing knowledge, critical resources, and capabilities within and across the boundaries of organizations to exploit both internal and external knowledge and ideas (Chesbrough, 2003). In OI, ideas pass to and from different organizations for exploitation. Based on bidirectional knowledge flows, two distinct directions in the OI process are inbound OI (outside-in process) and outbound OI (inside-out process) (Gassmann et al., 2010; Huizingh, 2011). While inbound OI refers to the internal use of external knowledge from various innovation sources, such as partners, customers, universities, and research organizations, outbound OI refers to external exploitation of internal knowledge through selling patents or direct licensing (Cricelli et al., 2022).

According to IC theory, this means that knowledge-based value-creating resources are related to not only intrafirm resources and capabilities but also those over and across organizational boundaries. Thus, the *external* human, structural, and relational capital should be better acknowledged for understanding OI.

Proposition 6 External IC resources are important for understanding OI.

Crowdsourcing, with its multidisciplinary nature, is a complex phenomenon (Cricelli et al., 2022). It is consistent with the OI paradigm (Bogers & West, 2012), as it refers to the use of outside sources for ideation and crowd wisdom or collective intelligence in value creation (Brabham, 2013). Crowdsourcing indicates the practice of opening the process of getting ideas or performing tasks to the public and asking a body of people (the crowd) to share their knowledge as users to improve their own experience (Buettner, 2015).

The adoption of OI strategies requires the reorganization of how processes are carried out, which need to be linked to a new and more open and entrepreneurial culture, cooperative behavior, and a collaborative mindset of the people involved (Cricelli et al., 2022).

Proposition 7 Open and entrepreneurial culture is an important facet of structural capital that supports crowdsourcing and the use of collective intelligence.

2.5 Ethical Leadership

While transformational leadership aims to develop maximum followers (Northouse, 2012), ethical leadership focuses on a *code of honesty to ourselves* to make leaders and followers more ethical (Anderson & Sun, 2017). Ethical leadership more explicitly estimates the moral values of leaders, such as honesty, motivation, credibility, integrity, and justice (Lu & Guy, 2014), and recognizes top managers as the key personalities who create organizational culture and ethical climate. Ethical leadership involves the demonstration of high moral values in personal actions and interpersonal relationships and the promotion of such behavior to followers through open, trustful, and two-way communication as well as encouragement and empowerment in decision-making (Brown et al., 2005; Ullah et al., 2021).

Research has shown that employees conform to the ethical values of their leaders (Brown & Mitchell, 2010). Thus, a moral leader influences the behaviors and attitudes of their employees (Treviño & Nelson, 2016) and creates a productive employee work behavior (Mayer et al., 2009). In addition, ethical leadership is related to important follower outcomes, such as employees' job satisfaction, commitment, engagement, and voice behavior (Brown & Mitchell, 2010; Ullah et al., 2022). Some previous studies have also demonstrated that ethical leadership and IC, especially in the knowledge-based economy, positively impact business performance (Donker et al., 2008) and that IC facets (human and social) and organizational ethical culture have a mediating effect on the CEO's ethical leadership and corporate social responsibility (CSR) relationships (Ullah et al., 2022).

Ethical leadership positively influences employees' innovative performance (Ullah et al., 2021), as an ethical culture inspires employees to participate in learning (Ullah et al., 2022). Furthermore, Ullah et al. (2021) revealed that IC, particularly human and social capital, plays a mediating role in the relationship between ethical leadership and employees' innovative performance. Higher ethical values may improve IC (Ullah et al., 2021), as responsible leadership plays a vital role in supporting the conversion of employees' tacit knowledge into organizational IC (Kumari et al., 2015). Ethical values can help companies attract talent, improve corporate image, and develop an ethical culture and environment for shared learning, open communication, product development, and teamwork (Ullah et al., 2022).

Ethical CEO leadership supports moral activities and attitudes toward business and generates trust among internal and external stakeholders. Ethics and trust shape an organizational culture of honesty and ethics and create an ethical climate that boosts open communication with employees, teamwork, knowledge sharing, creativity, and better organizational problem-solving, enhancing organizational IC (Maletič et al., 2018). The trust generated by ethical behaviors enables superior relationships, leading to increased relational capital. Ethical leadership and followership attract and retain talents, which can further lead to better human capital (De Hoogh & Den Hartog, 2008). In summary, ethical capital entails leaders to be liable for humankind in general, not just for their firms, and enables leaders to build an ethical corporate culture (Crane et al., 2019) and to be accountable for humanity (Ullah et al., 2022).

Proposition 8 Ethical leadership creates an ethical corporate culture and is an important facet of structural capital that not only enhances performance and productivity but also supports companies to be more accountable for humanity.

2.6 Sustainability

With the global market facing fierce competition, competitiveness has become the most popular slogan and aspiration of individuals, organizations, cities, countries, and regions. An intriguing question is whether competitiveness should be defined through financial indicators or through well-being (Januškaitė & Užienė, 2018). While investments in competitiveness are expected to bring a better future, the future depends on what is done today. Sustainability is essential to ensure that tomorrow comes and is better than today and yesterday.

Sustainability is a crucial issue for the future of the planet and humanity. With growing global concerns regarding the scarcity of natural resources, economic viability, social inequity, poverty and human rights violations, climate change, and rapid environmental degradation, sustainability issues have also become increasingly relevant (Ching et al., 2016; Reboredo & Sowaity, 2022). Environmental, social, and governance (ESG) pillars of CSR have become an important source of competitiveness, performance, and long-term value for organizations (Crifo et al., 2019; Mutuc Burgos & Cabrilo, 2022; Yu et al., 2018). To achieve strategic sustainability, companies have become more environmentally aware and protective, more involved in social activities that support the well-being of the community and employees, and more focused on corporate governance (Asiaei & Bontis, 2019; Wang, 2011).

The relationship between sustainability and IC is somehow very logical (Aras et al., 2011; Fuentes-García et al., 2008; Jain et al., 2017) but remains insufficiently explored. There is growing demand for firms to balance economic growth and environmental and social concerns (Jain et al., 2017), and firms have become more aware that the productive factor behind their sustainable growth is what they know and can do with this knowledge to make better decisions and create value (i.e., their IC).

Although the literature connecting these issues remains scarce, studies have confirmed that IC is a key element in sustainable operations (Chen, 2008) that can also change the impact of CSR activities on firm performance and value (Mutuc Burgos & Cabrilo, 2022). Sunday (2017) demonstrated a positive relationship between IC and corporate sustainability and a significant impact of human capital on economic, social, and environmental sustainability. Human capital seems to be specifically important for a firm's environmental and social performance (Reboredo & Sowaity, 2022). More competent employees with professional credentials positively affect a firm's reputation and contribute to the overall trust in firms' activities (Nemiño & Gempes, 2018). Thus, human capital improves stakeholders' perceptions about a firm's sustainable development, which can be further translated into higher market value (Smith et al., 2010). Finally, motivated employees expand relationships with stakeholders and feel more responsible for their overall corporate behavior (Mutuc Burgos & Cabrilo, 2022).

Some studies have also found that IC positively mediates the relationship between CSR and financial performance (Surroca et al., 2010; Jain et al., 2017), although findings may vary for developed and developing economies and according to different CSR dimensions (ESG) (Mutuc Burgos & Cabrilo, 2022).

2.7 Green IC

For a long time, it was considered that competitiveness and environmental sustainability cannot work together, as natural resources are limited and industrial production creates waste and pollution. However, with concepts such as green innovation and green IC, this situation has changed, and now industries can grow without damaging the environment (Januškaitė & Užienė, 2018; Liu et al., 2022).

Green innovation integrates green concepts and environmentally friendly techniques into business operations and the innovation process (Barrena-Martínez et al., 2020; Liu et al., 2022). It includes the implementation of new ideas and methods to reduce the negative effects of production and increase economic, social, and environmental benefits (Zhang et al., 2019).

In the knowledge economy, knowledge-based resources and capabilities are the leading drivers of environmental and social innovations (Chen, 2008). Thus, the process of accumulating green IC is a process of promoting sustainability within organizational operations and business value creation (Liu et al., 2022). Green IC refers to the sum of existing knowledge and skills that are used within a firm in organizational and environment-oriented processes and activities and that give the firm an opportunity to maximize its economic, social, and environmental performance and achieve a sustainable competitive advantage (Chen, 2008; Chang & Chen, 2012; Liu et al., 2022).

Green IC can be categorized as green human, green structural, and green relational capital (Chen, 2008). Green human capital refers to the general environmental knowledge and ability of employees and managers and their commitments to sustainable development (Chen, 2008). It plays an important role in green innovation and environmental management in the face of external pressures (Wang et al., 2020). Green structural capital refers to organizational capabilities and commitments, knowledge management systems and processes, reward systems, information systems, databases, and organizational culture that reflect environmentally friendly principles and philosophies (Chen, 2008). Green relational capital refers to the relationships between a firm and its stakeholders with respect to environmental protection and green management issues (Chen, 2008).

Proposition 9 (Green) IC is a key element of corporate sustainable growth and can maximize economic, social, and environmental performance and innovation.

2.8 Organizational Resilience

Organizational resilience refers to organizational viability over the long term under varying conditions (Tengblad & Oudhuis, 2018). Resilience should be "an everyday habit rather than something grasped for only in moments of crisis" (Välikangas, 2010, p. 3). Companies that create value for their customers over a long time achieve resilience. Thus, resilience should be considered as not only a capability but also a philosophy of how organizations can manage sudden and unpredicted changes and face complex and uncertain environments in responsible and proactive ways, often even before a crisis occurs (Tengblad & Oudhuis, 2018).

A holistic resilience framework proposes intangibles as the prime sources of resilience (Tengblad & Oudhuis, 2018). While many tangible traits and processes for resilience have been well researched, it is important to develop new perspectives on resilience and include intangible capabilities and resources in resilience models. Resilient leadership always prioritizes the development of companies' resources (Tengblad, 2004), although it may sometimes lead to employee dissatisfaction and declining returns. Resilient leaders need to lead innovations and change processes with courage and must have the strength to resist opposition to their solutions. Only the most innovative, imaginative, and daring leaders can effectively combine their resilience resources. However, courage, ambition, and optimism are not always positive qualities. The danger is that they may lead to unnecessary risk-taking and personal dominance, which can damage relationships and reputations, undercut organizational development, and lead to organizational failures (Kayes, 2015).

There are also many leaders who have successfully managed their companies, not being heroes without failures. This indicates the importance of resilient and constructive followership that includes the subordinates' initiative, enthusiasm, engagement, responsibility, and loyalty, which makes companies' results different. Andersson (2018) identified relevant conditions to develop supportive followership for organizational resilience (trustful and constructive relationships, community spirit and cooperation, engagement, meaningfulness, responsibility, and initiative) and highlighted social resources, such as the commitment and responsibility of employees, as essential for creating organizational resilience. Distributed leadership promotes such commitment and responsibility and, above all, the development of constructive followership.

Proposition 10 According to the holistic resilience framework, IC and intangibles are the prime sources of organizational resilience.

3 Consequences for IC Theory

3.1 IC Components

Considering the global externalization of work, changing employment and work relationships, and required skills and mindset at work, the concept of IC would benefit from updating in the increasingly digital economy. The large-scale changes discussed in the previous chapter have brought new challenges for IC, and tackling them requires new knowledge assets.

To maintain performance and competitiveness in the changed and digitalized environment, companies should rethink and revise the IC concept and start using updated metrics to manage it. Changes in organization, work relationships, nature of work, job-demand skills, and innovation require a more *open approach* to the IC concept, meaning that it is necessary to open the IC management boundary to the outside and to adequately emphasize the external dimensions of IC (Chen et al., 2015). All previously mentioned changes redefine the boundary between a firm and its surrounding environment, making the firm more porous and connected loosely with other value creators in an OI ecosystem (Chesbrough, 2003).

To address the challenges faced by contemporary companies, this paper reconstructs the concept of IC by expanding the concept from previously more internally defined to include important knowledge-based resources outside organizational boundaries, such as gig or on-demand workers or other external knowledge and innovation co-creators that support organizational value creation. With changed working relationships, increased digitalization, and collaboration between the company and its external actors, external dimensions of IC should be an indispensable part of a company's IC. Thus, we expand the content of IC to include the external dimensions, covering all internal and external knowledge-based resources that create a competitive advantage for the company. Mindful also of the wicked problems and challenges that sustainability issues are causing to the organizations, we propose that "green supportive" types of intra-and inter-firm IC components are of especial importance.

In human capital, the main issue is including contingent workers and gig workers in its examination and ensuring the necessary digital skills, such as data literacy and self-leadership skills of those who participate in the organization's value creation activities. For structural capital, an open and digital culture that supports entrepreneurial activities is more essential than ever. In addition, the roles of data availability, analytics tools and platforms, and data-driven culture are becoming valuable for organizations that aim at a more comprehensive use of their data. External relational capital is fundamental for OI and tapping into collective intelligence (Fig. 1).

3.1.1 Human Capital

As remote/hybrid work has become the norm across organizations, the abilities of organizational employees in executing such outside-office work have become increasingly relevant. Accordingly, a crucial feature of human capital is digital competence. Digital competence encompasses the knowledge, abilities, skills, and attitudes required for working in the digital age (Murawski & Bick, 2017). On an individual level, it is an umbrella term covering both the general digital competences required for nearly every occupation and the specific role- or task-related digital competences that are different for every occupation. For instance, most employees should possess basic-level data literacy to understand what data are available and what they indicate (Gupta & George, 2016), while the data literacy requirements are much heavier for analytics personnel who are involved in data curation and development of analytics solutions. In summary, digital competence can be defined as the ability to adopt new or existing technology to analyze, select, and evaluate digital information to solve problems and develop collaborative knowledge within a specific organizational context (Vieru, 2015).

Furthermore, the increase in gig work means that an increasing amount of human intellect working for a firm may come from outside of the realm of its fully employed human resources (McDonnell et al., 2021; Williams et al., 2021). Thus, the inclusion of freelancers in human capital is important. In the remote work context, self-leadership skills are an outstanding aspect of human capital, which are likely to impact the performance of organizational employees and freelancers and other contingent workers alike (Neck & Houghton, 2006).

3.1.2 Structural Capital

OI and related crowdsourcing activities require the active management of knowledge and information. Crowdsourcing is an innovative way to organize flexibly using the dispersed skills and ideas of a wide set of actors (e.g., organizational members, customers, suppliers, consultants, and gig workers). Capturing value from *the wisdom of crowds* necessitates wide participation, which can be supported by crowd management activities such as designing a platform, building a crowd culture, and sharing the captured value (Cricelli et al., 2022). Consequently, open

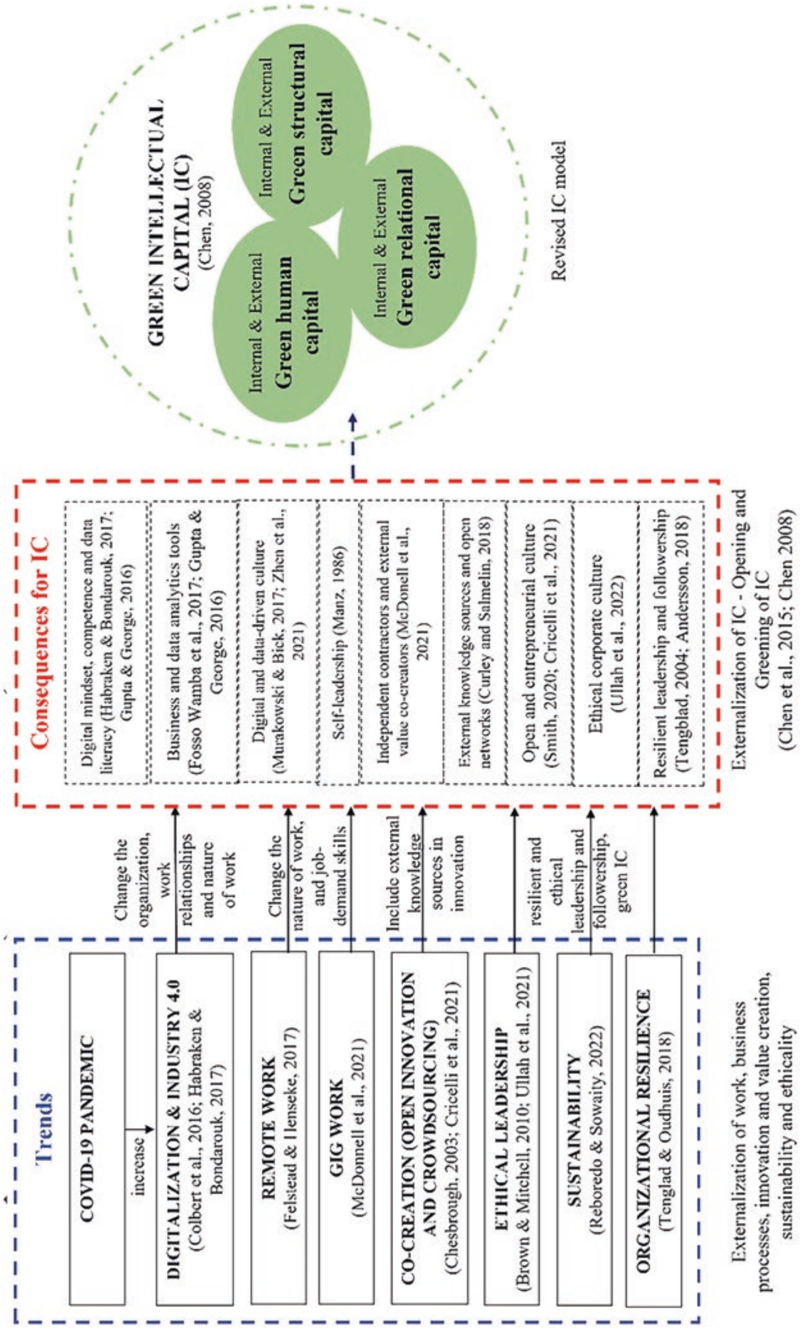

Fig. 1 Reconceptualization of IC (revised IC model)

and collaborative entrepreneurial cultures and associated activities represent a new important facet of structural capital in the face of OI models.

In addition, the success of digitalization depends on how well the organizational culture in place supports it. Digital culture comprises a set of shared assumptions and overall understanding and values concerning organizational practices in a digital context (Zhen et al., 2021). Culture both restricts and guides activity and provides tools for actors' agentic behaviors. Digitalization can be leveraged by espousing a culture that encourages risk taking, supports innovation, and facilitates wide collaboration (Grover et al., 2022). One specific digitalization-related cultural orientation is data-driven culture (e.g., Gupta & George, 2016; Kristoffersen et al., 2021). To enable large-scale data utilization and data value capture, the organization should strive to train and encourage its management and employees to make data-based decisions (Arunachalam et al., 2018; Kristoffersen et al., 2021). After all, data have only little intrinsic value, and almost all data value potential remains untapped when people or organizations act upon it, for instance, in decision-making situations.

To enhance the performance and productivity of an organization, it is crucial for the management to undertake responsible and ethical leadership, which not only enhances effective teamwork, creates ethical culture, and improves structural capital but also boosts employee work behavior and innovation performance and therefore overall IC of an organization (Kumari et al., 2015).

3.1.3 Relational Capital

While the conceptualization of relational capital is manifold, ranging from the internally oriented social capital construct of Subramaniam and Youndt (2005) to the externally oriented customer capital of Edvinsson and Malone (1997), we think these two variants should be segregated once and for all. We follow Inkinen et al. (2017) and suggest splitting relational capital into internal and external components, referring to relationships with intraorganizational and interorganizational stakeholders, respectively. Internal and external relationships create value in different ways: internal relationships present a crucial infrastructure for knowledge exploitation and benefit process and management innovation more, while external relationships might be more beneficial in knowledge exploration and therefore for product/service innovation (Cabrilo & Dahms, 2020).

External relational capital includes relationships with external knowledge and value co-creators, such as traditionally covered users, suppliers, competitors, universities, and other cooperative partners, as well as those with newly added stakeholders, such as gig workers, virtual teams, and digital nomads. External relational capital is critical for successful collaborative innovation (Chen et al., 2015). OI requires entrepreneurial culture, cooperative behavior, and a collaborative mindset (Cricelli et al., 2022). Also important are innovation intermediaries who facilitate the innovation process through enabling knowledge and technology exchange and transfer among organizations and crowds (De Silva & Meyer, 2018).

3.2 Performance Implications of IC

Innovation has been the most keenly studied outcome of IC management in organizations (e.g., Inkinen, 2015). The current innovation paradigm views innovation as open, networked, and participative (Curley & Salmelin, 2018). This updated approach to innovation should be acknowledged in the IC literature. Such innovation processes may further be supported by different IC elements than the more traditional closed R&D-driven innovation processes (Chen et al., 2015) and merit more examination.

Additionally, several well-known IC scholars (Dumay et al., 2018, 2020; Edvinsson et al., 2022; Secundo et al., 2017) have recently called for a more environmentally and societally oriented approach to IC that should be motivated by sustainability goals. This argument has been for an expanded concept of value creation beyond organizational wealth and into wider society, as well as from managerial to an ecosystem perspective. Ecological, societal, and economic sustainability are fundamental values, and advancing IC-based understanding on how to better contribute to them is important. IC can be used to mobilize a firm's IC to implement sustainable development in business practices (Wasiluk, 2013). In contrast, CSR activities can also be used to drive and advance human, structural, and relational capital (Gangi et al., 2019).

Studies have also confirmed that firms' attitudes and decisions about the disclosure of ESG pillars of CSR and IC transparency affect internal firm performance, external stakeholder engagement, policy makers' attention, and firm value by reducing investors' information symmetry and agency costs (Cabrilo, 2015; Tang & Luo, 2016; Yu et al., 2018). Environmental performance disclosure reflects corporate eco-literacy, social performance disclosure addresses HRM policies regarding the number and structure of employees and the impact of business activities on society, and governance performance disclosure is a safeguard against mismanagement (Reboredo & Sowaity, 2022). ESG information disclosure may enhance a firm's reputation and increase the value of intangible assets, embracing employee expertise, organizational processes, and the sum of knowledge contained within the organization and helping in recruiting, managing, and retaining talents and high-performing employees (Reboredo & Sowaity, 2022). However, whether disclosure on each ESG dimension, individually or aggregately, affects IC remains an important question for the future.

In addition, disruptions and knowledge storms (Tovstiga & Tovstiga, 2021) like the recent COVID-19 pandemic bring the *new normal* environment (Hitt et al., 2021) with global irreversible changes in how we view the world, do business, interact, and ultimately live our lives. All involved parties, including governments, organizations, and individuals, during and after a disruptive crisis struggle to restore stability, which further indicates the indisputable importance of resilience. For organizations, resilience arises from a combination of change capacity, efficiency, and reliability (Tengblad & Oudhuis, 2018). It requires the renewal and reassembly of resources through energetic and courageous innovation, resilient leadership, and followership, as well as intensive learning, to evolve from an absence of critical knowledge, fear, and uncertainty to the full mastery that draws on experiential knowledge and enables purpose-driven decision-making and actions (Čabrilo, 2021). Therefore, intangibles and IC are the prime sources of organizational resilience (Tengblad & Oudhuis, 2018), but these areas are still under-studied in the literature.

3.3 Moderating Variables

A moderating variable affects the relationship between a dependent and an independent variable by changing the strength or direction of that relationship (e.g., Hair et al., 2006). While many of the issues mentioned so far in this paper may be considered moderating variables, here we would like to especially underline the extent of remote work as an important contingency that may impact the extent to which various IC elements influence organizational performance. For instance, for a firm that mostly works online, technological infrastructure and related capabilities are essential for value creation. In contrast, in an organization where most work is conducted in the office, digital skills are not essential for ensuring high performance, and IT investments may even have a negative correlation with performance due to trade-offs with investments in building opportunities for face-to-face knowledge sharing.

3.4 Proposed Theoretical Model

Combining the suggestions made in previous chapters concerning the novel elements of IC, its relevant performance indicators, and potential contingencies, we now examine how value creation in the digitalized and largely remote work life in the VUCA world can be examined through the IC-based view.

Figure 2 presents the constructs and paths of the model. First, the novel facets of human, structural, and relational capital can improve the environmental, economic, and social sustainability of an organization. Remoteness of work arrangements conditions the impact of particular types of IC elements on organizational outcomes. The moderation effect is expected to be positive: the more remote the work arrangements in an organization, the more relevant the IC elements in the model will be for facilitating performance.

4 Conclusion

This paper argues that to remain relevant despite the recent large-scale changes in companies' operating environments, such as digitalization, sustainability crisis, and the pandemic and related forced move to remote work, IC theory would benefit from updating. We suggest some novel understandings and viewpoints concerning

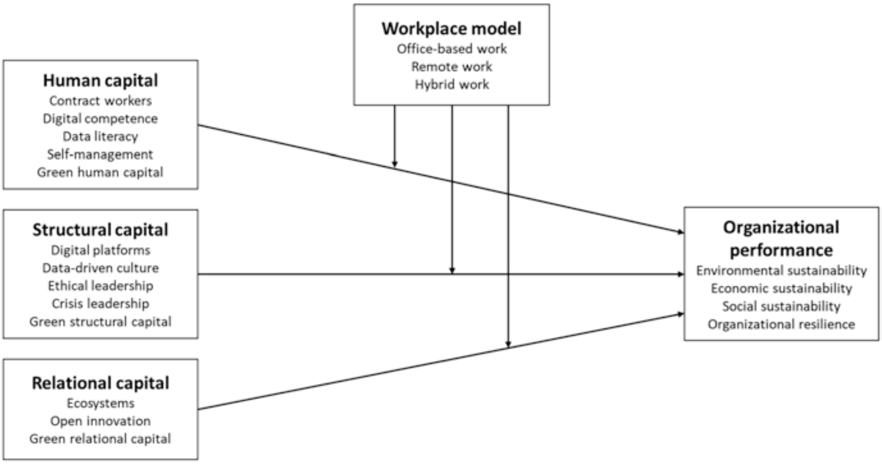

Fig. 2 IC and performance, example of a research model

the nature of IC components, organizational performance dimensions, and moderators of relationships between them.

The new research topics for the IC field, spurred by the recent developments in current work life presented in this paper, tap into the following questions:

- What types of new human capital issues are relevant for organizations?
- What types of new structural capital issues are relevant for organizations?
- What types of new relational capital issues are relevant for organizations?
- Are there new performance variables that are relevant for IC research, and if so, what are these?
- What types of new contingencies should be considered when addressing the IC-performance relationships?

This chapter contributes to the topicality and relevance of IC research by inspiring new thinking and offering ways to revise the research models that are developed and tested within this important field. We hope that our ideas will encourage scholarly discussion on how IC theory should be revised in the new post-pandemic world of work.

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Knowledge Management Essentials: Reflections on the Core of the Discipline and Future Outlook

Peter Heisig

Abstract

Reflecting on the history and development of the knowledge management discipline from an academic and applied research perspective, this chapter will outline the KM essentials as core of the discipline and open questions to be addressed in the future. Secondly, the author will discuss in particular the role of KM within organizational practice in regard to the overall societal challenges all organizations are facing today globally. Thirdly, the chapter will provide an outlook of the discipline in the light of future developments and suggests some research topics to be addressed by interdisciplinary KM research in the future. Beside on drawing on more than 35 years of experience in the KM field, this contribution will profit from previous research undertaken on the future of KM (2002 and 2012), contributions to guidelines and standards for KM (e.g., CEN, DIN, ISO), as well as from working with European Fortune 500 companies over the past 25 years.

Keywords

Knowledge management framework · KM history · KM methods · Critical resource · KM ethics · Future of KM · Human experiences · Artificial intelligence

1 Introduction

Knowledge management cuts across literally every sector of our societies, every industry, as well as every organizational function, which makes it a very exciting discipline for every open-minded person. It is a continuous learning journey for

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academics as well as practitioners. Furthermore, its interdisciplinary roots and character make it even more interesting but also much more challenging given the multitude of interrelationships among the different factors and dimensions involved in KM practice. Finally, knowledge plays a distinctive role on each social level from the individual, the group, and organization toward the society and global level. This makes it difficult to find and keep a focus and carries an inherent danger of misunderstandings between different academic backgrounds and practice contexts.

The highly interdisciplinary character of the KM field makes it a difficult choice for academics as the "normal" career paths in academia are still taking place within established disciplinary boundaries and promotion is based on publications earned from "mainstream" journals. Luckily the leading KM journals have improved their impact scores offering platforms to publish original research for future generations of KM researchers and academics. In addition, funding bodies are more open to interdisciplinary research proposals which might also help the KM discipline to address the open questions in the future based on properly funded research projects.

2 History and Development of the Knowledge Management

Given the cross-cutting nature of knowledge across different levels of analysis (individual, group, organizational, sector, society, global), also the history and development of KM could be observed and described on those different levels. Historical descriptions found in the literature narrate the history of KM back toward the early days of our civilization when humans started to convey their experiences by oral stories toward the next generations supported by first graphical visualizations and symbols assigned to certain meanings. Jashapara (2004) describes the history of KM in his textbook, starting from the oral traditions and the first writings in Mesopotamia. These developments are followed by the ancient Greek and Roman traditions of books and libraries, continued in the monastic and cathedral libraries in the Middle Ages with the emergence of first universities. As the turning point, he regards the invention of the printing press by Gutenberg around 1455 combined with the first indexing and classification system by Conrad Gesner hundred years later. The final leap are the inventions related to modern computers and the Internet in the last two centuries. A similar trajectory was described by Dalkir (2005:12–16).

On the societal level, phenomena such as the so-called knowledge explosion triggered by the increase of research output (Machlup, 1962; Mokyr, 2002) have been related to KM. Contrary to the generalized perception of an increasing amount of knowledge every 8 to 3 years (de Solla Price, 1963), Stuhlhofer (1983:169) concluded that "our knowledge is doubling every 100 years" based on the comparison of textbooks in the natural sciences measured by the content of a textbook known in previous times. An analysis of the growth and quality of mathematical literature (on determinants, published between 1820 and 1920, n = 1995) concluded that only 14% produced "new results and ideas," while 43% were considered as "trivia" and 21% as "duplicates" (May, 1968). To the knowledge of the author, there is only one single PhD dissertation (in German) addressing the *half-life time phenomenon* of technological knowledge (Vanini, 1999). The “knowledge explosion” or the ever-decreasing half-life time of knowledge is used to justify KM; I am wondering if those claims are more a like plausible myth or a fact based on properly researched evidence. Combined research with historians of science should be undertaken to critically evaluate these phenomena.

From an organizational perspective, the history of KM (Wiig, 1997; Lambe, 2011) was triggered by technological inventions such as computing technologies (personal computers) and networks (Arpanet, Internet), while the theoretical concept of the “learning organization” (Huber, 1991; Garvin, 1993; Örtenblad, 2001) helps to conceptualize organizational processes linked to the handling of knowledge. Since the emergence of the concept “knowledge management” (Henry, 1974; Lambe, 2011), the development of KM has been labeled either as “generations” (McElroy, 2000; Laszlo & Laszlo, 2002) or different “stages” (Snowden, 2002; Firestone & McElroy, 2003), “phases” (Lehner, 2019; Pawlowsky, 2019), or even “eras” (Dixon, 2010). There is no consensus which generation or stage (e.g., KM 3.0; WM4.0; fifth generation; sixth phase) the KM field is currently in. Nevertheless, the characteristics associated with the current phase of KM show some commonalities like “data-driven” (Lehner, 2019); “Big Data, artificial intelligence, and Internet of Things” (Pawlowsky, 2019); or “digital transformation” (North et al., 2018). These characteristics point to new capabilities related to increased processing capacities of IT applications supporting individuals and organizational functions (e.g., research, marketing, sales). I will return to this aspect later in the chapter regarding future research needs.

Finally, on the individual level, the term “personal knowledge management” (Reinmann & Eppler, 2008) was coined in order to highlight the importance of individual skills (TFPL, 1999; Heisig & Finke, 2003) in KM. This aspect of KM is mostly overlooked by the organizational KM, and it’s a black spot in KM practice as its hardly addressed in KM projects and KM programs. In the last 25 years, the author came just once across a pharmaceutical company which based their KM approach on three pillars, one being the assessment of KM related skills and providing focused training toward the R&D staff. KM research and KM practice could profit from the research in related fields like “personal information management” (Jones, 2017) and more recently on “digital literacy” (Michel & Heisig, 2020).

3 Knowledge Management Essentials

Reflecting on the discipline taking into account previous research on KM (e.g., Heisig & Mertins, 1999; Mertins et al., 2003; Scholl et al., 2004; Heisig, 2009, 2015) and practical experiences with several companies from different sectors, there are three core essentials in KM: (1) understanding of knowledge, (2) an evidence-based practical KM framework, and (3) knowledge about the KM portfolio of methods, tools, and instruments including their requirements, usefulness, and in particular their limitations. A good conceptual understanding of those core essentials will not only help to manage expectations on KM by users and managers but also safe organizational resources like time and financial investment as the author was able to observe in practice.

3.1 Knowledge

A comparative analysis of KM frameworks ($n = 160$) found that only three quarters explicitly describe the term knowledge with a dominance of dichotomies such as explicit and implicit/tacit used, while the classical data-information-knowledge (DIK) hierarchy is used by one in five frameworks (Heisig, 2009:7–8). Previous research (Scholl et al., 2004) surprisingly found that the classical distinction of explicit and implicit/tacit knowledge (Polanyi, 1966) was not regarded as a promising theoretical and practical approach. The need for more theoretical and empirical research was identified by a large panel of KM academics and KM practitioners ($n = 222$) aimed to avoid misinterpretation, to reduce confusion, to guide practice, and to increase understanding of the complexity (Heisig, 2015:157–160). The aim of further research should, rather than leaning toward defining a consensus, create awareness of the different perspectives on knowledge (e.g., Blackler, 1995) and its implications for organizational KM.

Despite the criticism if tacit knowledge could be considered knowledge at all (Schreyögg & Geiger, 2007), it is paramount for KM practice to be aware about the "tacit dimension" that "we know more than we can tell" (Polanyi, 1966). Furthermore, attention should be paid to the mostly overlooked perspective as the embeddedness of knowledge in practice or knowledge as "knowing in practice" (Orlikowski, 2002; Gherardi, 2000) referring to Schon's (1983) observation that "our knowing is *in* our action." Despite the early references of this perspective to knowledge in organizations, hardly anyone of the large panel of KM academics and KM practitioners (Heisig, 2015) referred to the concept of "knowledge in practice" while asked about their understanding of knowledge.

Still, KM practice should take this view very seriously as it points to the limitations of several KM methods or KM tools which overemphasize the explicit and implicit dimensions of knowledge but missing its strong relationship or the "embeddedness" in working practices. If the knowledge is in our actions, KM methods such as shadowing, learning-by-doing, joint problem-solving, and other approaches which makes employees working together or side-by-side or teaching each other would require more support than investment into technical applications and infrastructure. In this regard, Hislop's (2009) textbook about KM in organizations provides a good introduction. Unfortunately, those human-based KM approaches often lack the support by decision-makers which are often inclined toward new IT-based KM solutions.

3.2 Knowledge Management Framework

In the European Guide to Good Practice in KM issued by CEN (2004:11), a framework was defined as a description of "the most essential factors (assets, people, processes, tools) influencing the success or failure of a KM initiative, and their interdependent relationships." Rubenstein-Montano et al. (2001) distinguished between descriptive, prescriptive, and a combination of both called hybrid frameworks. Given these functions for practice, KM frameworks should be considered an essential part of KM.

Dozens of KM Frameworks have been proposed from different authors from academia, consultants, standardization bodies, professional associations, as well as KM practitioners from different sectors (see overview in annex in a study by Heisig & Orth, 2007). One example is the widely referenced model in the German-language area called the KM building block model developed by Probst et al. (2000) containing six operative knowledge processes plus two management processes providing a good starting point for the analysis phase of a KM project. Reports from KM practice (Vogel, 1999) indicate that the lack of a systematic integration of key success factors to be considered during design and implementation of a KM solution shows its limitation. The SECI model containing four knowledge conversion processes developed by Nonaka and Takeuchi (1994) and the core of the knowledge creation theory has been criticized by different authors (Nonaka & von Krogh, 2009). For instance, Ribeiro and Collins (2007) analyzed the bread-baking case used by Nonaka and Takeuchi (1994) as evidenced to support the conversion process of externalization of tacit knowledge. They conclude that such process doesn't happen as the machine only mimics some rather mechanical actions of the human bread-maker. Several other KM frameworks and KM approaches have been proposed by Wiig (1993), Snowden (1998), Firestone and McElroy (2003), some consultants (Arthur Andersen and APQC, 1996), or standardization bodies (BSI, 2001, CEN, 2004, DIN, 2012, ISO 30401/2018).

Based on empirical studies (Heisig, 1999; Scholl et al., 2004), multiple case studies (partly published Mertins et al., 2003, 2005) and an extensive comparative analysis of 160 KM frameworks, as well as dozens of KM projects with different European Fortune 500 companies (e.g., aerospace, energy, finance, manufacturing, software, steel, etc.), within public administration (e.g., government, police) and research organizations, the author designed the GPO-KM Framework (Heisig, 1999, 2005, 2007) composed of three analytical layers:

(1) The business or **tasks focus** is the core at the center of the framework. The work tasks within organizational processes represent the application contexts where employees and managers fulfill their tasks, solve problems, and take decisions. Knowledge is applied as well as created like two sides of a coin. In this application context, individual knowledge as well as team and social knowledge is regarded as a **resource**, while the persons involved acquire **experiences** as a kind of tacit "knowledge product" from the actions taken every day.

(2) The **knowledge activities** form the second layer comprised of a minimum of four core activities labeled "create," "store," "share," and "apply" knowledge. It needs to be emphasized that these activities are understood as *analytical* categories to trigger reflection and guide analysis of current organizational processes and routines to assess how knowledge is handled within those processes. Furthermore, these four activities are meant to guide the search, selection, and design of a KM solution including the assessment of KM methods and KM tools to improve the handling of knowledge from the broad KM solution portfolio. With the implementation of the approved KM solution, the selected KM methods and KM tools should become an integrated part of the organizational (work) process which should be improved with the KM solution.

Two aspects should be noted: (A) The activity "store" is sometimes misunderstood as a codification task. This interpretation overlooks research on transactive memory that indicates that knowledge is shared and stored in the distributed memories of team members (Austin, 2003). (B) The description of the KM activities as a sequence of activities or building blocks (Probst et al., 2000) resemble those of the information life cycle (e.g., Floridi, 2010) which could be misleading if interpreted and implemented as a rigid "knowledge" workflow. KM solution is about creating an environment which enables and supports the systematic handling of knowledge labeled with those core activities. Other KM frameworks (Heisig, 2009) propose up to 12 single activities which would further increase effort for data gathering and analysis and might increase the complexity of the solution design.

(3) The third layer addresses the **enablers** which are derived from research on key success factors for KM from meta-analysis of empirical studies (Helm et al., 2007) as well as the analysis of KM frameworks (Heisig, 2009). These enablers represent in the GPO-KM framework the following six areas of **analysis and design**: "culture," "strategy and leadership," "skills and motivation," "information technology," "organization and roles," and "controlling and measurement" (Fig. 1).

This third layer with the enablers derived from research on key success factors are particularly challenging due to the interactions and interdependencies between the different design areas: How does the *usability* (IT) of a KM platform or another software application supporting KM activities affects the *engagement* (motivation) of staff. The answer requires expertise about UX-Design and theories of motivation in the KM context. Which *leadership* style(s) is(are) most suitable for KM and which are the key components? Which governance (*organization and roles*) structure is suitable to KM and how different structures affect *culture*, *motivation*, and *leadership*? How does *controlling and measurement* influence the engagement (*motivation*) of knowledge workers? How do the different dimensions of the organizational *culture* influence the other areas like *leadership*, *measurement* approaches, *governance*, and vice versa?

An evidence-based approach toward KM would either need to fall back on the root disciplines of KM or use an experimental, pilot-testing approach to find out the

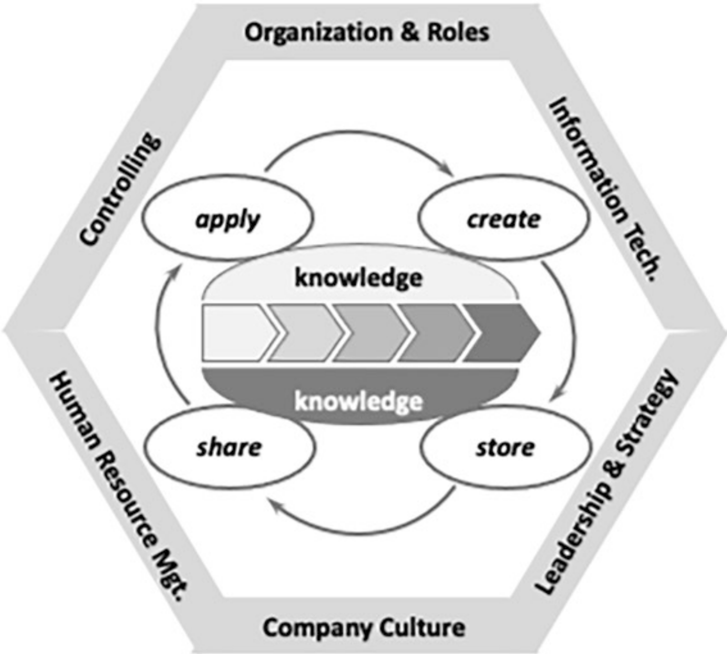

Fig. 1 GPO-WM® framework (Heisig 1999, 2005, 2007)

most appropriate solution. Unfortunately, focused research on those questions raised above hardly exists. It is a huge opportunity to undertake "useful research" (Mohrman et al., 2011) in order to advance theory *and* practice. A first step would be to analyze and summarize the current state and publish more review papers (Heisig, 2015). More could be done by academia in this regard. While such questions point to the true interdisciplinary core of the KM field with large links to sociotechnical design approaches, recognition in academia is still earned within the disciplinary boundaries.

The importance of these success factors and design areas is a well-known fact since the early empirical research (Heisig, 1999) and multiple other studies summarized by Helm et al. (2007). Still today, one can observe that practitioners and decision-makers in KM often either neglect certain areas such as skills, while new IT and software applications for KM attract much more attention as well as resources.

The GPO-KM framework is based on a sociotechnical approach to systems design (Mumford, 2000) and supported by a several instruments like a step-by-step analysis and design guideline using templates and questionnaires to enable broad participation and involvement of staff involved in knowledge work and knowledge handling as well as a database with early 100 KM tools and KM methods (Heisig, 2005, 2008). The approach takes into account earlier research in industrial sociology about the introduction of IT systems in office work in public administration and industry (Weltz et al., 1986, 1990) as well as research on empirical (tacit) knowledge within experience-based work in the shop floor environment (Böhle & Milkau, 1988; Mertins et al., 1993; Böhle, 1994).

The GPO-KM approach focuses on knowledge handling with work tasks in business or organizational processes. It differs from other process-oriented KM approaches (e.g., Kwan, 1999; Thiesse, 2001; Goesmann, 2002; Remus, 2002; El Sawy & Josefek, 2003; Gronau et al., 2004) which are strongly influenced by business process modeling approaches of the previous decade. During the early development phase of the GPO-KM approach, such modeling was found to require extensive effort (e.g., time for data gathering) and specialized methodological knowledge (e.g., modeling notation and software tool handling) which raises the entry requirements for many organizations in particular for small- and medium-sized companies (Mertins & Seidel, 2009). One example is the KDML knowledge management approach aimed to integrate knowledge conversion and business process modeling (Gronau et al., 2004) for analysis and design of KM solutions. Still, the effort required for data gathering and modeling makes this approach a difficult choice for practitioners with limited resources and lack of methodological knowledge. Feedback from practice from users of the GPO-WM approach in different sectors and countries (e.g., Austria, Finland, Germany, Italy) has shown the usefulness of this approach. The VDI Guideline 5601 *Knowledge Management in Engineering* (VDI, 2009) recommended the use of the GPO-WM approach within KM projects, and the DIN SPEC 91281:2012 references the GPO-WM analysis guide (Heisig, 2008).

3.3 Knowledge Management Methods and Tools: The Core KM Portfolio

Given that "our knowing is *in* our action" (Schön, 1983), the knowledge perspective cuts across all areas and functions within all kind of organizations with huge implications for methods, tools, and procedures used in the work tasks. Therefore, existing methods and tools should be assessed regarding their potential contribution toward knowledge activities and KM. At the beginning of the 2000, a group of practitioners from industry assessed and classified about 90 tools regarding the their contribution to KM (Armutat et al., 2002) which was later integrated into the CEN 14924 European Guide to Good Practice in Knowledge Management—Part III (CEN, 2004, 22–25).

Alone, the large number of possible methods to use for KM represents a huge challenge for students as well as practitioners. From an evidence-based management perspective, the narrow empirical basis or even lack of proper evidence regarding design, costs, and benefits of KM tools is limiting the uptake of KM in practice. Furthermore, often limitations of KM methods and KM tools are not explicitly discussed. Finally, consultants and vendors mostly "advertise" their favored tools or sometimes promise or worst misguide practitioners. An example of a recent advert in a practitioner's KM magazine claims that it would be possible to "secure critical business knowledge in a matter of hours." Not sure how this could be done if you take early research about deliberate practice to acquire expert knowledge and performance into account which was summarized with the *10.000 hours* rule (Ericsson et al., 1993).

Given the large number of possible KM methods, we wanted to understand if we could identify a core to KM methods and KM tools, which have been mentioned in the classical KM literature such as textbooks, handbooks, or specialized method books and journal papers. For a content analysis, the following sources were selected: one German-language (Lehner, 2019) and one English-language textbooks (Hislop, 2009), two handbooks (Easterby-Smith & Lyles, 2011; Holsapple, 2003), three classical KM books (Nonaka & Takeuchi, 1994; Probst et al., 2000; Davenport & Prusak, 2000), three method books (Rao, 2005; Mittelmann, 2011, 2019; APO, 2020), and two review articles (Massingham, 2014a, b). The content analysis used the number of occurrence and the coverage of a method within the sources. Furthermore, we clustered KM tools and KM methods which were aiming toward the same purpose such as capturing the lessons learned from an activity or project. The analysis resulted in the following list of KM methods and KM tools considered as essential core of KM.

The wealth of material on the KM methods listed is almost unmanageable. It ranges from brief descriptions to detailed monographs, dissertations, and web resources as well as case studies and, in some cases, implementation guidelines. A challenge, however, is the benefit assessment (qualitative and, if necessary, quantitative) for the respective application scenario of the KM solution, since the introduction is very much dependent on the organization-specific framework conditions and resources (Table 1).

3.4 Knowledge Management Curriculum

The three KM essentials described above such as (1) different perspectives on knowledge, (2) a KM framework guiding analysis and design of a KM solution, and (3) basic knowledge about the most mentioned KM methods should be part of a basic KM curriculum. Nine out of ten KM experts regarded the systematic instruction to KM as "highly important" and "important." Therefore, KM should be taught primarily at Master level but also undergraduate level at universities (Heisig, 2015). KM is a highly interdisciplinary and multidisciplinary field with its roots in psychology, sociology, organizational sciences, management sciences and computer sciences (Maier, 2004; Jasimuddin, 2006), and the key dimensions of KM with many interdependences between these dimensions (Helm et al., 2007; Heisig, 2009). Therefore, knowledge managers and those taking the responsibility for KM initiatives in organizations should have successfully completed a Master course with basic and applied modules including a practical project, preferably in organizational practice.

Table 1 KM method portfolio

KM method name (dominant)	Alternative terms and/or labels
Communities of practice	Knowledge communities
Knowledge maps	Expert directory (expert finder)
Yellow pages	
Lessons learned	After-action review, debriefing, expert debriefing, post-project review, postmortem, learn before-during-after
Organizational memory	Wiki, Blog
Knowledge transfer	Best practice transfer, learning day, shadowing, mentoring, peer assist, gray advisory boards
Storytelling	Learning histories
Intellectual capital reports	Skandia Navigator, Intellectual Capital Monitor, Wissensbilanz – made in Germany – etc.
Knowledge sharing	Experience-sharing meetings, BarCamp, World Café, Open Space, online discussion forum, FAQ, urgent request

4 Outlook for KM Research and KM Practice

The state, progress, and research needs of the KM discipline were researched within a global Delphi study in 2002 (Scholl et al., 2004) and with a large panel of 222 KM experts with an average KM experience of 12.3 years from 38 countries (Heisig, 2015). The results have been published elsewhere (Heisig, 2015; Heisig et al., 2016; Dayan et al., 2017; Sarka et al., 2019). The following suggestions are based on the personal reflection informed by own research, the literature, exchanges with other academics and practitioners, as well as practical experiences advising different organizations on KM matters.

4.1 Critical Discourse in Knowledge Management: Knowledge as Critical Resource

In the KM literature, the *functionalist discourse* dominates, where knowledge is understood as a resource or asset, as the analysis of the literature by Schultze and Stabell (2004) revealed. The authors observed only a very small number of studies that used a *critical discourse* related to KM. I believe that this is a deficit within the published research in KM journals in particular. Scientific progress develops from an argumentative debate contrasting different views, the test of different hypothesis, the objection to established "world views" or "taken-for-granted" facts, and the dispute with different researchers and practitioners. Here, the young KM discipline certainly has some catching up to do.

However, practitioners are also challenged to use knowledge as a critical resource (Kaplan, 2017). The recently published research on oil companies' early knowledge of the consequences of burning fossil fuels from the mid-1950s (Franta, 2018) and the concerted disinformation by their lobby associations (Franta, 2021) clearly shows the difference between knowledge, decisions, and actions. In this context, it might be very useful to revisit earlier research and discussions about wisdom in KM and in management in general (Rowley, 2006; Nonaka et al., 2018; Jakubik & Müürsepp, 2022).

One related avenue for future research employing a critical approach should look at the unintended consequences of KM which have been scarcely addressed, except some research on the "dark side" of KM (Chua, 2009; Aras, 2021).

4.2 Ethics in Knowledge Management

The use of knowledge as illustrated by the example of the oil industry above which represents just one example of among others points us to a broader issue regarding the handling and particularly the use of knowledge. Given that the impact and consequences of such (mis-)use of knowledge lay beyond the organizational boundaries of KM, also the responsibilities of those involved in KM must be regarded from a broader perspective too (Land et al., 2007).

I believe that this leads us to the question of the ethical dimensions in KM, which has hardly been addressed in the scholarly literature and relates to the "underlying motives for the introduction of KM systems, the way they are actually used and the impact of their use on individuals, the organization, and society" (Land et al., 2007, p. 1). Land et al. (2007:3) raised several questions which have also a very practical dimension such as "accountability built into all aspects of KM" or "how do we ensure transparency and uncover the hidden agendas?"

Another important stream of enquiry relates to indigenous knowledge "that is held and used by a people who identify themselves as indigenous of a place based on a 'combination of cultural distinctiveness and priori territorial occupancy relative to a more recently arrived population with its own distinct and subsequently dominant culture'" (Mugabe, 1999 ref. in Orozco & Poonamallee, 2014, p. 276). Surprisingly, indigenous knowledge was neither addressed in leading management outlets nor within the new intellectual capital taxonomy (Orozco & Poonamallee, 2014). The ethical questions arise from the commercialization of products elaborated from indigenous knowledge and the appropriation of the proceeds from these commercial activities.

Koulikov (2011, p. 237) discusses three new "ethics of 'informal' and unauthorized" transfer of knowledge as formal approaches to knowledge sharing often fail. The three new ethics are the "hacker ethic," the "participatory culture ethic," and the "proselytization commons ethic." The important issues arise from the basic questions about what motivates people to share knowledge and how an organization could or should support those new ethics. Still, research is fragmented and therefore presents an opportunity even it might be quite difficult research from the methodological point of view.

4.3 Interrelationships Between KM Enablers

KM as a sociotechnical system influenced by different dimensions as highlighted in many KM frameworks requires more interdisciplinary and multidisciplinary research as described by Heisig (2015) based on a panel of 222 KM experts. Besides these research avenues, further research should be undertaken regarding the following dimensions:

- Leadership and KM Activities
- The importance of leadership as support by top management and role modeling by middle managers is well known as enabler for KM. Recently, Pellegrini et al. (2020) reviewed 488 papers on leadership and its relationship with KM, indicating four research areas such as “human and relational aspects, systematic and performance aspects, contextual and contingent aspects and cultural and learning aspects” providing several potential research questions for future studies. Furthermore, despite the emphasis given by Nonaka and Takeuchi (1994) to the role of the middle managers, we can hardly find any further research on the role middle manager in KM (Carty & Walsh, 2007).
- Governance and Roles and Responsibilities
- Right in the early days of KM, Wiig (1997) already pointed out the relevance of the governance function in KM, still little research has been undertaken, mainly using a case study methodology (Zyngier & Burstein, 2012; Jørgensen et al., 2019). Similarly, the related dimension regarding the roles and responsibilities in KM, research is somehow none existent (Burstein et al., 2010).
- Culture and KM
- Research regarding the culture dimension and its relation to KM and KM processes is abundant and very dispersed. We are lacking more systematic review papers such as Mueller (2012) who identified three perspectives such as corporate culture as (1) a knowledge resource, (2) knowledge culture and its characteristics, and (3) KM which changes the corporate culture, which helps us to systematize the wealth of research and provide more detailed advice to KM practice.
- Skills and Motivation for KM
- One standard question always arises in exchanges with practitioners: “How to motive my employees to engage in KM?” while “Has your staff the right skills to efficiently engage in KM?” is hardly ever mentioned. Skills are either taken for granted or regarded as the responsibility of the individual employee. There is a huge research gap addressing skills and competencies in KM for employees and managers (TFPL, 1999; Heisig & Finke, 2003; Michel & Heisig, 2020), while the large amount of research addressing motivational aspects and incentivization would profit from more systematic reviews.

4.4 Tacit Knowledge, Human Experiences, and Artificial Intelligence?

The current developments in technology, labeled as a new phase in KM, reminds me of research projects undertaken over 30 years ago which were related to the introduction of CNC-machine tools replacing the manual-controlled machines and its impact on the empirical (tacit) knowledge of shop floor workers and staff in technical offices (Böhle & Milkau, 1988; Mertins et al., 1993; Böhle, 1994). The current developments are characterized by increased computing capabilities, more sophisticated algorithms, new software applications, and large repositories (Big Data, digital documents, digital video, and audio files); feeding those applications are accompanied by technology venders suggesting that recording our online project meetings including real-time transcription of the conversations which are immediately indexed for documentation and fast retrieval is regarded as a new solution for an effortless capturing of "knowledge." Well, I just hope that KM practitioners are not that naïve to believe that such codification approach would really solve the issue about proven and reliable knowledge worth to capture and share for further (re-)use, echoing warnings made by Liebowitz (2001) long ago.

Reflecting on the discussion about technology replacing human work activities as the introduction of CNC-machine tools about three decades ago shows – the question which arises with today's use of technical apps helping us to navigate from A to B, or executing tasks or take decisions in the private and the professional life is – how those applications will affect the experience base or tacit knowledge of users today and in the future. To put it simple: Are users of navigation apps still be capable to get from A to B with paper-based maps as well? Are they able to orient themselves and relate the map to the real environment and make the right decisions and take the correct turns? How will our knowledge and experience develop in the future in those areas of action which are increasingly assisted or even replaced by technical devices and applications? One stream of enquiry addresses "metahuman systems" which are defined as the combination of "machines that learn a parts of wider systems where *both* human *and* machines *learn jointly*" (Lyytinen et al., 2020:1) and already in operational use in industries like finance, electronics, as well as travel and tourism. While the authors identify four areas of future research, none of those four addresses the link between human knowledge development related to the use and rollout of metahuman systems. Jarrahi et al. (2023) also discussed the relationship between AI and KM using the four KM activities (see 3.2) as a partnership. Linked to this combination of humans and machines focusing on learning is the discussion about the integration of collaborative robots or Co-bots in workplaces (Peshkin & Colgate, 1999; Kwanya, 2023). Three models of interaction between humans and robots have been identified: (1) co-existence, (2) cooperation, and (3) collaboration. Haesevoest et al. (2021) find support for a collaborative relationship in managerial decision-making. While ethical issues arise from the use of Co-bots, the impact on human experiences and learning needs still to be investigated. KM researchers have a huge opportunity to explore the relationship of human-machine work environments and its impact on knowledge of humans.

4.5 Save Resources with Knowledge!

In order to conclude this chapter, I would like to address a global issue which again shows us on all three levels of analysis and reflection—from the individual level, the organizational level to the societal level—the huge gap between knowledge and action or the knowing-doing gap (Pfeffer & Sutton, 2000). In the face of the worsening climate crisis, we have the obligation to save our natural resources with knowledge or in short "Let's save resources with our knowledge!" I highly recommend reading the original Meadows et al., 1972 report by Meadows et al. The clarity of the presentation and the balanced discussion of solution options and pathways given the data and modeling expertise of the time are striking. It is therefore extremely disappointing that decision-makers, but also most citizens, have so far failed to take this knowledge into account in an appropriate manner and act accordingly. While there are numerous initiatives in the development field to use knowledge (Ferguson et al., 2010) for the benefit of people in less developed countries, we disregard knowledge in the field of climate change which will affect all of us. Therefore, I would like to end this section with a call of action to all those involved in knowledge management to put this knowledge to work.

5 Summary

I would like to conclude with the following statements. *Knowledge management* is a very interesting discipline and organizational function which enters a new phase with opportunities and challenges requiring further collaborative, applied research between academia and KM practice. *KM essentials* are composed of three main elements: first, different perspectives of knowledge to assess limitations of KM solutions; second, a wholistic KM framework based on a sociotechnical systems view to guide analysis and solution design; and third, a basic understanding of the most frequently mentioned KM methods to understand benefits and limitations—should be taught at master level at academic institutions. Finally, *KM research* and *KM practice* require more research using a critical discourse, addressing ethical issues, and investigating the impact of new technological applications on knowledge in organizations and use our knowledge to safe resources and our joint planet.

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Part II

Knowledge Management: A Human Perspective

Future Paths of Knowledge Management: How Do Spirituality, Calling, and Knowledge Management Fit Together?

Alexander Kaiser and Hector A. Martinez

Abstract

The topics of purpose, spirituality, calling, and self are more important than ever. However, they currently hardly play any role in traditional knowledge management approaches. The field of knowledge management has undergone a fundamental transformation, and it seems a perfect time to reflect on new ideas to respecify the future role of KM research and practice in a changing and increasingly dynamic world. In this chapter, we present a visionary future path for knowledge management. In this chapter, we will not only explore if and how spirituality, calling, and knowledge management fit together, but we will also seek to answer the question why an organization's knowledge management should focus on the future best self of its employees and how this can work and be implemented. We will argue that the key to this is the self and could be implemented with the concept of spiritual knowledge management.

Keywords

Spiritual knowledge management · Spirituality · Future best self · Vision · Learning from the future

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1 Introduction

A quick literature analysis on the topic of knowledge management (KM) clearly shows that there is an extremely large number of literature on very different topics and aspects of KM, but only a very small part of it deals with individual KM or personal KM. At the same time, there is strong empirical evidence that the topics of sustainability, purpose, spirituality, and self are more important than ever. However, sustainability as such is inseparably linked to people's lives, work, and actions. Even more, sustainability on a large scale will only work if it is anchored on a small scale—in other words, at the individual level. Purpose, spirituality, and self are also issues and dimensions that relate primarily to the individual and personal level.

The field of knowledge management has undergone a fundamental transformation, and it seems a perfect time to reflect on new ideas to respecify the future role of KM research and practice in a changing and increasingly dynamic world. Previous KM research focused mainly on explicit and tacit forms of knowledge and various classifications of rational and cognitive types of knowledge. However, this is not enough and not sufficient, as it does not take into account forms such as spiritual knowledge, emotional knowledge, or even all the forms of knowledge that manifest themselves through embodiment, to name just a few essential aspects.

In this chapter, we present a visionary future path for knowledge management. We argue that knowledge management that serves sustainability must not only be embedded at the individual and personal level but must also include people's purpose in life and reflections on and development of their self, or as we would put it, the spiritual dimension, thus encompassing people at a very existential level. In other words, the KM of the future must enable and control the deep learning process in such a way that people can learn and discover what person they really could and should be. Acquiring this knowledge can foster sustainability at multiple levels: individual, micro, meso, and even macro, as one of the most important components of this knowledge is closely linked to needs.

Building on existing work in the areas of spiritual knowledge (Bratianu, 2015, 2017), phronesis and purpose (Nonaka et al., 2008; Rocha et al., 2022; Ames et al., 2020; Rocha & Pinheiro, 2021b) calling (Duffy & Dik, 2013; Dik et al., 2012), vocation-coaching and coaching with compassion (Boyatzis & Akrivou, 2006; Boyatzis & Dhar, 2021; Boyatzis et al., 2019; Kaiser & Fordinal, 2010; Grisold & Kaiser, 2017), and organizational spirituality and KM (Rocha & Pinheiro, 2021a), this chapter not only explores whether and how spirituality, calling, and knowledge management fit together but also seeks to answer the question of *why an organization's knowledge management should focus on the future best self of its employees and how this can work and be implemented*.

Recently, the concept of *spiritual knowledge management* (Kaiser, 2023) was proposed for the first time and has already attracted some attention. In a nutshell spiritual knowledge management can be characterized as the process of creating, capturing, distributing, and effectively using knowledge in order to achieve the future best version of myself as a person or the future best version of itself as an organization. The basic idea of this approach is the fact that a fundamental dimension and key element of spirituality, which can be found in almost all definitions and approaches of spirituality—even if they are sometimes quite different—is the *self*. Spirituality is connected inseparably with a continuous evolution of the self toward a fully developed and fully unfolded self. The concept of spiritual knowledge management takes this into account and argues that a stepwise development takes place, which can be seen as a transformation from the current version of a person's self to the future best version of himself/herself. Since the future best version of the self is not (completely) known at the beginning of this path, this process can be thought of as a process of becoming (Clegg et al., 2005) and at the same time as a *deep learning process*. During this learning process, knowledge about the very nature and shape of the future best version of the self is created, and at the same time, this knowledge shapes and clarifies not only the future best version of the self but also the way to achieve it (Kaiser, 2023).

So we can also speak of self-development or self-actualization as a key to spirituality. This understanding of spirituality is in line with a number of authors—from very different fields and backgrounds—who all distinguish between different forms of the self over time. A person's calling can provide a sense of direction and purpose as they strive to realize their vision of their future best self. In this way, calling and the future best self can be seen as interrelated and supportive of one another, with the latter providing motivation and direction for the former. Therefore, spiritual knowledge management also has a lot to do with the topics of vocation (Dik et al., 2012) and calling (Duffy & Dik, 2013) and learning about one's own vocation.

In this chapter, we claim that the underlying idea and concept of spiritual KM, which is the deep learning process toward a future best self, will be a key aspect of future KM when it comes to the link between the organization's KM and the essential development of its employees.

In the next sections of this chapter, we will first discuss why it makes sense for the future KM of organizations to focus on the best self of its employees and then follow up with some ideas about how this can work in practice.

2 Why an Organization and Its KM Should Focus on the Future Best Self of the Employees

One of the key concepts to emerge from research on employee motivation and engagement has been the concept of the possible selves (Markus & Nurius, 1986), a term that encapsulates all the possible versions—positive and negative—that an individual has imagined as possible of themselves. The power of these possible selves in motivation is related to self-regulation theory (Markus & Wurf, 1987; Higgins, 1987, 1989, 1998; Boyatzis & Akrivou, 2006), which proposes that individuals respond with self-regulating behavior, emotions, or thoughts to perceived images of themselves. These self-regulating responses in turn lead them to become more or less like those imagined selves. From this working set of possible selves, the vision of the desired future self version has been identified as pivotal in motivating change in behavior and identity in humans (Higgins, 1987, 1989, 1998; Boyatzis

& Akrivou, 2006). In the research, a number of words are used to capture and describe this version of the possible selves (e.g., future self, best self, authentic self, ideal self, among others). For the sake of clarity and simplicity, in this chapter, we will refer to this broad concept as the future best self (FBS). The FBS is at the center of a number of individual-level change theories (e.g., Boyatzis, 2006) and—more pertinent to the organizational context—a number of coaching processes (e.g., Boyatzis's intentional change theory). Within the scope of employees performing in organizations, an employee's FBS is at the core of their personal engagement, development, and change in performance.

But of course, the role of individual-level insight and innovation in organizational performance is well-known and understood in KM. Nonaka's SECI model of knowledge creation—the theoretical framework for much of the research on KM—starts with knowledge created at the individual level (Nonaka & Takeuchi, 1995). As an employee either struggles with performance—or internalizes a new process shared by another (tacitly or explicitly) in the organization—they move through their learning curve to generate insight and innovation that perhaps, if well-documented and articulated through a KM system, can be leveraged for use by other organizational members. This process—which Nonaka described as the knowledge-creating organization—can lead to innovation in performance in virtually all levels, processes, systems, concepts, beliefs, or in other words, all facets of the organization. The proposition this chapter makes is that because of the link between the FBS and employee performance, and the link between employee performance and the knowledge created in the organization, the FBS has both a role and an impact in the organization, to the point that organizations should look to better understand and incorporate the FBS into their KM systems and processes.

Thinking about this type of integration (i.e., incorporating personal images of the FBS into the most important knowledge base of the organization) can feel odd. Indeed, one may initially reject incorporating employee FBS into an organization's knowledge base, as it may perhaps be that the FBS is too private or personal, or that the organization may manipulate or use it punitively against the employee. This rejection can be readily understood from a framing grounded on the traditional employer-employee work relationship—which is fundamentally a Theory X perspective (MacGregor, 1960). From such a framing, for a number of reasons (i.e., incentives and punishments), there are boundaries between an employee's future desires and the organization's success. From a Theory X perspective, the link between the employer and the employee is established on salary pay from the organization and submission of time and personal desires from the employee. The propositions in this chapter are framed around a different work contract, which has developed over the last several decades to include topics such as the meaningfulness of work, quality of life, and wellness, among other terms (Cartwright & Holmes, 2006; Shuck & Rose, 2013). What used to be a pay-for-employment contract, bounded by professional and role definition, has evolved, sparked by the search for employee engagement and its performance bounty (Harter et al., 2002). This search, as the research on motivation and engagement indicates, implicitly includes employee FBS.

Currently, these concepts (i.e., meaningfulness of work, quality of life, wellness, and engagement) have been operationalized and institutionalized through HR and talent management departments, into what become employee-developmental activities like executive coaching. Over the last decade, executive coaching has received considerable acceptance in firms (Taylor et al., 2019) and has possibly become the preferred way of facilitating greater levels of engagement from employees at work (Passarelli, 2015). In executive coaching conversations, it is common for an employee to voice their motivating and desired future version of themselves with an internal member of the organization (i.e., supervisor, colleague, or HR functionary), or with external coaches. The objective of this conversation topic—which in fact is the first step in many coaching approaches (e.g., Boyatzis's coaching with compassion)—is to help generate an alignment between an employee's FBS and their function, role, and development within the organization. This coordinating conversation looks to leverage the personal motivation of individuals toward becoming their FBS and encapsulate it within a firm, whose long-term strategy has been defined by top management. As such, the guiding principle of the coaching conversation is to identify common touch points between the personal vision and the organizational vision, without necessarily adapting either. However, it is relatively accepted that if there is a necessity for adaptation, employees are provided opportunities to design or craft their job or roles within the organization to better meet their desires (Wrzesniewski & Dutton, 2001). However, by not including these insights, organizations miss out on deeper opportunities to generate shareable knowledge for the entire organization. Perhaps the insights generated by executive coaching are trapped in the coaching relationship, leveraged only by the coach and the employee. In other words, organizations are not well structured right now to capture the full potential of the employee FBS.

While executive coaching and job crafting—which flow from the organization's mission and vision toward the employees—are generally accepted, there is much less acceptance and understanding from organizational management regarding the potential role and function that an employee's FBS could have in broader organizational processes. The broader objectives of macrolevel processes like KM are designed for improving direct skills or providing general knowledge pertinent to the scope of an employee's job role. So while individual developmental processes like coaching can provide a greater space in the process for individual motivation through the expression and investment in the realization of the employee's FBS, it is a more complicated argument as to why an individual's best self could be related to KM.

The link between an employee's FBS and an organization's KM, while complex and seemingly indirect, is quite robust and logical. The argument for the inclusion of the employee FBS in KM can be grounded on three main arguments: (1) a better understanding of the journey toward individual employees' development; (2) a more comprehensive understanding of the organization's talent management processes; and (3) provision of a greater space for employee's FBS as a path toward the future evolution and success of the organization. All three arguments are based on Nonaka's SECI model, where innovation and new knowledge are initially tacit, trapped within the individual, who is unaware that they are generating innovation and new knowledge. This is similar to how executive coaching is a private and isolated space for an employee to gain insight and knowledge through the articulation of implicit thoughts and ideas. The key that explains the impact of executive coaching is Karl Weick's question: how can I know what I think if I haven't said it yet? (Weick, 1979). The articulation of implicit thoughts allows for structuring and organizing that can guide decision-making and self-regulation. As such the process of executive coaching is a source of innovation and new knowledge that employees and firms do not leverage because of Theory X assumptions about the employee-employer relationship. If firms were able to combine employee FBS, other employees could better understand how employees are able to use the organization in becoming—or working to become—their FBS.

Beyond the personal opportunities for other employees, an articulated and combined catalog of employee FBS can be leveraged for decision-making about the organizational structures of the firm. The FBS can guide decisions regarding training, team membership, mentorship, and projects, among other initiatives. But perhaps more substantial is that an aggregated FBS can provide a much clearer picture of the talent strengths of the organization's staff. While it may seem that individuals have wildly different FBS, much like other decisions, it is more likely that there are FBS clusters within organizations, allowing management to better understand the motivation and desires of their employees.

With strengths more clearly identified, the organization is then more capable of realizing the third argument: integrating employee FBS into the organization's future. A number of companies already do something similar to this type of integration. Google and its holding company Alphabet are well-known for allowing employees to invest time from their work hours to develop entrepreneurial projects using organizational resources. These types of projects could be leveraged to become communities of practice within organizations, providing more than just time and resources but also a community of energized, engaged entrepreneurial employees willing to work on projects that could be a source of revenue for the organization. Without the incorporation of employee FBS into the KM systems and processes, there is less likelihood of these opportunities being realized within the organization's structure. Indeed, the employee may still be working on entrepreneurial projects, but they will lead the employee to leave the organization.

3 How an Organization and Its KM Should Focus on the Future Best Self of the Employees

Having argued and outlined why it is not only important but also necessary and useful for an organization's knowledge management to focus on the FBS of its employees as well as its members, this section of the chapter provides an idea of how this focus might be implemented. According to Boyatzis and his intentional change theory (Boyatzis, 2006, p. 613), there is a strong connection between the ideal self of a person and the personal vision. In other words, we can say that the personal vision is the manifestation of the ideal self. This is especially true when the personal vision is developed as part of a deep learning process that covers the essential aspects of a fulfilling life. Similar to dreams, visions depict our desired future and motivate us intrinsically. Nonaka argues in a very similar vein when he states that what differentiates one from another is the vision of the future and the practical ability to act to realize that future by using the aesthetic sensibilities to create knowledge (Nonaka et al., 2008). A profoundly developed and reflectively generated vision also relates to the uniqueness of a person and thus to the future best self.

There seems to be consensus that a vision has to capture the following elements: First of all, a vision depicts a state in our future, most likely our medium-term to long-term future. However, a vision does not contain any concrete strategies for realization. Finally, a vision can be seen as an ideal (future) scenario that connects a person to the person he or she could and probably should be—that is, to the future best self. A vision is different from a goal or an objective. A vision is a documented purpose that is detailed, customized, unique, and reasonable. A goal is a general statement of an intent that persists until it is achieved or no longer needed. An objective, on the other hand, is a specific and product-oriented statement of an intended accomplishment that is attainable, observable, and measurable by specifying the what, where, when, and how. In contrast to an objective, a vision focuses on why. Therefore, a vision does not change but only becomes refined over time, whereas plans or strategies to pursue a vision (e.g., goals, objectives) remain flexible and changeable (Kim & Oki, 2011, p. 250).

There are various definitions for the term “vision” in the literature. We build up on the definition by Collins and Porras. They state that a vision consists of two major components, namely, a core ideology (yin) and an envisioned future (yan). The yin contains the unchanging reasons why we live and what defines us. The yan is our envisioned future, what we want to achieve in our live and who we want to become (Collins & Porras, 1996, p. 66).

3.1 Vision Development as a Knowledge Creating Process

In a study by Kaiser (2017), we introduced a framework describing a knowledge-based process of developing and articulating sustainable visions. This framework proposes that three features characterize the development of sustainable visions no matter if the vision is created on the individual level or on a collective level and no matter if the collective is small, medium-sized (group, team, department, organization, etc.) or big (community, etc.):

- Learning from an envisioned future
- Need orientation
- A wavelike process through three steps and three discoveries that support the development of a deep learning vision

In the following sections, we build on Kaiser (2017) and adapt this framework for the purpose of creating a profoundly developed and reflectively generated vision that can thus act as a manifestation and externalization of the self.

3.1.1 Learning from an Envisioned Future

This approach uses our ability of imagination, theoretically established on theories of memory and prospection from the field of cognitive science (for an overview, see Gilbert and Wilson, 2007) and is inspired by Scharmer's theory of learning from the future as it emerges (Scharmer, 2009). Learning from an envisioned future consists of two parts—learning and envisioning the future.

First, some thoughts about learning: Experiential learning theory defines learning as "the process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping and transforming experience" (Kolb, 1984, p. 41). Hence, learning is an action-reflection process based on reflecting experiences in the past. In his theory Kolb (1984) emphasizes the central role that experience plays in the learning process, one subjective and personal, referring to the person's internal state and the other objective and environmental. These two forms of experience interpenetrate and interrelate in very complex ways.

Second, we have to consider the term "envisioned future." An envisioned future can be defined and described as the picture of an ideal, fantastic, attractive, and desired future. Therefore, it is very strongly connected not only with the idea of a fulfilling life but also with the best future self. So using the two meanings of experiences (subjective and objective), in the case of learning from an envisioned future, those experiences are—subjective—experiences in the envisioned future. Again we have the action-reflection process and therefore knowledge is created through the transformation of imagined experiences which have been made in the future. The most important aspects and characteristics of the envisioned future can be compared with the presence and as a consequence knowledge is created by reflecting "the difference which makes a difference" (Bateson, 2000, p. 459). More precisely learning from an envisioned future can be defined as a reflection about features, objects, and entities which have ended in the future and such which have newly come up and emerged.

The idea is to be somewhat detached from today's circumstances (and its restrictions, boundaries, and impossibilities) while, at the same time, being enabled to shift the thinking to come up with visionary and creative results transcending the boundaries of the current situation and environment (Scharmer, 2009). So learning from an envisioned future is using the power and flexibility of imagination that we humans have by mentally "pre-experiencing" hypothetical future scenarios and personal events (Szpunar, 2010, p. 143). The narrative result enables externalization of tacit dreams, wishes, and desires as if they had become true and thereby generating a picture of the desired personal future from which explicit knowledge can be derived in order to act accordingly in the present.

3.1.2 Need Orientation

Various authors (Kelly, 2004, 2017; Maureder, 2004; Kaiser, 2017) argue that the future best self is defined or characterized by, among other factors (at least), legitimate, substantial needs. Substantial needs can be defined as needs which are strongly connected with a fulfilling life. Therefore, substantial needs are rather subjective, whereas fundamental or basic needs (such as oxygen, food, water) are the same for all human beings.

Like medical conditions, needs generate feelings and desires and are expressed or manifested by signs and symptoms; those might either point to a lack of resources, like in the case of an illness, or positively seen, to the prosperity of the human being (McLeod, 2011). McLeod argues that knowledge of needs is inferential, meaning that needs can be derived from their manifestation. For instance, having the patient reporting about symptoms, the doctor may discover—by her expertise—the medical needs the patient has. Symptoms as well as signs of needs and desires can be reported and observed, respectively (McLeod, 2011).

Following Max-Neef we can distinguish between needs and their specific satisfiers. A satisfier is seen as a concrete solution to a need; it is a form of being, having, doing, and interaction, related to structures (Max-Neef, 2017). Unlike fundamental needs, satisfiers are culturally determined and might be different in various cultural contexts and historical periods. Needs are most fundamental and are the basis for desires and satisfiers. They are the motivational source of our acting. McLeod suggests that “needs are not themselves experienced.” He argues that needs may be indirectly manifested in desires, in feelings, and in other psychological states (McLeod, 2011). Wiggins describes the difference between needs and satisfiers as “What I need depends not on thought or the working of my mind (or not only on these), as wanting or desiring do, but depends on the way things really are” (Wiggins & Dermen, 1987, p. 62). Of course there are several categories of needs (McLeod, 2011; Thomson, 2005). For the purpose of this chapter, we focus on substantial needs as requirements to be met for the individual’s fulfillment and well-being and the organization’s sustainable existence. Those needs are strongly connected with the future best self, with a purpose and calling.

3.1.3 A Wavelike Process

The development of a profoundly developed and reflectively generated vision is characterized by a wavelike process of three steps and discoveries. These include (a) learning from an envisioned future and discovering attractive satisfiers and a “vision-1”; (b) crystallizing and deferring the basic essence and discovering the underlying substantial needs; and (c) transforming, validating, and applying those needs and preparing a vision (Fig. 1).

The *first step* in this process covers learning from an envisioned future and corresponds with the upward movement on the left-hand side of this wave. The discovery of knowledge enabled by learning from the future contains a great number of attractive satisfiers which serve as a basis to formulate a “vision-1.” This vision-1 can be seen as a first version of a vision. However, this first version may be incomplete and fragmentary on the one hand, and on the other hand, it may contain some

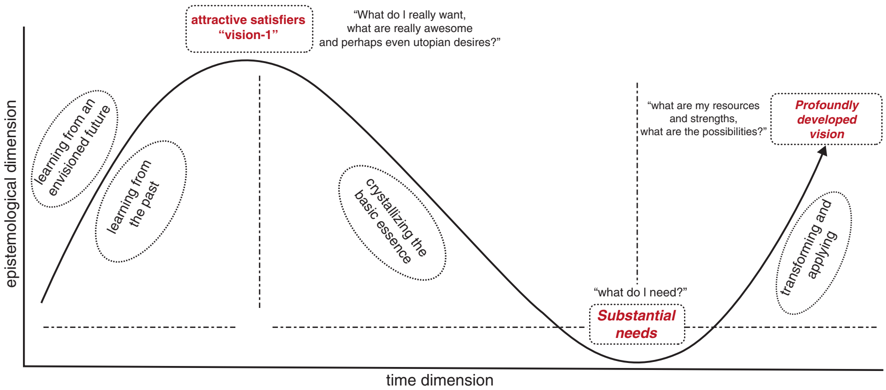

Fig. 1 Wavelike process of three steps and their respective outputs

satisfiers, which are not only visionary but even illusionary as they could not be realized whatsoever. Within this step 1, profound knowledge about the future best self is created that can be classified as satisfier knowledge as well as self-transcending knowledge. Explicit satisfier knowledge includes primarily knowledge about dreams, wishes, and ideas. Satisfiers are articulated and externalized when answering the question "what do I really want?". Step 1 puts individuals and even whole social systems into the positive emotional attractor PEA (Boyatzis et al., 2013a, b), which is also important to identify the main aspects of the future ideal self. This enables the creation of self-transcending knowledge. Self-transcending knowledge can be described as a third kind of knowledge besides the established concepts of objective explicit knowledge and subjective tacit knowledge and defined as tacit knowledge prior to its embodiment that describes the ability to sense and see emerging opportunities before they become manifest (Scharmer, 2001, p. 139). Self-transcending knowledge is created when a person or a social system transcends the existing boundary and is evolving to "the next level" (of development). Therefore, it is strongly connected with the highest possible future self and refers "to a territory of knowledge formation that is upstream from both explicit and tacit-embodied knowledge" (Scharmer, 2001, p. 139). So the generation of self-transcending knowledge is strongly enabled by the approach of learning from an envisioned future. The first upward movement enables creativity, phantasy, fun, joy, PEA, thinking out of the scope, transcending existing boundaries, detaching from restrictions and impossibilities, future orientation, solution orientation, and hence a firework of exciting, innovative, and fascinating ideas and satisfiers.

In the *second step*, the underlying essence of the satisfiers and the vision-1 is crystallized. The downward movement of this wave enables the emergence of substantial needs as a second discovery within the process of developing a profoundly developed and reflectively generated vision. This step can be seen as a form of an abductive reasoning process as described, for example, by Peirce (1974) as well as a hermeneutical step. From a knowledge-based point of view, this step focuses on the implicit part of vision-1 and the satisfiers and aims at making it explicit and visible. Within step 2, explicit need knowledge about substantial needs is strongly enabled to emerge. Need knowledge can be created and externalized when answering the questions "what do I need for a fulfilling life and a fulfilling future?" and "why do I desire the imagined future?" This type of knowledge is one of the critical factors by which the future best self is defined or characterized.

The *third step* involves implementing a deeply developed and reflected vision in the world in such a way that it is achievable. So here it is about decisions and about actions and about the so important side of acting within the definition of knowledge as capacity to act. In doing so, the consequences for others in achieving this vision are also considered and reflected significantly. This focuses on the common good and phronesis, which are also key components of the future best self. Within step 3, practical wisdom (phronesis) is enabled to emerge. Nonaka used the concept of phronesis (practical wisdom) which builds on Aristotle's distinction between three types of knowledge: episteme, techne, and phronesis. He describes phronesis as the "high quality tacit knowledge acquired from practical experience that enables one to make prudent decisions and take action appropriate to each situation, guided by values and ethics" (Nonaka & Toyama, 2007, p. 377f). The third step, which is at the same time the second upward movement in this wavelike process, enables sustainability, commitment, action guiding, viability, and innovation and thus not only the articulation and externalization of the essential aspects of the future best self but also their implementation in life. So the first upward movement energizes and drives the downward movement and this pushes (moves) the second upward movement.

To sum up, at this point we can conclude for the moment that a vision, which has been created in the form of the outlined development process, can be seen as the manifestation and externalization of one's future best self, as it includes knowledge about essential needs, knowledge about deep desires and wishes, as well as knowledge about resources, talents, and strengths of a person. At the same time, this also covers the important aspect of sustainability on the individual level as well as on the level of organizations. One of the most important definitions of sustainability was published in 1987 in the report of the UN World Commission on Environment and Development, also known as the "Brundtland report: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (UN, 1987). So sustainability is defined through its capacity to meet human needs.

3.2 Connecting the Future Best Self of the Employees with the Future Best Self of the Organization

If we continue to consequently follow what we have considered so far, then it is obvious that the boundary object for the connection between the individual level and the level of the organization is the vision itself. The vision of an organization will reflect the vision of its employees if and only if the individual visions are taken into account for the vision formation process of an organization. But how could this work as most common approaches to vision development are extremely top-down oriented and do not even take into account the personal vision of the employees. In a study by Kaiser et al. (2021), we presented a radical bottom-up approach to developing sustainable shared visions in organizations, which has already proven useful when applied in various practical projects and has led to good results. The basic idea behind this is quite simple. In order to connect the individual with the organizational level, not only the personal vision has to be created but also a personal organizational vision, which is a radical 100% transformation of all relevant aspects from the individual vision to the organizational level. A shared organizational vision is then negotiated and defined based on these personal organizational visions:

- First, the personal vision is defined as a holistic vision (Senge, 1990) of a single person. This personal vision includes all areas of life that are relevant for a specific person. It often covers the family, community, organization, and world of the person that creates the vision.
- Second, the personal organizational vision is an image of how each individual organizational member envisions the organization in which they work in the future. In the personal organizational vision, a person defines how the organization helps to fulfill the personal vision. It can be seen as an intermediate artifact that crosses the individual and organizational sphere. The personal organizational vision is shared in groups or (sub)-systems of the organization.
- Third, the shared organizational vision is developed in a negotiation process based on these personal organizational visions and defined as the vision of the entire organization that guides action for the future and provides essential orientation.

The personal vision strongly determines the personal organizational vision and the personal organizational vision strongly influences the organizational vision. Therefore, the process model of such a connection between the individual and the

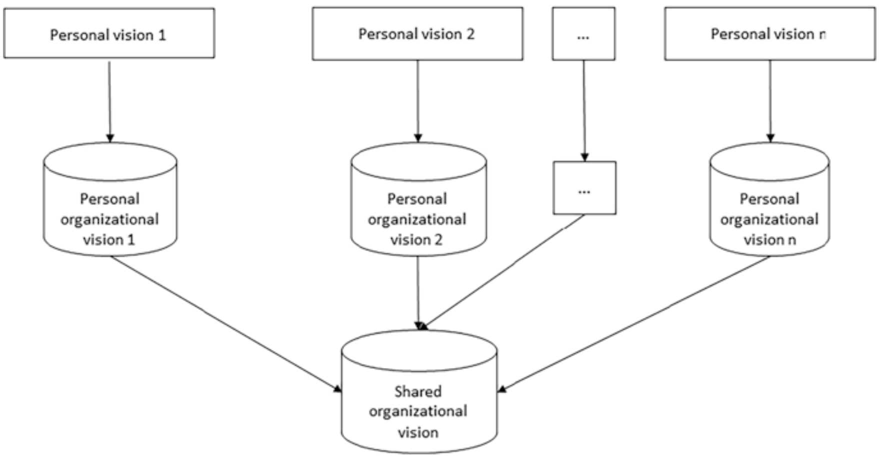

Fig. 2 Process model of a connection between the individual and organizational level

organizational level based on the vision as boundary object looks like as follows (Fig. 2).

With the modified SECI model by Nonaka and Takeuchi (2019), the knowledge flows of the development process of a shared organizational vision can be well described on both the epistemological and ontological dimensions. Along the ontological dimension, we first have the individual level on which a complete SECI process takes place within the preparation of the personal vision and subsequently the preparation of the personal organizational visions. Next comes the group level, which is used to share the developed personal organizational visions. Here, different subgroups of the organization successively create their shared vision. This is followed by the organizational level, when a shared organizational vision has been completed and is supported by all members. Finally, the interorganizational level takes place. By communicating the shared organizational vision, other organizations get a clear understanding of what the organization stands for.

Four knowledge assets—knowledge about needs, knowledge about desires and deep wishes, knowledge about values, and knowledge about resources and strengths—that are constitutive for the representation of the self build up a knowledge chain (Holsapple & Singh, 2001) as they connect each ontological level with each other. These knowledge assets have to be externalized on the individual level in order to be able to formulate a personal vision. The group level helps to externalize the personal organizational vision of each member. However, also at the group level, members of each subgroup of the organization transform these four knowledge assets to create a shared vision of the group. At the organizational level, these four knowledge assets of each subgroup enable the development of a shared

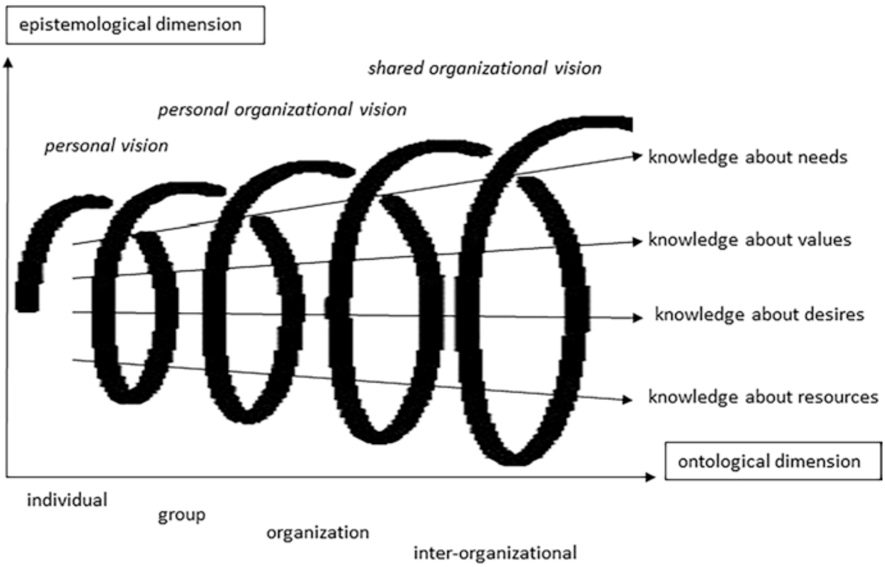

Fig. 3 Dimensions within the development process for shared organizational visions

organizational vision. Finally, at the interorganizational level, the four knowledge assets can be identified within the shared organizational vision. Thus, they serve as a very robust link of the FBS between the individual and organizational levels, as there exists a continuity and traceability along these four knowledge assets across all ontological levels and also a mutual dependency and derivability from one ontological level to the next. Figure 3 shows the epistemological and ontological dimensions within the development process for shared organizational visions.

4 Conclusion

On the first view, it seems maybe absurd and even impossible to connect calling, spirituality, and knowledge management. In this chapter, however, we have argued that this connection could be one major aspect of the knowledge management of the future. One key message of this connection could be summarized as "It is all about the self." Learning about the best future self is at the center of spirituality; capturing the essence of the best future self is the main aspect of calling. People who live their calling and are on the path to their FBS are not only healthier, happier, and more fulfilled; they are also more productive and efficient in the work they do. The more such employees a company or organization has as members, the more successful and meaningful that organization will act and be. But it is not just about the self; it is also all about knowledge and knowledge about the self. In this chapter, we have outlined that knowledge about FBS is crucial both for individuals themselves, but to the same extent also for the organizations and companies in which these individuals work. It will foster a better understanding of the journey toward individual employees' development and at the same time provide greater space for employee's FBS as a path toward the future evolution and success of the organization.

Therefore, this chapter is also a call for a much stronger connection between personal KM and organizational KM in the knowledge management of the future. Self, spirituality, and calling will be just the explicit link between the two levels of knowledge management that may already exist implicitly but have not yet been considered by either research or practice. So we can follow up on the very beginning of this chapter and conclude with the claim that the future of KM, if it aims to be a sustainable and modern knowledge management, will be a spiritual knowledge management.

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The Human Side of Knowledge Management

Delio I. Castaneda

Abstract

The emergence of knowledge management in the 1990s made it clear that information management was not enough to achieve organizational strategy. As multiple authors have documented, knowledge is information in agents' heads. Information without people is static. Individuals dynamize information and convert it into knowledge. If knowledge implies that people acquire, process, create, share, and apply knowledge, a fundamental question is why some individuals want to do it and some do not. From the organizational behavior field, human actions depend on individual variables and environmental conditions, including organizational variables. The two dimensions are equally important; however, in this chapter, only three of the most relevant human variables were described based on research results: attitudes, self-efficacy, and trust. Attitudes are evaluations people make of others, things, situations, and concepts. Many publications confirm the relationship between attitudes and knowledge management, especially in the knowledge sharing component. This chapter presented some of them. Self-efficacy is an individual's confidence in his or her abilities to execute a particular task. Self-efficacy influences how people think, feel, and act and therefore their achievements. There is a positive relationship between self-efficacy and knowledge sharing, and some studies were presented. Trust is a belief, assessment, or assumption about an exchange partner that results from the partner's expertise, reliability, benevolence, and deliberateness. Trust has a positive impact on knowledge sharing. When there is trust within a group, the intensity of knowledge sharing increases.

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Knowledge management · Knowledge sharing · Attitudes · Self-efficacy · Trust · Human variables

1 Introduction

Knowledge management is an evolving discipline (Serenko, 2021). The emergence of this field in the 1990s made it clear that information management was not enough to achieve organizational strategy. As multiple authors have documented, knowledge is information in agents' heads. In this way, information is an antecedent of knowledge. Information without people is static. Individuals dynamize information and convert it into knowledge. People analyze and integrate information based on their previous experience and expertise.

With the arrival of the information and knowledge era, the value of organizations began to shift from tangible to intangible assets, and knowledge became the primary input to achieve organizational objectives (Sahibzada et al., 2022), taking away the role of raw materials. Managing knowledge became a priority for organizations, especially those that chose to be leaders in the field. Knowledge management is a facilitator for rapid decision-making (Buhagiar & Anand, 2023) and a powerful tool that leaders have to accelerate organizational performance (Zheng et al., 2022). In its beginnings, mainly in the United States, knowledge management was addressed primarily by technology. The main reason was the accelerated development of information and communication technologies, which were excellent allies of workers to speed up the processes of searching, storing, and transferring information. This allowed the creation of powerful tools for storing and transferring information at lower costs. However, people are the ones who create, share, and apply knowledge. Therefore, technology was necessary but not sufficient to manage knowledge.

Mohajan (2016) defined knowledge as the accumulation of experiences, practical information, and skilled perception, which offers a framework for estimating and integrating new experiences and information. The importance of knowledge in the organizational context was summarized by Davenport and Prusak (2001), when they affirmed that the main source of creation of a company's competitive advantage resides fundamentally in its knowledge, or more specifically, in what the organization knows, in how individuals use what they know, and in their ability to learn permanently. Knowledge as a strategic resource and a key contributor to achieving a competitive advantage pushes a search for new metaphors to supply the attributes needed in constructing a new framework of knowledge management (Bratianu & Bejinaru, 2019). Managing organizational knowledge is possible in the context of workers who learn and share their knowledge for the generation and improvement of services and products of institutional value. Knowledge and other capabilities of people within an organization are important indicators of organizational competitiveness (Pfeffer, 1994). Although individual knowledge is an important organizational resource, it is the collaborative knowledge in an organization that determines its sustainable competitiveness (Hoops & Postrel, 1999).

If knowledge implies that people acquire, process, create, share, and apply knowledge, a fundamental question is why some individuals want to do it and some do not. From the organizational behavior field, human actions depend on individual variables and environmental conditions, including organizational variables. These two dimensions are equally important; however, in this chapter, only three of the most relevant human variables will be described based on research results: attitudes, self-efficacy, and trust.

2 The Human Component of Knowledge Management

Knowledge is defined as information processed in people's brains. It was thought that information was processed in the same way by all people, which meant that the sense was the same for all. That is an oversimplification. Knowledge has three fundamental forms: rational, emotional, and spiritual (Bratianu & Bejinaru, 2020). Rational knowledge is explicit, while the emotional and spiritual knowledge is tacit (Nonaka & Takeuchi, 1995). Today, it is known that cultural differences and personal learning histories, as well as mood, influence meaning. This explains why two individuals perceive the same information with personal bias and may differ in the semantic domain. In summary, information is static, and knowledge is dynamic.

Each company has vast amounts of information that has not yet become knowledge because the workers do not know it. If workers do not know the information, there are no learning processes and therefore lack the use of it. Knowledge is an invaluable resource for achieving the organizational strategy. Knowledge is the foundation of an organization's competitive advantage.

The speed of global information production is increasing, and it is becoming difficult for organizations, through their workers, to identify, capture, and share all that is considered relevant. An alternative is to prioritize the knowledge acquired from the environment. Knowledge is valuable if it contributes to the achievement of organizational objectives or if it is unique, that is, the organization has it and not the competitors. This knowledge contributes to differentiation. Knowledge is dynamic and needs to be shared to become valuable in the organization. The main objective of knowledge sharing is the mutual knowledge exchange among organizational members (Castaneda & Toulson, 2021).

Yesil and Dereli (2013) conceptualize knowledge sharing as the exchange and transfer of relevant information and work know-how as well as collaborating with others in finding the solution to organizational problems. Knowledge sharing refers to activities for capturing and promoting knowledge transfer to others (Eletter et al., 2022). Knowledge sharing allows organizations not only to ensure a continuous flow of significant knowledge but also to retain positive connections within the organization (Cano-Kollmann et al., 2016). Knowledge sharing gives work meaning to a worker (Avila & Castaneda, 2015). Some psychological factors affect the knowledge sharing behavior of employees in an organization. In this chapter three are presented: attitudes, self-efficacy, and trust.

3 Attitudes

Attitude is a mental position taken toward a topic, person, event, object, or product that influences a person's feelings, perceptions, learning processes, and behaviors (Stevens et al., 2005). Attitudes are evaluations people make of others, things, situations, and concepts. Attitudes form a cognitive map in individuals to interpret the world and respond in that direction. Holding a positive attitude can lead to a wide range of pro-attitude actions (Bae & Yan, 2023).

According to the attitudinal theory, attitudes precede and help to predict work behaviors (Jaramillo et al., 2011). The Society for Industrial and Organizational Psychology (2016) stated that job attitudes might include engagement, job satisfaction, job involvement, organizational commitment, and perceptions of support and fairness. Some studies have probed the relationship between attitudes and performance (Edmans, 2012; Harrison et al., 2006). Job attitude captures the evaluations employees make about their work environment (Wosnyj et al., 2022).

If knowledge management attitudes in workers are known, they contribute to predicting knowledge management actions. In the same direction, attitude is essential in understanding the knowledge sharing behavior. According to some authors like Wagner (2021), an attitude has three components: affective (feelings or emotional reactions toward the object), cognitive (beliefs about the object), and behavioral (overt actions or intentions toward the object). For instance, if a worker has a negative attitude toward knowledge sharing, from the cognitive component of the attitude, the person may have negative thoughts, ideas, or beliefs about the implications of knowledge sharing. Some workers think that sharing knowledge makes them vulnerable and less indispensable in the organization. The organization should tell workers that there is no intention to dismiss them. Distorted thoughts are corrected with credible information from trustable people. From the affective component of the attitude, the worker may have negative emotions or feelings when he or she is sharing knowledge. This can happen due to an individual's likes or a low competence for sharing knowledge.

Concerning the behavioral component of the attitude, it may happen that the worker not only has thoughts about sharing or not sharing knowledge, but also previous bad experiences sharing knowledge, and then a low intention to share it again. One of the theories that have contributed to the understanding of attitudes is the theory of planned behavior, which is a development of the theory of reasoned action. For Fishbein and Ajzen (1975), attitudes are evaluations influenced by beliefs. According to the theory of reasoned action, the attitudes that employees develop associated with a topic lead to motivations to engage in a behavior (intentions), which in turn lead to actual behaviors (Ajzen, 1991). A belief relates the object to certain attributes. According to these two theories, a person's attitude toward an object or concept is determined by evaluations of the associated characteristics, as well as by the strength of the evaluations.

Beliefs are a set of personal ideas that change depending on the interaction with the environment, with other people, and on one's reasoning. Beliefs are important because they help humans define their world and guide their behavior (Ajzen, 2002). Wasko and Faraj (2005) found that individuals share knowledge when they believe that doing so increases their reputation. Similarly, Bock et al. (2005) argued that an individual's beliefs about the cost and benefits of sharing knowledge influence the effective behavior. When the organization associates knowledge with reputation but does not encourage knowledge sharing, then workers perceive this behavior as inconvenient. In the same direction, Samieh and Wahba (2007) supported the relationship between the participants' beliefs, the value of organizational contributions, and the knowledge sharing behavior.

For instance, if an employee does not feel supported or is not committed to the organization, he or she may have intentions to quit (Kurtessis et al., 2017; Meyer et al., 2002). If an employee believes knowledge sharing is desirable, then his or her evaluations for this behavior will be positive, and it increases the possibility of intending to share knowledge. Multiple publications confirm the relationship between attitudes and knowledge management, especially in the knowledge sharing component (Liu & Zeinaly, 2021; Wu et al., 2022). The last authors found that attitude to knowledge sharing affected knowledge sharing intentions, in the context of technology companies in China. Other studies using the theory of planned behavior are Bock and Kim (2002) and Lin (2007).

Hislop (2003) stated that when evaluating the commitment of individuals to share knowledge, a relevant variable is attitude. Constant et al. (1994) found that a person's attitude toward sharing information is a factor that facilitates or inhibits doing so. Kwok and Gao (2005) studied the influence of some factors on attitudes toward knowledge sharing. In the first place, according to them, extrinsic motivation based on incentives did not impact attitudes toward this behavior. Second, the absorptive capacity of the firm influenced the attitude to knowledge sharing. In contrast, Maha et al. (2018) found that extrinsic and intrinsic motivation had a positive relationship with attitudes to knowledge sharing. Osterloh and Frey (2000) found support to state that economic incentives negatively affect intrinsic motivation to share knowledge. This result is confirmed by Kwok and Gao (2005). An approach that gives some light on the apparent contradiction in the previous studies comes from Chennamaneni (2006), who noted that the perception of organizational incentives had a moderate positive effect on attitudes toward knowledge sharing. However, when other variables, such as the perception of reciprocal benefits, were included in the model, the effect of incentives was weak.

Bartol and Srivastava (2002) observed that, although individual incentives can contribute to increasing knowledge sharing, the incentives that are granted for collective performance increase the feeling of cooperation and the effective knowledge sharing behavior. Wolfe and Loraas (2008) found that individuals are more active in sharing knowledge in the context of work groups where collective competitiveness is valued. Liu and Liu (2021) stated that decisions made on human capital strategies influence employee's attitudes and behavior. According to Judge and Kammeyer-Mueller (2012), evaluations, perceptions, and appraisals are defining features of job attitudes that together capture how employees make sense of their work environment and knowledge. Huang and Pham (2022) found that attitudes toward knowledge sharing moderated the relationship between career mentoring and explicit knowledge sharing. What to do when attitudes toward knowledge management are negative? The good news is that a person's attitude can be changed. However, the company or public entity must first assess whether the problem is a worker's distortion of reality or an objective judgment of multiple organizational problems.

When the attitude is negative based on distortions of the cognitive component, then the best way to correct it is through objective information from credible sources. The worker may believe that it is not important for the boss to share knowledge. If this belief is not true, then the leader should stress the importance of sharing knowledge frequently. In some cases, the worker's negative attitude toward knowledge sharing is based on facts. For instance, it is increasingly common for some workers to depend on having the knowledge to obtain contract renewal. The forms of labor contracting are increasingly precarious, and in many countries, the time of a contract is short, frequently months, and having knowledge that others do not have is an asset for knowledge workers to keep a job. All of this is detrimental to sharing knowledge and the construction of collective knowledge.

In summary, although attitude is a psychological and, therefore individual, variable, it is highly dependent on environmental factors, such as organizational policies and practices. Attitudes are based on beliefs that can be modified if they are wrong, and this can be done with objective information.

4 Self-efficacy

Human behavior is extensively motivated and regulated through the exercise of self-influence. Among the mechanisms of self-influence, none is more pervading than believing in one's personal efficacy (Bandura, 2009). Multiple studies have been emphasizing the association between self-efficacy and organizational variables like culture and organizational empowerment (Wu et al., 2023) and organizational citizenship behavior (Magdaleno et al., 2023).

Self-efficacy is defined as an individual's confidence in his abilities to execute a particular task (Chen & Hung, 2010). Self-efficacy is a generative capability in which cognitive, social, emotional, and behavioral skills must be organized (Bandura, 1997). Self-efficacy is a facilitator of creative thought (Dreymann & Strobel, 2021). Self-efficacy has three dimensions. The first, magnitude, applies to the level of task difficulty that a person believes he or she can attain. The second, called strength, refers to whether the conviction regarding magnitude is strong or weak, and the third, generality, indicates the degree to which the expectation is generalized across situations (Bandura, 1977).

Self-efficacy influences how people think, feel, and act and therefore their achievements. If an individual believes that he lacks the capacity to produce results, then he will not act to make an event happen. Two people with the same knowledge can perform differently depending on their self-efficacy. This happens because self-efficacy is not related to the number of abilities that the person possesses but to the beliefs that he or she has about what he or she can do with his or her abilities in a variety of circumstances (Cisneros & Munduate, 2000). Chen and Gao (2023) found that higher social media *self-efficacy* was strongly and directly associated with less loneliness and higher *self*-esteem.

Self-efficacy beliefs determine people's goals and aspirations. Individuals with high self-efficacy tend to expect favorable results. In the same way, this concept also influences the way how obstacles are faced. People with low self-efficacy focus on risks and costs more than on opportunities (Bandura, 2002). People with high self-efficacy minimize the value of obstacles, which enables them to exercise control in an environment with limited opportunities. Brown et al. (2005) stated that individuals with high self-efficacy focus their attention and motivation on the tasks necessary to achieve expected performance levels and persevere with the goal, despite obstacles.

Self-efficacy regulates human functioning through motivational, affective, and decision-making processes. Additionally, it influences a person's perception of self-improvement or self-weakening, perseverance in the face of difficulties, and vulnerability to stress and depression. Kavanagh and Bower (1985) found that positive moods promote self-efficacy, while negative moods reduce it. Stadkovic and Luthans (1998) stated that self-efficacy changes over time when the person obtains new information and experience in performing a task. They also stated that self-efficacy is not global, and for this reason, somebody may have high self-efficacy performing one task and low self-efficacy performing another.

When people with low self-efficacy are faced with difficult environmental demands, they behave increasingly erratically, with low aspirations and low quality of performance. Those with high self-efficacy set more ambitious goals and tend to perform better (Wood & Bandura, 1989).

According to Bandura (1977), self-efficacy beliefs are constructed from four sources of information: enactive mastery experiences, vicarious experiences, verbal persuasion, and psychological states. Enactive mastery experiences are the most influential source of efficacy information because they provide evidence about mustering whatever the individual takes to succeed. Success builds a robust belief in personal efficacy. Failures undermine it, mainly if they occur before a sense of efficacy is firmly established. A resilient sense of efficacy requires experience in overcoming obstacles through perseverant effort. Difficulties provide an opportunity to learn how to turn failure into success by managing capabilities to exercise better control over events. Knowledge of the rules and strategies for constructing effective courses of behavior provides people with the tools to manage the demands of everyday life.

Efficacy appraisals are influenced by vicarious experiences mediated through modeled attainments. Modeling serves as another effective tool for promoting a sense of personal efficacy. Through comparative social inference, the attainments of others who are like oneself are judged to be diagnostic of one's capabilities.

Therefore, seeing, or visualizing, people like oneself perform successfully typically raises efficacy beliefs in observers that they possess the capabilities to master comparable activities. The conclusion for the individual is, "if they can do it, then I can do it." However, if the worker sees the model as very different from himself, his beliefs of personal efficacy are not much influenced by the model's behavior and results.

Verbal persuasion information is conveyed in the evaluative feedback given to performers. Evaluative feedback highlighting personal capabilities raises efficacy beliefs. It is easier to sustain a sense of efficacy, especially when struggling with difficulties if significant others express faith in the individual capabilities than if they convey doubts. People who have been persuaded that they lack capabilities tend to avoid challenging activities and give up quickly in the face of difficulties.

Finally, in judging their capabilities, people rely on somatic information conveyed by physiological and emotional states as emotional knowledge (Bratianu & Bejinaru, 2019, 2020). An individual reads his or her physiological activation in stressful situations as a sign of vulnerability. High arousal can debilitate performance. Stress reactions to inefficacious control generate further stress through anticipatory self-arousal. According to Bandura (1991), the ways of altering efficacy beliefs associated with somatic information are to enhance the physical status, reduce stress levels and negative emotional proclivities, and correct misinterpretations of bodily states.

Self-efficacy is related to organizational learning in the sense of the value of members' beliefs about how well their organizational systems can perform functions and how well they can work together. The efficacy functions include organizational capabilities to discern market opportunities and future trends, generate innovative ideas, and translate them into new or improved services and products (Bandura, 1997). Self-efficacy impacts learning and performance in three ways (Bandura, 1982). The first is the goals that employees choose for themselves. Employees with low levels of self-efficacy tend to set relatively low goals. A worker with a high level of self-efficacy set high personal goals. The individuals learn and perform at levels consistent with their self-efficacy beliefs. Secondly, self-efficacy influences learning as well as the effort that people exert on the job. Employees with high self-efficacy frequently work hard to learn how to perform new tasks because they are confident that their efforts will be successful. Third, self-efficacy influences the persistence with which people attempt new and difficult tasks. Employees with high self-efficacy are confident that they can learn and perform a specific task, so they are likely to persist in their efforts even when problems surface.

Studies have shown that self-beliefs predict motivation and task performance in organizational settings (Gist, 1987). For instance, self-efficacy predicts sales performance (Barling & Beattie, 1983). There is also an association between effective transformational leadership and self-efficacy (Ehrnrooth et al., 2021). There is also a positive relationship between self-efficacy and knowledge sharing (Bilginoglu & Yozgat, 2018; Castaneda et al., 2016). Safdar et al. (2021) based on a systematic review concluded that self-efficacy is a predictor of knowledge sharing. Cabrera et al. (2006) found an association between breadth role self-efficacy and knowledge sharing. There are some studies in virtual communities in which an association between self-efficacy and knowledge sharing behavior has been found (Hsu et al., 2007; Tseng, 2007).

Kim et al. (2020) indicated that individual characteristics, such as self-efficacy, and knowledge creation self-efficacy significantly predict sharing of knowledge. Shao et al. (2015) found that hierarchical culture that focuses on efficacy was positively related to employees' explicit knowledge sharing. In addition, group culture that focused on trust was positively related to employees' tacit knowledge sharing, and their relationship was fully mediated by employees' computer self-efficacy. Runhaar and Sanders (2016) showed that some human resource practices strengthened the relationship between occupational self-efficacy and knowledge sharing.

Brooke et al.'s (2017) findings indicate that individual-related factors and environmental-related factors have a significant influence on knowledge sharing behavior. The results also reveal that self-efficacy mediates the relationships between prior experiences, social support, trust, and knowledge sharing behavior. Lee et al. (2022) stated that self-efficacy positively mediated the association between knowledge sharing and sustainable happiness. Kim et al. (2021) stated members with higher self-efficacy are more likely to share knowledge with their teammates.

Naan et al. (2019) concluded that self-efficacy had a strong positive influence on employee job performance, perceived environmental support, and knowledge sharing, while perceived environmental support and knowledge sharing positively influenced employee job performance. Mshaly and Al-Azawei (2022) showed that knowledge acquisition, knowledge sharing, and online self-efficacy were determinants of performance expectancy, and online self-efficacy was a predictor of effort expectancy.

In summary, the beliefs a worker has about his or her abilities influence the behavior of knowledge sharing. Self-efficacy is a belief that also affects if the employee undertakes a task where knowledge sharing is necessary and the persistence with which the worker performs the task.

5 Trust

Trust is a dynamic concept involving multiple stages, from initial establishment to a stable belief in others and to the restoration of it when it is undermined (Rheu et al., 2021). An individual's trust in others is focused on how they make decisions that affect him/her instead of just on how they behave (Waskito et al., 2023). Trust is dependent on the performance of service staff, the values they manifest, and the process involved in obtaining services (Tanny & Zafarullah, 2023). Trust combines several components such as rational, cognitive, and affective (McAllister, 1995). Trust is a belief, assessment, or assumption about an exchange partner that results from the partner's expertise, reliability, benevolence, and deliberateness (Cheng et al., 2008). On the other hand, distrust is defined as a lack of confidence in the other, a concern that the other may act to harm one and that the other does not care about one's welfare, intends to act harmfully, or is hostile (Jashapara, 2011).

Trust is recognized as a powerful intangible asset in the development of collaborative workplace cultures (Savolainen, 2011). Trust has been associated with job satisfaction, organizational commitment, loyalty to the firm, and ethical behavior (Nelson et al., 2023). Human resource management practices do not affect knowledge sharing directly, but they help with the generation of trust that is necessary for employees' willingness to share what they know (Collins & Smith, 2006). At the same time, trust is a fragile, intangible asset. It can be built or broken by an individual, but he or she alone cannot utilize it or carry its unfavorable consequences (Savolainen & Lopez-Fresno, 2013).

According to Rempel et al. (1985), trust has three components: predictability, dependability, and faith. Predictability concerns the consistency of an individual's action or performance over an extended period. Dependability is a belief in one's dispositional characteristics engendered from an accumulation of past experiences. Faith is a belief about the future behaviors of another person. Sako (1992) proposes three trust types: contractual trust, competence trust, and goodwill trust. Contractual trust is based on adherence to agreements and promises, competence-oriented trust is based on the competent performance of assigned roles, and goodwill trust is based on a belief in fairness and mutual commitment. Zalmalson et al. (2022) indicated that the presence of social cues is more likely to enhance users' social perceptions when they perceive the website as trustworthy. Pino et al. (2022) proposed a mediating effect of company trustworthiness in the relationship between the framing mode of a company's messages and consumers' intentions and behaviors toward that company.

For Mayer et al. (1995), trust is an amalgam of a person's belief in another's ability, benevolence, and integrity. Ability refers to one's skills or competencies to complete a given task successfully. Benevolence describes whether the trusted party's intention aligns with the trustor and is benevolent. Integrity concerns morality and a sense of justice. For these authors, trust is the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party. The importance of interpersonal trust grows in knowledge sharing because employees must let themselves be vulnerable to others.

Chen and Hung adopted Mayer et al.'s (1995) definition of trust, suggesting that interpersonal trust in others' abilities, benevolence, and integrity increases the desire to give and receive information, resulting in improved performance of distributed groups, which creates and maintains an exchange relationship. Trust propensity is important because it not only contributes to the formation of trust but also establishes the initial level of trust before to any knowledge of the trustee (Westjhon et al., 2022). Rotter (1967) defined interpersonal trust as an expectancy by an individual or a group that a word, promise, or verbal or written statement of another individual or group can be relied upon. Interpersonal trust can also be defined as a person's willingness to depend on another person's actions that involve opportunism (Williams, 2001). Aruoren et al. (2021) conceptualized organizational trust as an employee's belief that a co-worker, manager, or supervisor, and the organization at large will take actions that are beneficial to him. Organizational trust can be both horizontal and vertical. Horizontal trust refers to trust among coworkers within an organization, while vertical trust refers to trust between employees and their supervisors as well as the organization in general.

Trust in the leader and the organization and commitment are necessary for the successful attainment of the leader's vision. Siegel et al. (1995) suggested that organizational commitment can be preserved if trust has been established with employees. Lo et al. (2021) showed that top management support has a positive impact on trust and that trust has a positive impact on knowledge sharing. Nadeem et al. (2020) found that trust (cognitive-based trust and affective-based trust) moderates the relationship between shared goals and knowledge hiding behavior. Trust in management is one of the main factors influencing employees' decision to share knowledge. Leaders are responsible for knowledge sharing, guidance to learning, motivating and commitment, as well as creating an open, trustful climate (Savolainen & Lopez-Fresno, 2013). Leadership by trust can be defined as a leader's ability, intellectual resources, and skill to enable interaction, cooperation, and productivity (Savolainen, 2011).

Trust is strongly associated with the belief that other people will not use what the worker has for their benefit. Therefore, trust is a result of two contradicting interactions: on the one hand, there is a fear of losing one's own value; on the other hand, there is a desire to collaborate (Smaliekiene et al., 2017). There is a substantial body of research showing that trust predicts risk-taking, task performance, citizenship behaviors, information, and knowledge sharing, the last one central in knowledge management initiatives.

Trust is an intangible, relational asset for cooperation between people and a managerial resource and skill for knowledge sharing and creation and for developing human intellectual capital. Chowdhury (2005) states that when there is trust within the group, the intensity of knowledge sharing increases. A trusting person would be more likely to provide useful knowledge to others as trust facilitates effective knowledge sharing. Trust does not consist only of people's trust in others but also of their behavior and willingness to use knowledge to influence future actions.

Trusting relationships lead to greater knowledge sharing, and trust enhances innovative behavior in an organization because it reduces the levels of internal control and makes the organizational structure less rigid (Block, 2013). Abili et al. (2011) showed that trust has a direct effect on the process of communication in the organization, and this in turn, influences the amount of knowledge sharing within organizations. Khyzer et al. (2009) deduced that trust, perceptions, and willingness to share influence online participants' attitudes toward knowledge sharing. When a relationship is based on trust, people are more willing to share knowledge. Shahhosseini and Nadi (2015) analyzed the association between organizational trust and knowledge sharing among 340 teachers and found that organizational trust had a positive and significant effect on knowledge sharing. Aruoren et al. (2021) results indicate that organizational trust is positive and significantly related to both knowledge sharing and organizational justice and that organizational trust mediates the relationship between knowledge sharing and organizational justice.

Jawadi (2010) suggested that trust in common goals depends on information shared by members of groups, and especially their willingness to share knowledge. Jarvenpaa et al. (2004) analyzed the interdependence between trust, knowledge sharing, and cohesiveness and identified an interaction effect between trust and knowledge sharing, suggesting that trust depends on the situation's structure. Khanifar et al. (2020) showed that trust has a direct, positive effect on knowledge sharing and has an indirect significant positive impact on a collaborative culture. Sahibzada et al. (2022) found that trust has a significant and positive effect on three knowledge management processes: acquisition, sharing, and utilization.

In summary, trust is a belief with a strong influence on knowledge sharing. This belief is influenced by the behavior of the leaders and in particular by what the workers observe and listen from leaders about knowledge sharing.

6 Conclusions

A line of knowledge management has been dedicated to studying the human and organizational factors of the creation, exchange, and application of knowledge. Knowledge management has developed tools for storage and electronic transfer of information; however, this information requires individuals to process it, build it collectively, and generate applications of organizational value.

In this chapter, three of the fundamental human variables to strengthen knowledge management have been documented. These variables are attitudes, self-efficacy, and trust. All of them have been researched, and there are hundreds of publications in the academic literature documenting their value for knowledge management. However, the role of psychosocial variables in knowledge management is not yet a predominant line in the field's literature. What is documented in this chapter is expected to contribute to strengthening the understanding of the role of attitudes, self-efficacy, and trust in the effectiveness of knowledge management interventions, with a focus on knowledge sharing.

From the attitudes, it can be concluded that the degree of favorability that a worker has toward transferring knowledge directly influences the effective behavior of knowledge sharing. Attitudes can be changed so that if there are incorrect beliefs in the individual about the organizational conditions for sharing knowledge, these can be corrected with objective information from credible sources.

Self-efficacy, that is, the belief that a worker has about their ability to create, exchange, and apply knowledge, is another relevant variable in effective knowledge management. The degree of self-efficacy influences the confidence with which an employee undertakes activities related to knowledge management as well as the scope of the challenges associated with knowledge and the persistence to face adversities of the environment.

Finally, the trust that a worker has in his leaders and colleagues marks the beginning and continuity of the flow of knowledge that he shares. The lack of trust is one of the most relevant variables that explain the lack of knowledge sharing.

In conclusion, organizations should not only direct their efforts toward technological updating but also to promote trustworthy environments, with transparent leaders and objective information that favor trust, self-efficacy, and positive attitudes of workers associated with knowledge sharing. This should be a line of work for researchers and practitioners in knowledge management for the following years.

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Unlearning as a Future Challenge for Knowledge Management

Clara Cubillas-Para, Juan Gabriel Cegarra-Navarro, and Anthony Wensley

Abstract

Knowledge management (KM) practitioners have studied the processes through which knowledge is acquired, distributed, and used. However, they have generally not considered the fact that before learning something new, organizations have to revise, update, or, indeed, actively remove outdated, incorrect "knowledge." In this regard, some researchers have shown the imperative need to analyze the concept of unlearning as a process that allows companies to regenerate, revise, update, or set aside existing knowledge that is no longer useful in its current form. The concept of unlearning has evolved from being seen as something negative (getting rid of knowledge) to something positive (updating knowledge). During this evolution, different classifications of the concept of unlearning have emerged: first, from the point of view of the causes of unlearning (accidental versus intentional) and, second, from the levels of execution of the process of unlearning (i.e., individual, group, or organizational). This chapter aims to highlight these different points of view with respect to the concept of unlearning, as well as to introduce the term "unlearning capability" as a challenge for future research on knowledge management. In addition, this chapter analyzes the dynamic view on unlearning, exploring the theoretical and practical challenges for knowledge management research. New lines of research and suggestions are proposed to knowledge management practitioners and researchers.

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Keywords

Unlearning · Forgetting · Organizational dynamic capability · Unlearning capability · Knowledge management challenges

1 Introduction

When analyzing organizational knowledge, knowledge management (KM) practitioners have concentrated on conducting research into the way knowledge is created, distributed, and accumulated. This has resulted in a predominantly static view of KM; as a result, relatively little attention has been paid to the processes through which organizations update their knowledge or set it aside before (re)learning something new. Analyzing these processes seems particularly important for KM professionals as, under an open-system paradigm, organizations are active actors that relate and respond to turbulent and volatile environments (Lendowski et al., 2022), adapting to them within the bounds of their resources and capabilities (Makkonen et al., 2014). This implies that organizations not only create and accumulate knowledge but also update or set aside mental models, routines, habits, or various types of knowledge structures when they need to adapt to new situations. This process is known as organizational unlearning (Becker, 2010; Kim & Park, 2021; Lyu et al., 2020; Morais-Storz & Nguyen, 2017; Zhang & Zhu, 2021).

The concept of unlearning has drawn criticism in the literature, with authors questioning its relevance in organizational management research (Howells & Scholderer, 2016), the degree of intentionality implicit in the concept (Fernandez & Sune, 2009; Holan & Phillips, 2004; Klammer & Gueldenberg, 2019) or the level in which it takes place (Cegarra-Navarro et al., 2021b; Cegarra-Navarro & Wensley, 2019; Matsuo, 2020). Nonetheless, research has identified the significance in terms of positive organizational outcomes when organizations need to adapt to changing environments (Cegarra-Navarro & Wensley, 2019; Fiol & O'Connor, 2017). Thus, adopting the approach proposed by Cegarra-Navarro and Wensley (2019), the concept of unlearning can be defined as *an intentional and conscious process initiated by individuals within an organization, taking place at the individual, group, and organizational levels.*

Even though it is supposed to be the source of competitive advantage for organizations, unlearning may have the opposite effect as new information can turn out to be false, and new behaviors, habits, or routines can be harmful, inappropriate, or fragile (Starbuck, 2017). Therefore, unlearning may not improve organizational performance if companies are unable to critically investigate their existing "knowledge" at a specific moment in time and further investigate its consistency with potential new knowledge (Hedberg, 1981; Klammer & Gueldenberg, 2019). Thus, unlearning should be understood in a broader context. To the extent that unlearning involves the removal of knowledge and its replacement by other knowledge, procedures must be in place to ensure that the replacement knowledge is appropriate for the evolving context (internal and external) within which the organization operates. As a result, this chapter argues that unlearning must be viewed as a *dynamic* *organizational capability*, meaning that having the organizational capability to unlearn successfully will likely provide the organization a competitive advantage over similar organizations that have not developed such an organizational capability.

As noted previously, unlearning has evolved from being seen as something negative (getting rid of knowledge) to something positive (updating knowledge). During this evolution, different classifications of the concept have emerged (Holan & Phillips, 2004): first, from the point of view of the causes (accidental versus intentional) and, second, with respect to the levels of its execution (i.e., individual, group or organizational). This chapter aims to highlight the different points of view with respect to the concept of unlearning. Furthermore, the concept of unlearning capability is explored as a potential enhancement of KM research to act as a basis for developing more flexible and dynamic models of KM.

2 Unlearning

Learning and unlearning are activities that take place within organizations, which facilitate/drive organizational change allowing companies to improve their knowledge base over time (Tsang & Zahra, 2008) and hence change their response(s) to their external environments. Organizational learning refers to the process through which companies acquire new knowledge and routines, potentially facilitating changes in the behavior of the organization's individuals (Tsang & Zahra, 2008), and hence the organization itself. For Huber (1991), the four stages of organizational learning are knowledge acquisition, information distribution, information interpretation, and corporate memory. However, the author does not consider that before they can learn something new, people in companies frequently need to unlearn what they believe they already know (Joo et al., 2022; Starbuck, 2017). In this regard, in order for individuals to even consider changing their behavior, it requires recognition by the individuals that such changes are necessary. The organizational consequences of failing to recognize outdated or misleading "knowledge" have been amply demonstrated by Christensen et al. (2018).

In their study, Holan and Phillips (2004) found that managers faced two challenges: new information was forgotten, and old information could not be forgotten even after formal rules had changed and the new expected behaviors and routines had been "established." Despite being inappropriate or even potentially harmful to the organization, the old behaviors remained. These results manifest that previous patterns had not been erased since they were active once more after the new patterns were forgotten. Thus, the authors contend that it is impossible to discern between forgetting and learning in real-world situations. The efficacy of organizational learning processes is also significantly impacted by the process of unlearning, which takes place before, during, and after learning activities have begun.

The idea of double-loop learning, which is the learning process that occurs when errors are discovered and fixed and, in addition, when a company examines and modifies its current policies, procedures, goals, and rules, is strongly related to the concept of unlearning (van Oers et al., 2023). Double-loop learning allows a transformation of the organization's knowledge base and/or incorporate specific competencies into new business processes and capabilities. It is, therefore, part of both generative learning, which can boost an organization's capabilities, and strategic learning, which enables companies to apprehend and understand changes in their environment and hence broaden the range and/or nature of goals they can pursue as well as the resources and options they have to accomplish these goals.

It is often the case that employees may be "blinded" by their current practices, beliefs, or assumptions and fail to perceive changes in their environment and therefore be reluctant to accept new information and facts (or even recognize their existence). Even if they do perceive or receive new knowledge, they may struggle to absorb it and therefore find it difficult to act if the new knowledge is inconsistent with or contradicts their preexisting ideas. By unlearning, employees will understand that their perception is driven by their beliefs and practices. Thus, if those practices and beliefs result in appropriate outcomes, they will continue to use them, but to the extent that they do not produce appropriate outcomes, they will need to revise/unlearn some existing beliefs, assumptions, knowledge, and practices or behaviors that are based on or derived from them (Starbuck, 1996). Additionally, by altering cognitive models, unlearning assists managers in reorienting organizational ideals, norms, and behaviors (Cepeda-Carrión et al., 2015). Therefore, organizational unlearning will take place if companies actively support the adoption and implementation of new knowledge structures, thus resulting in the development of new procedures, routines, and behaviors.

2.1 Unlearning vs Forgetting

Hedberg (1981) introduced the concept of organizational unlearning describing it as the process through which "learners" discard outdated knowledge or routines to create space for new knowledge (Cegarra-Navarro & Wensley, 2019). Since then, many authors have provided their own analyses of the concept, emphasizing in the process some important differences with the forgetting process. In this regard, Fernandez and Sune (2009) defined the term "organizational forgetting" as the "(un) intentional loss of knowledge in organizations at any level."

Based on the unlearning definitions developed in the research literature, the concepts of unlearning and forgetting may be considered to refer to two different processes that must be distinguished based on the intentionality of the action. On the one hand, there is a stream of research that identifies unlearning or forgetting as an accidental or unwanted loss of knowledge that results in a decreased stock of organizational knowledge (Jain, 2023). On the other hand, an alternative research stream identifies unlearning as an intentional process that precedes organizational learning (Cepeda-Carrión et al., 2015). This latter perspective supports the proposition that before acquiring and assimilating new knowledge, it is crucial to set aside some routines, habits, values, procedures, and structures, and that is to unlearn them (Fernandez & Sune, 2009).

Holan and Phillips (2004) classified organizational forgetting based on the intentionality of the process and the novelty of knowledge. According to the authors, there are four types of organizational forgetting: dissipation, suspension, degradation, and purging (See Table 1).

- *Dissipation* implies accidentally forgetting new knowledge (for instance, because the company has failed to consolidate new knowledge).
- *Suspension* is related to the intentional forgetting of new knowledge (for example, innovations that have been abandoned).
- *Degradation* is related to the accidental forgetting of established knowledge.
- *Purging* relates to the purposeful forgetting of established knowledge, referring to this term as *unlearning*.

Fernandez and Sune (2009) proposed the "four-type taxonomy of organizational forgetting," classifying organizational forgetting according to the codification of knowledge and the intentionality of the process (see Table 2). Based on their classification, organizations can (1) intentionally forget codified knowledge (i.e., replacing old procedure handbooks with new ones), (2) intentionally forget non-codified knowledge (i.e., changing organizational culture), (3) unintentionally forget codified knowledge (i.e., loss of documents), and (4) unintentionally forget non-codified knowledge (i.e., poorer workers' performance as a result of vacation periods).

For Klammer and Gueldenberg (2019), what differentiates forgetting from unlearning is the intentionality and the depth of knowledge. In this regard, when the action is intentional, it can result in technical unlearning (if the loss of knowledge is shallow, for instance, it has to do with systems or procedures) or in adaptive unlearning (if the loss of knowledge is deep, for example, emotions and organizational culture). In this context, technical unlearning relates to a solution for relatively well-defined difficulties that can be solved quickly and in a fairly straightforward fashion. For example, a system or procedure is modified in such a way that it can be enacted without changing underlying beliefs, values, or assumptions. Contrarily, adaptive unlearning requires people to examine deeply embedded knowledge, values, assumptions, or beliefs, which may be hard to identify, may be difficult to change, and may require considerable effort and time to expunge fully.

Table 1 Ways in which organizations can unlearn based on Holan and Phillips (2004)

	New knowledge	Established knowledge
Accidental	*Dissipation* Company's inability to retain a piece of new knowledge still not integrated in the organizational memory	*Degradation* Accidental loss of stored organizational knowledge over time
Intentional	*Suspension* Removing some piece of new organizational knowledge before it is inserted in the organizational memory system	*Purging* Some pieces of established knowledge are removed from the organizational memory system on purpose—*unlearning*

Table 2 The four-type taxonomy of organizational forgetting proposed by Fernandez and Sune (2009)

Intentional forgetting of codified knowledge For example, the replacement of old procedure handbooks	*Unintentional forgetting of codified knowledge* For example, a loss of documents
Intentional forgetting of non-codified knowledge For example, a change in corporate culture	*Unintentional forgetting of non-codified knowledge* For example, poorer performance because of vacation periods

Based on these classifications, organizational unlearning can be considered as the intentional, voluntary, and conscious process involved in putting aside non-codified knowledge to make room for new knowledge (Cegarra-Navarro & Wensley, 2019; Delshab et al., 2021; Fernandez & Sune, 2009; Lyu et al., 2022; Tsang & Zahra, 2008; Zhang & Zhu, 2021). In contrast to forgetting, which may have a detrimental influence on a company's production capacity, productivity, or quality (Fernandez & Sune, 2009), intentional unlearning may give businesses a chance to adapt to change (Cepeda-Carrión et al., 2015; Orth & Schuldis, 2021; Zhang & Zhu, 2021), and thus, potentially improve its performance or, at least, prevent degradation of performance.

2.2 Intentional Unlearning

From an organizational learning perspective, organizational unlearning is one of the four behaviors (knowledge acquisition, knowledge sharing, knowledge utilization, and organizational unlearning) that constitute the organizational learning process (Lyu et al., 2022). However, much of the prior research in knowledge management has focused on the first three stages and, more generally, on knowledge accumulation. Organizational unlearning, also known as intentional unlearning (Cegarra-Navarro & Wensley, 2019), refers to the conscious and deliberate process through which companies set aside and update their outdated knowledge, routines, habits, process, or procedures to foster organizational change (Cegarra-Navarro & Wensley, 2019; Cegarra-Navarro et al., 2016a, b, 2021a; Tsang & Zahra, 2008). In organizational practice, unlearning entails choosing actively not to act or think in "old" ways (Stenvall et al., 2018). Therefore, organizational unlearning is one of the best mechanisms for companies to deal with turbulent and dynamic environments as it allows them to be more flexible and avoid rigidity, which is critical for enterprises to remain competitive when facing such environments (Lyu et al., 2022).

The unlearning process is initiated by people within the organization (Cegarra-Navarro et al., 2021b) taking place at individual, group, and organizational levels (Cegarra-Navarro & Wensley, 2019). Therefore, organizational unlearning requires individual unlearning, which is the personal awareness that some items of knowledge possessed by individuals are no longer useful or valid (Tsang & Zahra, 2008). According to Starbuck (1996), doubt is the primary catalyst for unlearning within an organization. The author claims that there are at least eight different types of doubt stimuli that might serve as a trigger for employees at the organization to unlearn. These are the following:

- "It isn't good enough": This viewpoint relates to dissatisfaction since it may be society's primary source of doubt.
- "It's only an experiment": Even if they believe their practices are the best, people experimenting with new methods often surprise themselves.
- "Surprises should be question marks": Unlearning opportunities can be found in both pleasant and unexpected disruptions. In this situation, employees can use disruptions to identify where their beliefs are weak and then adopt strategies to make them stronger.
- "All dissents and warnings have some validity": As there are various viewpoints on the same subject, dissents and warnings might encourage people to reconsider their assumptions and practices.
- "Collaborators who disagree are both right": Different experts' beliefs are frequently sounded in a piece of truth. Finding the common point between them instead of judging which view is incorrect is the best course of action.
- "What does a stranger think strange?": Even if they could offer "ignorant" advice, strangers can provide fresh ideas.
- "All casual arrows have two heads": According to this point of view, even though one individual may believe that A influences B, it is also important to consider how B might affect A. So, it is crucial to look for feedback pathways.
- "The converse of every proposition is equally valid": This perspective believes that dialectic reasoning can be used to reject tacit assumptions in most situations. The dialectic approach argues that practically every claim has a strong counterargument that may be used to reconcile it.

The above stimuli may be considered to be unlearning "enablers." However, for unlearning to occur, companies need structures and processes that facilitate and support the creation of awareness, the abandonment of old habits, and the (re)learning process. In this regard, Cegarra-Navarro and Wensley (2019) identified three contextual components that help companies to prepare the ground for knowledge updating. The first contextual factor is the examination of lens fitting, which refers to the corporate structures and processes that enable employees to assess the organizational environment and identify any policies, practices, habits, or knowledge that need to be modified. The second component, relinquishing, is developed at the group level and refers to structures and procedures that encourage and enable individuals to change their habits (for instance, creating small groups to analyze situations where they recognize that a change in habitual behaviors, routines, or procedures is needed). Finally, the consolidation of emergent understandings is the third contextual factor, which refers to providing employees permission to use the new mental models, implying unlearning at a group level. Cegarra-Navarro and Wensley (2019) support the proposition that unlearning is a dynamic process where the interaction of the contextual elements is represented by what may be termed the "unlearning cycle." Similarly, the existing research literature supports the proposal that individual unlearning promotes group unlearning, and the latter will result in organizational unlearning.

2.2.1 The Operationalization of Unlearning

Although there are criticisms of measuring a "metaphor" such as unlearning (Howells & Scholderer, 2016), several authors have already attempted to operationalize and generalize organizational unlearning, even though every organization may potentially operationalize it in a different way (Cegarra-Navarro & Wensley, 2019). Depending on the level at which it is implemented, some authors have described unlearning at the individual level, while others have suggested that unlearning occurs at the group level, and yet others have suggested that unlearning operates at the organizational level.

Tsang and Zahra (2008) highlighted the importance of individual unlearning for organizational unlearning to take place. In this context, the authors relate individual unlearning to the individual awareness of non-useful knowledge and the termination of routines. Accordingly, organizations will start the unlearning process only when individuals at organizations are aware of unproductive knowledge and useless or inappropriate routines.

Other authors have operationalized unlearning from a group perspective. For instance, Akgun et al. (2006) operationalized unlearning as a process taking place at a team level, measuring it as changes in "team belief" and "team routine." For their part, Cegarra-Navarro et al. (2021a) developed an unlearning context to measure the unlearning of members of an organization. Specifically, they created an unlearning context for airport staff, measuring unlearning at a group level (staff of the airport), and assessing changes in workers' knowledge structures to implement measures and modifications in passenger services.

Yang et al. (2014) argued that unlearning occurs not only at a group level but also at an organizational level, operationalizing unlearning as the modifications in the strength of ties between firms and suppliers/customers. The authors used the items regarding changes in beliefs and routines to measure unlearning, following Akgün et al. (2007). Sheaffer and Mano-Negrin (2003) operationalize unlearning under "unlearning capability," measuring it at an organizational level. For the authors, unlearning can be assessed with three items related to the organization's initiative to change its strategic objectives, rethink the business theory after achieving goals, and the administrative orientation of the firm. Lyu et al. (2022) operationalized unlearning through items that relate to the organization as a whole (i.e., our company is ready to abandon outdated beliefs and routines; our company provides a favorable context for changing obsolete beliefs).

More recent studies have also proposed three distinct subprocesses to operationalize the unlearning process. According to Fiol and O'Connor (2017) and Reese (2017), *destabilization, discarding*, and *experimenting* are the three main operationalizations of organizational unlearning. The three subprocesses refer to company leaders' steps to unlearn. Drawing on several unlearning studies, Cegarra-Navarro and Wensley (2019) discussed three subprocesses that capture the individual, group, and organizational levels where unlearning occurs. The authors provide a detailed unlearning context where the three levels of unlearning are recognized, thus giving importance to individual awareness, group relinquishing, and organizational relearning. In contrast to Fiol and O'Connor (2017) and Reese (2017), Cegarra-Navarro and Wensley's (2019) unlearning concept recognizes the dynamism of the concept.

2.3 Unlearning in the Context of Mainstream KM

When analyzing the literature on knowledge management models, the models focus on creating, transforming, disseminating, or accumulating knowledge. However, while some models consider the environment's dynamism and adopt approaches that consider organizations as active entities interacting with the environment, the models neglect a crucial process: unlearning. Given that knowledge management models are particularly important for adequately managing organizational knowledge, it is important that they capture how organizations discard existing knowledge or update it to adapt to the environment's dynamism.

The comprehensive concept of knowledge creation and the management of "serendipity" are the foundations of the SECI model developed by Nonaka and Takeuchi (1995). This model is based on knowledge creation, describing how explicit and tacit knowledge can be produced, transferred, and recreated in organizations through socialization, externalization, combination, and internalization stages. Wiig (1993) developed a model for building and using knowledge, focusing on knowledge creation, accumulation, and storage. Von Krogh and Roos (1995) model of organizational epistemology distinguishes between different knowledge levels (individual and social), focusing on knowledge sharing.

Choo (1998) proposed a sense-making model to analyze how informational elements can result in the accumulation and absorption of knowledge to make decisions. Other models, such as the one proposed by Meyer and Zack (1996), record knowledge acquisition, refinement, storage, distribution, and presentation as the cycle processes of knowledge creation. Some authors have also used Intelligent Complex Adaptive System models in KM research. In this regard, Bennet and Bennet (2004)'s approach considers organizational knowledge a critical resource in uncertain environments, and therefore, knowledge needs to be controlled and properly applied.

Whatever the knowledge management models, they support collaboration and creativity while assisting organizations in better using their knowledge assets. These models all account, to some extent, for the dynamic that organizations must deal with. However, speaking about knowledge generation without considering the necessity of putting aside prior information appears inadequate. Indeed, the inability to relinquish or revise past knowledge before learning can take place has been reported to be harmful to organizations. If existing knowledge is not relinquished or revised, it will likely result in confusion and, in some cases, reversion to previous behaviors, which are likely to be maladapted to the emerging situations. Thus, knowledge management models must consider that before organizations can learn something, they need to make room for new knowledge, mental models, and routines; that is, they need to unlearn.

Although the concept of unlearning has been widely discussed in the literature, some critical points need to be identified, discussed, and analyzed. First, unlearning has sometimes resulted in negative organizational outcomes (Tsang & Zahra, 2008), as new knowledge and behaviors can be detrimental or misleading (Starbuck, 2017). Voluntarily giving up a routine does not imply that the new routine is better than the previously enacted routine. Therefore, one can argue that companies will find competitive advantage from unlearning if they are capable (able and competent) of discriminating what knowledge is needed at any given moment, adapting to their environment and stakeholders, and maintaining this capability over time. This approach further supports the definition of unlearning as the process of setting aside or modifying the knowledge that is not useful at a given point in time (Klein, 1989) and not discarding it, as proposed by Hedberg (1981) or Klammer and Gueldenberg (2019).

To the best of our knowledge, very few studies have addressed unlearning as a capability. In this regard, Morais-Storz and Nguyen (2017) stated the need for companies to be able to unlearn and learn to be resilient without providing a definition. Authors such as Orth and Schuldis (2021) and Rodríguez et al. (2016) both assessed and referred to the concept of unlearning capability. However, they failed to clearly define the term or identify the items that could be used to measure unlearning capability. They also failed to identify the items comprising unlearning or suggest approaches to their measurement.

Attempting to address this gap, this chapter argues that unlearning is an organizational capability that reflects the collective capability of organizations to update, reconfigure, and adapt the organizational resources, capabilities, and competencies in dynamic environments. Therefore, "unlearning capability" may be defined as an organization's capability to actively replace or revise existing knowledge to reflect changes in the organization's internal or external environments. Such replacement or revision may well lead to the replacement or revision of outdated knowledge, practices, habits, and beliefs. Thus, the unlearning capability is found collectively, meaning it is reflected in organizations rather than individuals. For example, companies are likely to rely on extensive organizational memory to be able to enact appropriate routines and procedures. However, it is essential that they develop a capability to revise and replace the contents of this memory to reflect changes in the organization's internal and external environments. It should be noted that it may well be the case that in some sense, the organization already knows the appropriate response to a particular change in the external or internal environment. Relevant knowledge may be present in organizational memory but not "activated." The enactment of an organizational capability may lead to the identification and "activation" of this knowledge, so they do not need to learn it but to know when it will be needed and how they should apply it to different environments.

Second, unlearning is very difficult, even perhaps impossible, to measure in a principled way. The operationalization of unlearning is complex, which may be why KM practitioners have oriented their research to analyze other processes related to knowledge, leaving unlearning aside. Some authors have even come to consider unlearning as a metaphor. Unlearning can only be measured with a context (Cegarra-Navarro & Wensley, 2019), as it is impossible to quantify the amount of lost knowledge from one period to another (Fernandez & Sune, 2009). Thus, following the reconfiguring dynamic capabilities proposed by Makkonen et al. (2014) and the intentional unlearning context developed by Cegarra-Navarro and Wensley (2019), it can be argued that unlearning as a capability should be operationalized through a three-capability context where the three primary outcomes of unlearning can be found: awareness capability, relinquishing capability, and relearning capability.

Third, previous studies on unlearning have assumed that individual capabilities result in organizational competencies. By considering unlearning as a capability, one further argues that it can be the case that when organizational capabilities are enacted as proposed in this chapter, it may have an impact on individual capacities. Furthermore, the enhancement of these individual capacities may lead to further enhancement of organizational capabilities. Thus, this chapter argues that incorporating the unlearning capability into KM research and practice may lead to an enriched vision of KM practices and models that provides a focus on the dynamic richness inherent in KM and also some of the subtle interactions that take place between individuals, groups, and organizations. Both the dynamic nature of KM and inter- and intra-level interactions have not been sufficiently studied in prior KM research or represented in KM models.

3 Positive Implications for the Implementation of Unlearning in Knowledge Management Practices

It might be thought that by getting rid of a resource such as knowledge, an organization would become less efficient or even lower its absorptive capacity as a result of losing the possibility of finding synergies (i.e., desorptive capacity). However, the studies conducted in the early part of the twenty-first century have revealed that when knowledge is updated (i.e., unlearning takes place), an improvement of the competitive position happens (Becker, 2005; Carey et al., 2006; Macdonald, 2002; Mauk, 2004; Pourdehnad et al., 2006; Tsang, 2005).

It is tantalizing to consider the extent to which the internal structure of knowledge may be related to whether the deletion/addition or modification of knowledge will result in improved organizational performance and changes in the organization's absorptive capacity and agility and resilience. The link between unlearning capacity and organizational agility will be discussed below. For the time being, it is suggested that more research be conducted on what one might call the "fine structure" of knowledge. For example, as it has been noted, there are situations where during unlearning, some knowledge may be actively replaced, whereas, in other cases, knowledge may be modified. Knowledge items vary in the level of confidence that people have in them and the degree to which they are prepared to countenance their replacement. Other items of knowledge are considered to be foundational to our view of the world or be foundational to the very way in which an organization functions, the very basis of its existence one might say! One may consider knowledge to be multidimensional. As it has been indicated before, items of knowledge cannot simply be accumulated. In some cases, some items of knowledge may have to be relinquished and others modified. As a positive aspect relating to the accumulation of knowledge is that additional knowledge may not of itself be valuable to the organization, but it may assist in "activating" other knowledge. It may, in this sense, lead to an enhancement of the organization's absorptive capacity.

As noted above, among the possible positive effects of unlearning is the development or enhancement of "organizational agility," which is the company's capacity to renew, regenerate, adapt, and change quickly in the face of ambiguous situations that require improvisation (Sull, 2010; Winby & Worley, 2014). It should be noted that the current global disruptions caused by the COVID-19 pandemic and the Ukranian war provide a fertile research context to examine the nature and strength of the relationship between unlearning and organizational agility (Cegarra-Navarro & Martelo-Landroguez, 2020).

Another positive aspect of unlearning arises out of the enactment of relearning. In this vein, the literature suggests that those who can replace their outdated knowledge with a new knowledge can adapt faster and more appropriately to new situations (Abra & Roberts, 1969; Navarro & Polo, 2007; Quackenbush, 1997; Zhao et al., 2013). Relearning subsequent to making mistakes is one of the key aspects of unlearning and has been shown to help individuals in dealing with stress and achieving a desired work-life balance (Cegarra-Navarro et al., 2016a, b). For example, being able to face a new relationship or situation without previous stereotypes and prejudices may help the individuals involved to develop more appropriate relationships or respond more appropriately to different situations.

From a strategic point of view, unlearning also helps to maintain a dynamic balance between focal vision (e.g., focusing on current relevant customers' needs) and peripheral vision (e.g., understanding potential customers' future needs) (Cegarra-Navarro et al., 2016a, b; Day & Schoemaker, 2006), thus avoiding incurring the well-known strategic myopia (Levinthal & March, 1993; Levitt, 2004; Smith et al., 2010). From this perspective, it is argued that unlearning is like the accommodation capacity of the human eye. In other words, it is the lens of the organizational system, which, thanks to its elasticity, allows seeing far and near in tenths of a second, thus avoiding blind spots (Wiegand, 1999). Furthermore, relying on the same metaphor, the organizational nervous system allows for a balance to be achieved between the attention being paid to the focal vision and the attention being paid to the peripheral vision where appropriate.

Disinformation is one of the biggest concerns in democratic countries (Buchanan, 2020; Wolverton & Stevens, 2019). Behind fake news and counter-knowledge, strategies to manipulate public opinion are articulated numerous times (Thompson, 2008). In this context, the capacity to unlearn has also been related to overcoming counter-knowledge, or disinformation generated from uncertain and unverified sources of information (Cegarra-Navarro et al., 2012). Cegarra-Navarro et al.'s (2021a) study suggest that the capacity to verify the veracity of information and compare it with other sources helps to substitute false information for more reliable information/knowledge, which helps to show other people that their beliefs are wrong and to align them with new ones created through this alignment among different stakeholders.

Maintaining a balance between defensive reasoning and open-mindedness is essential for personal well-being and organizational change management. A possible way to achieve such balance is through an unlearning context that enables the individual to question those defensive routines that can be counterproductive and embrace new possibilities. In this regard, the context of unlearning moves individuals out of their comfort zones and makes it easier for them to listen effectively to other points of view that help them question their own beliefs (Cegarra-Navarro et al., 2011).

Based on previous studies, one can conclude with the idea that unlearning capacity has three complementary manifestations: (1) the capacity that every individual has to get relinquish or revise items of knowledge, (2) the necessary context for such relinquishing/revision, and (3) the new knowledge that results from exercising the capacity itself. Because these three manifestations do not always go hand in hand at the individual, group, and organizational levels, controversy arises over how to measure unlearning (Hislop et al., 2014). It should be noted that previous studies have resolved this controversy may be addressed by establishing a context that facilitates awareness and relinquishing at the individual level and relearning at the organizational level. However, as noted above, this does not invalidate the need to explore other aspects of knowledge and its measurement that may be essential to fully understand and facilitate unlearning.

4 Some Thoughts About Organizational Agility Capability (OAC), Organizational Unlearning Capability (OUC), and Technology

As noted above, it would appear to be the case that there is a clear link between organizational agility and the concept of organizational unlearning capability (OUC) that has been introduced and discussed earlier. There is an extensive literature in organizational agility spanning over 25 years and existing both in the Strategy and Information Systems literatures. This also leads us to propose a link between agility, organizational unlearning, and technology (both information technology and technology considered in a more general context). In the first place, one will consider the concept of organizational agility and trace some of the potential links between organizational agility and organizational unlearning capability.

Given that there is no one definition of organizational agility capability (OAC), one may start with the proposal reported by Tallon et al. (2019):

> Chakravarty et al. (2013) regard agility as a combination of entrepreneurial agility (an ability to anticipate and seize market opportunities that permit a firm to revise "its positioning and strategies and organize new business approaches to gain early advantages in changing conditions" (2013, p. 978)) and adaptive agility (a more defensive view of agility if firms

> seek to protect themselves or recover from a market disruption rather than seeking a first-mover advantage). (p. 223)

One can note from this definition that OAC involves, among other things, the capability of being able to change the organization as a result of changes in the organizations external environment. Thus, one may consider that possession of OAC requires that organizations are able to both sense and respond to signals provided by the external environment. This requirement is highlighted by Tallon et al. (2019):

> [O]rganizational agility has been conceptualized in different ways, and yet a consistent theme found in the literature is that organizational agility reflects sense and response capabilities. Both types of capabilities are necessary; firms are likely to struggle if either capability is limited or impeded in some way. An open question, however, pertains to the interface between sensing and responding. There is likely a time delay between sensing and responding and a tension underlying the use of scarce resources. The presence of sensing capabilities does not mean that the right response or indeed any response is sure to follow, no matter how evolved those capabilities might be. (p. 231)

In the context of our discussion above, one could like the sensing stage described by Tallon et al. (2019) to the awareness stage of the OAC. However, it may be suggested that there is at least an additional step between sensing and responding and that is the step that this chapter has referred to as "relinquishing." Furthermore, sensing must be accompanied by sense making—the signals are interpreted. In the context of unlearning capabilities, such interpretation results in the identification of potential divergence from organizational goals, thus requiring some response. In order to respond appropriately, individuals within the organization need to (re)learn.

It can be contended that the OAC literature has not addressed in sufficient depth the need and value of both unlearning and learning. It has been noted that there is a gap between sense and respond, which has implications at the individual, group, and organizational level.

Individuals need to be actively encouraged to seek out internal and external signals and question their interpretation. This may well lead to the questioning of established routines, procedures, and knowledge structures. Procedures, routines, and knowledge structures may have to be relinquished (abandoned) if they are no longer appropriate and new routines, procedures, and knowledge structures learned. The above discussion barely touches the surface of links between OUC and OAC. It would seem that there are considerable opportunities for the two related, but distinct, research agendas to cross-pollinate both conceptually and empirically.

As the title of this subsection implies, the authors are also concerned with the relationships between technology and both OAC and OUC. Many organizational routines, procedures, and knowledge structures are intimately interleaved with technologies including mechanical and information technologies. This does not mean that given a particular technology, there is only one set of procedures, routines, or knowledge structures that can be interleaved with it. Research broadly characterized as socio-technical systems established that there might well be different ways to organize the interaction of technologies, individuals, and organizations. Creating an environment that facilitates the recognition of such flexibility can certainly support

OAC. In addition, aspects relating to OUC may well enable organizations to flexibly respond to changes to their internal and external environments.

However, there are many ways in which technologies may hinder/undermine the development of OAC or OUC. It is often the case, particularly when one considers information technologies, wherein signals are filtered and constrained by the technology. Some signals may be too weak and either be ignored or not even register if the sensors are not sensitive enough. Other signals may be classified in such a way as to be ambiguous or conflate one signal with another. Thus, technologies may interfere with the awareness component of the OUC.

Perhaps more troubling procedures, routines, and knowledge structures may be deeply embedded in the technologies utilized by the organization. For example, enterprise resource planning systems (ERPs) typically embed organizational procedures, routines, and knowledge structures in code. The users of the ERP systems typically do not know the full details of the encoded procedures, routines, and knowledge structures, and even if they have some knowledge, ERP systems are very difficult to modify. Indeed, given their complexity, such modifications are liable to result in unintended consequences. Thus, it becomes very difficult to relinquish the procedures, routines, and knowledge structures embedded in the ERP. For a more extensive discussion of these issues, the authors would direct the reader toward Wensley and van Stijn (2006).

5 Concluding Remarks

As this study contends, the concept of unlearning has been debated ever since it first appeared. Despite having precise definitions, such as those provided by Cegarra-Navarro and Wensley (2019), this study discusses that unlearning should instead be considered a capability. By understanding it as a capability, an unlearning flow is created in which the company as a whole can determine what organizational knowledge is applicable in various conditions, sustaining that skill over time.

From a practical point of view, KM professionals should consider the unlearning capability, as most businesses are used to learning quickly without managing their stored traditional knowledge and procedures (Lyu et al., 2022). Adding more water to a full glass is not a good idea. Organizations must manage existing knowledge before producing new knowledge or incorporating knowledge from outside the organization. Thus, being capable of doing so seems crucial for companies to adapt successfully to environmental and organizational changes. Considering the frameworks to measure the unlearning capability, this study proposes that while traditional approaches to unlearning focus on what happens at the individual and group levels, the current approach focuses on what happens at the organizational level. There are clear relationships between individual and group unlearning and an unlearning capability within an organization that needs to be explored. Just because an unlearning capability exists to some extent within an organization does not guarantee that all individuals and groups in the organization will unlearn.

From the point of view of KM, it is important to understand the updating process through which knowledge can be updated and obsolete knowledge can be put aside in each context. Therefore, future studies within KM should address this issue. In our humble opinion, there could be two ways to execute the unlearning process. On the one hand, the renewal of knowledge would consider more radial actions, for example, the early retirement of those workers who do not adapt to digitization and the replacement of them by younger people. On the other hand, the regeneration of knowledge could lead to less radical actions, for example, the relocation of certain workers in one position or another, depending on their previous experience. It is like what happens with university teaching plans, where a professor can change the subject depending on the interest of his faculty. In summary, future lines of work should examine knowledge regeneration and renewal practices to promote unlearning.

The arguments proposed above relating to various concepts related to unlearning seem to support the hypothesis that “intentional unlearning” is indeed a “regenerative capability.” Organizations can only take advantage of intentional unlearning after awareness, relinquishing, and (re)learning capabilities have been established and enacted. All of these capabilities have a direct connection to the ideas of (1) sensing and seizing, which is the capability to take advantage of opportunities and position oneself favorably in an environment; (2) knowledge creation, which is the capability to create and absorb new knowledge continuously and to create new products or processes; and (3) knowledge integration, which is the capability to acquire and integrate new knowledge (Makkonen et al., 2014).

This paper has some limitations that must be handled. First, this work is essentially theoretical, and future research should use the empirical methodology to consider, address, and measure unlearning as a dynamic organizational capability. Furthermore, as the chapter has addressed the importance of managing existing knowledge before the new one can be introduced into the organization, future research should integrate the unlearning process into the knowledge management models. Second, although a thorough literature review has been done, the theoretical foundations of the unlearning capability may be improved with a more exhaustive literature review. Then, as the unlearning capability is essentially a new concept, the framework and items proposed and approaches to be adopted to measure them will likely require further investigation and development. Finally, future research should address additional factors influencing the organizational unlearning capability that were not considered in this study.

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Emotions and Their Relation with Knowledge Risks in Organizations

Malgorzata Zieba

> *All good managers are like good parents and good teachers. They understand the human condition, human needs, and human foibles. They understand the complexity of human motivation and that quite frequently the heart can rule the head.*
>
> *A. Furnham*

Abstract

The aim of this chapter is to analyze and present knowledge risks from the perspective of emotions. Every year, new studies are published, where novel aspects of knowledge management field are examined and tested. One of such aspects that is worth examination and exploration is the role of emotions (both positive and negative) experienced by employees and managers that can contribute to their behaviors concerning knowledge risks (e.g., knowledge hiding, knowledge loss) and, therefore, knowledge management in organizations. Examples of positive emotions are love, joy, satisfaction, contentment, interest, amusement, happiness, serenity, or awe, while the most commonly felt negative emotions are fear, anger, disgust, sadness, rage, loneliness, melancholy, and annoyance. In this chapter, the potential influence of those emotions on the behaviors related to knowledge risks will be examined. The chapter lays theoretical grounds for the future studies related to emotions and their role in knowledge risks behaviors manifested by employees and managers.

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Knowledge risks · Emotions · Knowledge management

1 Introduction

There is a growing number of studies devoted to emotions and their role in organizational behavior (Ginsberg & Davies, 2007; Härtel et al., 2009; Payne & Cooper, 2001). It is a natural consequence of the fact that organizations consist of individuals, and to manage those individuals, one needs also to consider their human aspects, such as emotions, moods, relationships, and well-being (Härtel, 2008). According to Ginsberg and Davies (2007), the way employees and leaders act to their personal emotions has profound consequences for any organization. Emotions can influence the relationships and organizational decisions at work. This influence can take place even in case of unconscious facial expressions related to emotions a person is experiencing. In general, the emotional state of an employee, a manager, or a leader and the way it is expressed might affect the organization, impact others, and have the influence on the decisions made (Ginsberg & Davies, 2007, p. 5). Härtel et al. (2005) claim that all organizations hurt their employees somehow, by making some decisions that stress their employees, for example, about workplace reductions or higher efficiency ratios. If an organization does not recognize emotions that are brought about by its decisions and behaviors, it cannot deal properly with the pain and disturbance it causes. Additionally, organizations need to concentrate more on creating emotionally healthy environments that will help in proper emotion handling and contribute to employees' emotional health. This can help in creating a proper culture to support a more productive work behavior (Härtel et al., 2005, p. 1).

Knowledge risks are also an underexamined topic in the organizational setting. Knowledge since the centuries has been perceived as something positive, worth sharing, but also the source of power. With the rise of knowledge management field, new methods and techniques have been examined, which helped in knowledge storage, creation, or dissemination. Since the origin of the KM discipline, a lot of emphasis has been placed on some guidelines for managers on how to make KM possible and efficient in their organizations (e.g., Anantatmula & Kanungo, 2010; Ho, 2009; Jashapara, 2011; Zieba et al., 2016). Various KM processes and activities have been proposed, and their rationale as well as effectiveness have been researched (e.g. Chawla & Joshi, 2010; Plessis, 2007; Zaim et al., 2007). Some best practices have been identified, alongside solutions that can support them (e.g., IT solutions) (e.g., Gupta et al., 2000). However, little has been known about potential risks that are related to knowledge and that can potentially hinder the organization. Only recently, some studies have been published on this topic (Bratianu, 2018; Brătianu et al., 2020; Susanne Durst et al., 2018, 2019; Durst & Zieba, 2019a), but still the research is in its infancy. As knowledge risks might have severe consequences for organizations, for example, loss of crucial knowledge, reduced competitiveness, the loss of valuable financial and nonfinancial resources, disruptions, and/or flawed workflows (Durst & Zieba, 2017), it is needed to examine the potential factors that can be linked with knowledge risks in more depth.

Despite the obvious importance of emotions in organizational settings, most part of the research eliminates emotions, considered as unproductive and irrational, hence, not welcome in organizational setting. Härtel et al. (2005) stated: "For the most part, research has tended to be based on assumptions of rationality, excluding notions of emotionality" (Härtel et al., 2005, p. 2). It is definitely interesting and valid for researchers to understand the role of emotions at multiple levels and in various settings (e.g., group, organization, home/host culture, etc.). For example, there are no studies on how emotions can be linked with the appearance of knowledge risks in organizations. To fill this knowledge gap, this chapter aims at evaluating knowledge risk behaviors in relation to emotions experienced at work and proposing ways on how a healthy emotional culture might be created in an organization to ensure the limitation of knowledge risk behaviors and their negative consequences.

The remaining part of this chapter is structured as follows. First, the typology of knowledge risks is presented. Second, key emotions and their potential impact on employee's behavior at work is presented. Third, the potential link between knowledge risks and emotions is described. Finally, the chapter is closed with conclusions and future research avenues.

2 Knowledge Risks

To start the analysis of knowledge risks and their potential link with emotions, it is necessary to define this term. According to Durst and Zieba (2019b), knowledge risk is "a measure of the probability and severity of adverse effects of any activities engaging or related somehow to knowledge that can affect the functioning of an organization on any level" (Durst & Zieba, 2019b, p. 2). In other words, knowledge risks can influence any organization, and this influence can be of various seriousness. Sometimes, the consequence of, for example, espionage can be the loss of competitive advantage of an organization, resulting in the bankruptcy and dropping out of the market.

Knowledge risks can be of different types, and a useful tool for their differentiation is the taxonomy of knowledge risks proposed by Durst and Zieba (2019b). The authors classified knowledge risks into three main categories: human knowledge risks, technological knowledge risks, and operational knowledge risks. Human knowledge risks are related to personal, social, cultural, and psychological aspects of an individual; therefore, they are linked with human resources management. Examples of such risks are knowledge hiding or knowledge hoarding. The second category is technological knowledge risks. Those risks are related to the application of technologies in organizations, for example, information and communication technologies. Among this category, there are risks such as hacker attacks or risks related to social media. The last category is operational knowledge risks. Those risks encompass the ones resulting from everyday functioning of the company, such as making alliances or mergers or using wrong or obsolete knowledge (Durst & Zieba, 2019b). In the table below, various types of knowledge risks are presented, together with their definitions.

As it can be seen in Table 1, there is a variety of knowledge risks, and they are categorized into three groups: human knowledge risks, technological knowledge risks, and operational knowledge risks. The largest category is operational knowledge risks, as it encompasses risks related to knowledge that result from everyday operations of organizations. All those knowledge risks are potentially somehow linked with emotions of employees and managers. In the following sections, different types of emotions are described, together with their potential relation with knowledge risks.

3 Emotions: How Can They Influence Our Behavior at Work?

Emotions can be defined as "behaviours that express feelings towards a triggering object," and they can be experienced both internally and expressed externally (Nadler & Lowery, 2009, p. 24). There are various emotions identified and named by researchers. The most commonly identified positive emotions are love, joy, satisfaction, contentment, interest, amusement, happiness, serenity, or awe, while the most commonly felt negative emotions are fear, anger, disgust, sadness, rage, loneliness, melancholy, and annoyance (Ackerman, 2019). The ten basic emotions indicated by different theorists and listed by Stanley and Burrows (2001) are as follows:

- Interest–excitement
- Enjoyment–joy
- Startle–surprise
- Distress–anguish
- Rage–anger
- Disgust–revulsion
- Contempt–scorn
- Fear–terror
- Shame–shyness–humiliation
- Guilt–remorse (Stanley & Burrows, 2001, p. 5)

Apart from listing emotions, it is necessary for a better clarity to present core-relational themes for them. In the table below, there is a list of emotions proposed by Payne and Cooper (2001), together with their core-relational themes (Table 2).

Emotions are not an easy topic in business. One can imagine that the positive ones (e.g., happiness or hope) will be well perceived and accepted in organizations more easily than the negative ones. For example, if an employee feels proud about the company and the brand or is happy, such emotions will be probably welcome. However, if an employee is angry, jealous, or contempt, it might not be easily accepted, and therefore, employees would need to ignore or rationalize them

Table 1 Definitions of particular types of knowledge risks

Human knowledge risks	
Knowledge hiding	"an intentional attempt to withhold or conceal knowledge that has been requested by another person" (Connelly et al., 2012, p. 65)
Knowledge hoarding	The act of accumulating knowledge that may or may not be shared at a later date (Connelly et al., 2012), and this knowledge has not been asked for by another individual—for example, an employee may keep personal information secret as an act of omission that is not addressed to a particular person (Webster et al., 2008)
Unlearning	A type of deliberate forgetting, which involves a conscious process of giving up and abandoning knowledge, values, and/or practices, which are deemed to have become outdated in an organization (de Holan, 2011)
Forgetting	Forgetting can be both accidental (due to bad memory) or intentional (trying to avoid bad habits) (de Holan, 2011)
Missing/inadequate competencies of organizational members	A situation when organization members do not possess the necessary training, experience, skills, and capacities to complete the tasks assigned to them (Zieba et al., 2021)
Technological knowledge risks	
Risks related to cybercrime	Risks related to cybercrime are connected with the threats of malicious software either destroying or locking computer systems in organizations (Perlroth et al., 2017)
Risks of hacker attacks	A subform of risks related to cybercrime; a hacker attack is a situation in which an outsider is trying to break into computer systems of organizations, especially in order to get secret information (Zieba et al., 2021)
Risks related to old technologies	Risks related to the use of old information technologies, resulting in problems with their functioning and updating (Zieba et al., 2021)
Digitalization risks	Risks connected with the overuse of digital form of data and reliance entirely on this form of knowledge (Zieba et al., 2021)
Risks related to social media	Risks of bringing a number of unplanned or undesired consequences, such as the spread of fake information or the existence of fake social media accounts that troll company's operations (Zieba et al., 2021)
Operational knowledge risks	
Knowledge waste	Not making use of available and potentially useful knowledge in the organization (Ferenhof et al., 2016)
Risks related to knowledge gaps	A mismatch between what a firm must know and what it actually does know, which in turn may hamper the firm in meeting its objectives (Perrott, 2007)
Relational risks	The probability and consequence of having dissatisfactory cooperation and/or opportunistic behavior by partners (Delerue, 2005)
Knowledge outsourcing risks	A risk of losing skills and capacities needed to perform central (knowledge) processes (Agndal & Nordin, 2009)
Risk of using obsolete/unreliable knowledge	Risks that occur when the out-of-date knowledge is applied in the organizational context/interorganizational settings or when a company applies unreliable knowledge, for example, received from a malicious source (Zieba & Durst, 2018)

(continued)

Table 1 (continued)

Risk of improper application of knowledge	Risks that occur when a company does not have the right skills and abilities to analyze and apply knowledge properly (Zieba & Durst, 2018)
Espionage	"the practice of spying or using spies to obtain information about the plans and activities especially of a foreign government or a competing company" Merriam-Webster Dictionary
Continuity risks	Risks that relate to an organization's ability to maintain its core capabilities over time and its ability to continue to perform and compete at consistent levels as people come and go (Lambe, 2013)
Communication risks	Risks that appear in the process by which information is exchanged between individuals through a common system of symbols, signs, or behavior, such as misinterpretation, broken communication flow, etc. (Zieba et al., 2021)
Knowledge acquisition risks	Risks that relate to an organization's ability to acquire the new knowledge it needs in order to follow a new strategic direction (Lambe, 2013)
Knowledge transfer risks	Risks related to all the potential interruptions in the process of transferring knowledge, e.g., lack of willingness to share, knowledge stickiness, etc. (Durst & Zieba, 2017)
Merger & acquisition risks	Risks related to the phenomena occurring during mergers and acquisitions, such as employee reduction, lack of available knowledge, etc. (Zieba et al., 2021)
Integration risks	A subform of merger & acquisition risks—the merger/acquisition of an organization by another organization can lead to the situation that the merged organization is not able to integrate the different knowledge sources in a proper way so that it is usable for the members of the newly formed organization (Durst & Zieba, 2017)

Source: Zieba et al. (2021)

(Furnham, 2008, p. 3). Most organizations are not the places where expressing emotions, especially negative ones are well seen. Many employees feel that they need to behave in an official way at work, meaning that there is no place for discussing private problems or showing their weak sides in front of peers or the management. This can result in discussing problems with other colleagues behind their backs and not solving conflicts in an open way. A special burden might lay on leaders and managers—they are often expected to be strong and keep their cold blood even in the face of a serious crisis.

Pescosolido (2005) proposed the concept of "emergent leader," who can be defined as "a group member who exhibits initiative and have influence over other group members" (Pescosolido, 2005, p. 318). Such leaders hold no legitimate authority or power; they also have no control over organizational rewards or punishments. Pescosolido (2005) highlighted the importance of such leaders for group emotional management and their role in setting the "emotional tone" for the group. Leaders often need to make decisions that will affect the whole team and bring some emotions. Sometimes, there are no good decisions, and by deciding on any option, someone will be hurt or disadvantaged.

Table 2 The core-relational themes for each emotion

Emotion	Core-relational themes
Anger	A demeaning offense against me and mine
Anxiety	Facing uncertain, existential threat
Fright	An immediate, concrete, and overwhelming physical danger
Guilt	Having transgressed a moral imperative
Shame	Failing to live up to an ego ideal
Sadness	Having experienced an irrevocable loss
Envy	Wanting what someone else has and feeling deprived of it but justified in having it
Jealousy	Resenting a third party for loss or threat to another's affection or favor
Happiness	Making reasonable progress toward the realization of a goal
Pride	Enhancement of our ego-identity by taking credit for a valued object or achievement, either our own or that of someone or group with whom we identify
Relief	A distressing goal-incongruent condition that has changed for the better or gone away
Hope	Fearing the worst but yearning for better and believing the improvement is possible
Love	Desiring or participating in affection, usually but not necessarily reciprocated
Gratitude	Appreciation for an altruistic gift that provides personal benefit
Compassion	Moved by another's suffering and wanting to help

Source: Payne and Cooper (2001, p. 55)

Undoubtedly, emotions can interfere with a person's work, both the ones a person experiences due to their private and professional situation. For example, anger, resulting from a divorce or a job-linked experience, might slow a person down, hold him or her back, and reduce his or her productivity. One might not think clearly when experiencing guilt or jealousy. Reactions to emotional states might result in paralysis, denial, avoidance, vacillation, and errant judgment. Emotions may also be overwhelming and affect even very strong individuals and high performers (Ginsberg & Davies, 2007, p. 3).

But emotions can have positive and negative features at the same time. Even emotions that are perceived as negatively toned (e.g., anger or envy) can be subjectively (partly) experienced as positive. For example, by feeling angry, one can feel less helpless or frustrated, while by envying someone's better work results, one can feel motivated to devote more time to certain areas of work or self-improvement. Similar phenomenon can take place with emotions perceived as positively toned. Love, for example, depending on the stage of the relationship and present events, like when it is unrequited, can cause great distress (Payne & Cooper, 2001, pp. 55–56).

It has been established that employees experience strong emotions at work. For example, they might feel angry about the appraisal process; they might feel guilt and shame when they make a mistake. When employees need to face regularly negative situations, such as angry customers, abusive colleague or boss, lack of acceptance of ideas, or getting negative feedback constantly may all lead to chronic problems, which in turn can lead to "nervous breakdowns" (Furnham, 2008, p. 3).

According to Payne and Cooper (2001), stress and emotions should be analyzed jointly, as stress creates emotional consequences and emotions that encompass all the phenomena of stress. In other words, stress involves emotions and, therefore, should be perceived as a part of the process (Payne & Cooper, 2001, p. 53).

According to Ashkanasy and Daus (2002), emotions are the key of attitude creation and behavior in organizations. The authors claim that emotional labor is a crucial element of employees' everyday work life, and emotional intelligence is an important concept to analyze in an organizational setting. The same opinion is shared by Härtel et al. (2005), who are also advocates of emotion-based theories in the workplace. Emotional intelligence involves, at least in part, "a person's abilities to identify and to perceive emotion (in self and others), as well as possession of the skills to understand and to manage those emotions successfully" (Ashkanasy & Daus, 2002). In other words, emotional intelligence helps individuals to understand their own emotions as well as the emotions of others. Emotional intelligence can be useful at work both for managers/leaders and employees. It may help them in creating a better relationship with co-workers as well as for better self-understanding and control even in stressful situations. Emotionally intelligent employees and managers may not only recognize the importance of emotions at work but are also able to observe and handle them properly both in themselves and in other co-workers (Furnham, 2008, p. 3).

Emotions can also make some knowledge risks more intense and severe. For example, there are some risks that may result from the COVID-19 pandemic, like the risk of deliberate isolation when a remote employee can naturally lock themselves in their silo, isolate from colleagues, focus on their tasks, and not get involved in teamwork (Zieba et al., 2021). The negative emotions that a person has, for example, anger or sadness, may intensify such behaviors and, therefore, increase the likelihood of knowledge hiding.

On the basis of the above, it can be concluded that the topic of emotions at work is very important and up-to-date. Most of the people spend the majority of their day at work, and they become more and more aware of the impact work can have on them. When an employee works in an environment that is toxic (e.g., because of toxic colleagues, boss, etc.), he or she can become depressed and demotivated. Especially, younger people look for favorable working environments. They often quit their jobs because they become demotivated and do not like the atmosphere at their work. That is why, it is becoming more and more important to pay attention to emotions at work and the support of employees also in this area. The following section of this chapter will present the potential link of emotions and knowledge risks in organizations.

4 The Potential Impact of Emotions on Knowledge Risk Behaviors

In general, emotions are linked to organizational setting in a variety of ways. For example, if employees are unhappy, they are disconnected from their work, as they concentrate on their problems and ways to solve them or simply on their own perceived miserable fate. Also, if an organization fails to understand the emotional aspects of its functioning, it will not be able to recognize its toxic behaviors, such as unfair organizational policies, toxic and abusive co-workers or supervisors, and poor management practices, e.g., for managing changes (Charmine E.J. Härtel et al., 2005, p. 3). Emotions at work can also interfere with knowledge risks, and the link between emotions and knowledge risks can be of two types. On the one hand, if an employee feels an emotion (e.g., anger), he or she can create some knowledge risks, e.g., knowledge hiding. On the other hand, some knowledge risks may cause emotions in employees, for example, cyber risks might bring fear to the management and employees. Taking that into account, this section will present the potential link between particular emotions and knowledge risks in organizations.

The first types of knowledge risks are knowledge hiding and knowledge hoarding. These knowledge risks can appear when an employee is angry with his/her colleague—they may hide or hoard their knowledge then. Similarly, when employees are envy or jealous, for example, because the colleague was promoted instead of them, they will be tempted to hide or hoard their knowledge. Knowledge hiding and hoarding can be caused by the fear and envy of an employee that someone might be better at work or achieve something easier/faster. Additionally, self-pride may stop employees from knowledge sharing and keeping the knowledge to themselves, because they might like the situation when they know more than their peers and they can be proud of themselves. Fear of losing this status might cause knowledge hiding or knowledge hoarding. Knowledge hiding and hoarding may also have emotional effects. They may cause anger and frustration if an employee cannot find the answer they are looking for at work. They can also result in sadness and anxiety, especially if a person finds out that knowledge was hoarded by a peer.

Another knowledge risk, forgetting might be caused by love (e.g., being in love and distracted) or melancholy. It may also be caused by sadness and anxiety, when employees are not able to concentrate on their tasks and tend to forget about various things. This might cause frustration, anxiety, sadness, and self-anger that one does not remember something important. Unlearning is an intentional activity and might be caused by guilt, shame, or jealousy. If an employee made a mistake and feels guilty or ashamed, he or she might try to unlearn the activities or habits that led to this mistake. Also, if an employee sees that his or her peer achieves better results and becomes jealous, he or she might unlearn their own way of behavior and try to adapt a new one. On the other hand, the necessity to unlearn one's own ways of performing a job that is forced by the management might cause such negative emotions in employees such as anger, anxiety, or sadness.

The last knowledge risk from the human knowledge risk category is missing/inadequate competencies of organization members. This risk may result in several negative emotions. If employees feel that they do not have adequate competencies, they might feel guilt and shame. They might also become jealous about other coworkers who do not miss those competencies. They might also feel anger, anxiety, or sadness. Those emotions might either help them in undertaking some actions to overcome this knowledge gap or they might lead to even greater frustration and lack of undertaken steps. This could depend on both employees and managers and their way of handling this risk.

The next group of risks are technological knowledge risks. Those risks in general might result in several negative emotions, such as anger, anxiety, or sadness. If employees and managers experience risks related to hacker attacks, old technologies, or digitalization, they may become angry, anxious, or sad. The risks related to social media can be caused by anger or an employee or a manager, who might act against the company due to some bad treatment he or she experienced and, for example, post some negative or fake news on social media about this company. This can also result in further anger, anxiety, or sadness of the management or peers, when they experience the loss of reputation of their company.

The third category of knowledge risks—operational knowledge risks—are the largest category, and those risks can be both caused by various emotions or result in them. For example, risks related to using obsolete knowledge or improperly applying knowledge can be caused by love, sadness, or anxiety—when an employee is not in his or her best form or is deconcentrated due to these emotions, he or she can use the knowledge in a wrong way or use the knowledge without making the necessary update first. If this happens, an employee might feel anger, anxiety, sadness, guilt, or shame. Many operational risks may result from anger, anxiety, sadness, guilt, shame, or jealousy of employees/managers. When employees feel angry with the employer, for example, because of reductions or lack of pay rise, they may be tempted to create knowledge risks. Such a situation can take place when the anger or sadness of an employee leads to espionage and the delivery of crucial knowledge to competitors. It is also worth noticing that knowledge risks related to integrations, mergers and acquisitions, or simply relations with other companies might lead to anger, anxiety, sadness, and jealousy but also hope for the better. This might depend on how well the company is handling the situation and whether, for example, there are no planned reductions (Table 3).

From the performed analysis of the literature and the trial to identify the potential link between knowledge risks and emotions, one can see that the majority of emotions both causing and resulting from knowledge risks are negative. The most common ones are anger, anxiety, and sadness. This is not very surprising, as knowledge risks in their nature might bring negative consequences to organizations and their employees, such as knowledge loss, knowledge spill-over, lost reputation, or lost sustainability (Durst & Zieba, 2019b). Taking the above into account, managers and leaders should become aware of this potential link between knowledge risks and emotions to be able, on one hand, to reduce the probability of a knowledge risk appearance and, on the other hand, to handle the emotions that appear after the risk becomes a reality.

Table 3 Potential relations between knowledge risks and emotions

Knowledge risks	Emotional cause	Emotional effect
Human knowledge risks		
Knowledge hiding	Anger, envy, jealousy, self-pride, fear	Anger, anxiety, sadness
Knowledge hoarding	Anger, envy, jealousy, self-pride, fear	Anger, anxiety, sadness
Forgetting	Love, sadness, anxiety	Frustration, self-anger, anxiety, sadness
Unlearning	Guilt, shame, jealousy	Anger, anxiety, sadness
Missing/inadequate competencies of organization members	–	Guilt, shame, jealousy, anger, anxiety, sadness
Technological knowledge risks		
Risk of hacker attacks	–	Anger, anxiety, sadness
Risks related to old technologies	–	Anger, anxiety, sadness
Risks related to social media	Anger	Anger, anxiety, sadness
Digitalization risks	–	Anger, anxiety, sadness
Operational risks		
Risk of using obsolete knowledge	Love, sadness, anxiety	Anger, anxiety, sadness, guilt, shame
Risk of improperly applying knowledge	Love, sadness, anxiety	Anger, anxiety, sadness, guilt, shame
Integration risk	–	Anger, anxiety, sadness, jealousy, hope
Outsourcing risks	–	Anger, anxiety, sadness, jealousy, hope
Knowledge transfer	Anger, envy, jealousy, self-pride, fear	Anger, anxiety, sadness
Relational risk	Anger, anxiety, jealousy	Anger, anxiety, sadness, jealousy
Knowledge acquisition risk	Anger, anxiety, sadness, guilt, shame, jealousy	Anger, anxiety, sadness
Communication risk	Anger, anxiety, sadness, guilt, shame, jealousy	Anger, anxiety, sadness
Continuity risk	Anger, anxiety, sadness, guilt, shame, jealousy	Anger, anxiety, sadness
Risks related to knowledge gaps	–	Anger, anxiety, sadness, guilt, shame
Espionage	Anger, jealousy	Anger, anxiety, sadness
Knowledge waste	Anger, anxiety, sadness, guilt, shame, jealousy	Anger, anxiety, sadness
Mergers and acquisitions knowledge risks	–	Anger, anxiety, sadness, jealousy, hope
Risk of using unreliable information	Love, sadness, anxiety	Anger, anxiety, sadness, guilt, shame

Source: Own elaboration; list of knowledge risks based on Durst and Zieba (2019b)

When analyzing emotions and their link with knowledge risks, it is worth to mention the theory of knowledge fields and knowledge dynamics (Bratianu & Bejinaru, 2019a). Knowledge dynamics means "the variation of knowledge at individual, group or organizational levels within a given context" (Bratianu & Bejinaru, 2019a, p. 6). Emotions are able to create emotional knowledge that can be potentially transformed into rational knowledge and spiritual knowledge. According to Bratianu and Bejinaru (2019b), "Emotional knowledge is used in the non-verbal language of the body and it communicates something about the emotional state of a given person." Emotional knowledge of a person may in this context influence the decision-making prowess, and it may also affect the emotions and behaviors of others. Emotional knowledge is also subjective, as it is grounded in our sensory system and perception of a cognitive process and it can play an important role in the problem-solving activities (Bratianu & Bejinaru, 2019a).

It is also worth to mention not only the direct impact of emotions and emotional knowledge on knowledge risks, as described in this chapter, but also the indirect one, resulting from the perception of risk. Sometimes, a person might not be able to identify a certain risk, because he or she is in a certain emotional state (e.g., sad after the loss of a beloved) and not able to use his or her rational knowledge for the identification and mitigation of certain knowledge risks. Also, a person might not be able to identify certain knowledge risks due to their lack of emotional knowledge. For example, if a person is not able to identify the emotions of a colleague, he or she might not become aware that this person is angry and, therefore, might be prone to knowledge hiding or hoarding.

5 Conclusions

This chapter contributes to the existing state of the art of both management and psychology science. On the one hand, it presents knowledge risks, and on the other hand, it identifies the potential emotions that can lead to knowledge risks or may appear as a consequence of knowledge risk existence. It shows how interdisciplinary the work of a manager/leader can be. In his/her work, it is not only necessary to concentrate on business indicators but also on employees and their emotions. As quoted at the beginning of this chapter, "All good managers are like good parents and good teachers" (Furnham, 2008), and they should understand the behavior of their subordinates and peers from different angles and perspectives. Employees are also becoming more and more demanding with regard to their working conditions, and the atmosphere at work is getting more and more important. Having the feeling that one is understood, appreciated, and also taken care of in case of difficulties and strong emotions can be an important factor in staying in a certain workplace. This on the one hand can be a useful hint for managers; on the other hand, it imposes an additional challenge and difficulty of being a supervisor.

Emotions can also help in explaining motivational aspects of work, for example, why some employees might hide their knowledge, while others share it easily. It is worth to use the quote by Ashkanasy and Daus (2002) here: "Management of emotions in organizations must now be seen as an important tool in every manager's kit, one to which managers will increasingly need to pay attention in the future" (Ashkanasy & Daus, 2002, p. 82). Taking that into account, it is also worth to highlight the necessity to include the learning contents on emotions and emotional intelligence in training curricula for future managers and employees in various occupations. Educational institutions at various levels have traditionally concentrated on the importance of IQ and have not paid much attention toward other types of intelligence (e.g., intrapersonal and interpersonal competencies, emotional intelligence); however, it is important for business educational institutions to consider ways to incorporate emotional intelligence skills into the "toolbox" of future employees and managers for enhanced career success (Tucker et al., 2000).

It can be assumed that a better understanding of employees' emotions could potentially help organizations in achieving more, for example, by conflict minimization of smaller turnover of employees. It is important to highlight here that the goal of emotion handling is not to keep employees happy and satisfied all the time but to allow them to feel the negative emotions, too, and help them in handling all the types of emotions.

The major limitation of this study results from the fact that it is of theoretical character. By merging the knowledge from the field of psychology and management, it was possible to sketch some potential link between emotions and knowledge risks. This link has to be further examined both from the theoretical and practical perspective. There is a need for future studies related to emotions and knowledge risks. Knowledge risk management in itself is a novel research area, and emotions are still an under-researched theme in the context of business environment. It would be necessary to examine in practice the relation between knowledge risks and emotions with the use of a qualitative survey. Such a survey could help in identifying and linking particular emotions with knowledge risks. It could also examine ways of handling emotions by managers in order to help their peers in more efficient and less stressful working. As it was indicated in one of the sections of this chapter, work can be very stressful, and it may result in many emotions felt by employees, so creating a safe working place, where emotions are well understood and not criticized is becoming more and more crucial nowadays.

It would be also interesting to examine the potential impact of the cultural differences between the managers and employees from various countries and with various ethnical backgrounds, as they may constitute a natural area of future examination. Moreover, emotions at work could also be examined from a broader perspective of the well-being of employees. Despite the high importance of employee's well-being for the success of organizations, little is known on how well-being might influence human knowledge risks appearing in organizations. Examining this broad perspective linking emotions with well-being of employees and knowledge risks could bring some more interesting insights.

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Knowledge Management and Innovation in the COVID-19 Context: Flowing from the Organization Toward the Network Level

Elena-Mădălina Vătămănescu and Elena Dinu

Abstract

By scrutinizing two pivotal phenomena, that is knowledge management and innovation, this chapter places a special focus on the knowledge "flowing" process from the organization toward the network level and delves into the relevance of intellectual capital. Adjointly, emphasis is laid on the COVID-19 context, which has posed novel challenges for the understanding of all organizational and network facets. The discussion looks into the business environment developments lately, revealing that companies resort to the knowledge resources embedded in their networks, striving to capitalize on opportunities by reconfiguring dynamic knowledge capabilities and creating new knowledge. By relying on relational capital represented by networks, which facilitates the sharing of knowledge and the buildup of intellectual capital (Paoloni et al. *Journal of Knowledge Management*, 2022), organizations aim to overcome the uncertainties and challenges brought about by the global health crisis and its subsequent economic and social effects. Simultaneously, organizations harness digital technology capabilities to manage internal and external knowledge resources and sustain innovation in products and services but also management and business model innovation. To this end, they employ various knowledge management strategies to develop creative collaborations and partnerships with stakeholders and thus constantly accrue and replenish core knowledge resources through synergic business exchanges. Such knowledge flows nurture the development of innovative capabilities, growth, and performance.

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Keywords

Knowledge management (KM) · Innovation · Intellectual capital (IC) · Organization · Network · Knowledge flows · Knowledge sharing

1 Introduction

The Covid-19 pandemic has shown how the knowledge resources embedded in an organization's intellectual capital (IC) could be harnessed to cope with the crisis, accommodate new and unexpected work models and processes, and set the foundation for new knowledge (Vătămănescu et al., 2021). The Covid-19 pandemic provided both challenges and opportunities for growth to those businesses that quickly adapted to the new realities by exploiting the knowledge resources embedded in the organizational intellectual capital and swiftly reconfiguring their knowledge capabilities. By dynamically reconfiguring their knowledge capabilities, various organizations have been able to adapt faster to the new normal. In contrast, others have remained stuck in their usual routines and thus were adversely affected by the lockdown.

Intangible resources have become the primary production factor and the source of sustainable competitive advantage and performance, and the strategic role of knowledge management is reinforced (Bolisani & Bratianu, 2018; Bratianu, 2022; Ioniță & Dinu, 2021). Nowadays, all the processes oriented toward developing and replenishing knowledge resources have reached prominence in competitive and sustainability-oriented companies. By leveraging knowledge-based resources (e.g., know-how), organizations have been able to ensure business continuity, strive, and even grow during the Covid-19 crisis.

As Konno and Schillaci (2021) argue, intellectual capital originates in the knowledge-creation process and the development of new organizational relationships, and these processes are at the core of innovation. Organizational learning is a dynamic process through which the company acquires knowledge from interactions with its environment (Baker & Sinkula, 1999). In most cases, these interplays are the single-loop or adaptive learning type that update and correct previous knowledge, mainly at the operational level. In some other cases, double-loop or generative learning occurs at a strategic level, which is then reflected in norm changing.

Against the disruptions' backdrop, decision-makers should not see knowledge as just information processing measured solely via efficiency metrics. Instead, they should create an adequate infrastructure for harnessing individual, organizational, and transorganizational (network) acumen, which may transpire in innovative solutions (Vătămănescu et al., 2022a). A knowledge-creating and innovative organization resembles an organism with a sense of common purpose, where everybody contributes not only with explicit knowledge but also with know-how and particular models, symbols, and beliefs to a shared vision (Nonaka, 2007).

Though ideas are developed by individuals, new knowledge is amplified and developed through interactions among people, organizations, and communities (Nonaka, 1994). According to Nonaka's SECI model, organizational knowledge creation requires the SECI processes (socialization, externalization, combination, and internalization) to be managed in a continuous cycle, e.g., by encouraging knowledge exchanges and shared experiences within teams, once trust is established; promoting interaction, dialogue, and genuine insights; combining and integrating internal and external knowledge resources; and learning-by-doing when testing new ideas. The new knowledge that is crystalized must then go through a justification and quality assessment grounded on strategic objectives and performance indicators and finally integrated into the organizational knowledge network (Nonaka, 1994).

Individual knowledge is integrated at the organizational level and further to the transorganizational level through leadership, management, technology, and organizational culture (Bratianu, 2022). Kogut and Zander (1992) posit that organizations develop new competitive capabilities, i.e., innovation capabilities, by combining internal and external knowledge resources, learning to monetize, and organizing technological opportunities to take advantage of future market opportunities.

According to Bratianu (2022), knowledge management (KM) strategies are developed in the space of opportunity delineated by a company's environment, while the organization plans for the future and uncertainty. Nevertheless, in the process of strategizing, apart from logical thinking, imagination and creativity are required because of the uncertainty, i.e., the knowledge gaps regarding the future. From this perspective, the aforementioned author highlights four types of deliberate knowledge strategies, corresponding to a known/unknown matrix about what is known and what could be known. Hence, depending on their decisional focus, i.e., utilization of the extant knowledge, filling the knowledge gaps, (social) participation, or creation of new knowledge, the strategies are knowledge exploitation (known-knowns), knowledge sharing (known-unknowns), knowledge acquisition (unknown-knowns), and knowledge exploration (unknown-unknowns). Emergent knowledge strategies such as organizational learning and scenario design focus on behaviors to mitigate unknown future developments. Nevertheless, in practice, all strategies have deliberate and emergent elements (Alexandru et al., 2020; Bratianu, 2022).

Paying heed to all these arguments, this chapter envisages scrutinizing two pivotal phenomena, that is knowledge management and innovation with a special focus on the "flowing" process from the organizational to the network level. Also, emphasis is laid on the COVID-19 context, which has posed novel challenges for the understanding of all organizational and network facets.

2 COVID-19 Pandemic and the Reconfiguration of Knowledge Management Processes

The Covid-19 pandemic has evolved as a multilevel disaster, affecting most of the ecosystem's subunits, from the individual agent to the global society as a whole. People, communities, organizations, authorities, societies, and the labor market have discovered to be utterly unable to deal with the new influx and possessed no significant resources to take immediate action (Bratianu et al., 2021; Bratianu & Bejinaru, 2021; Cegarra-Navarro et al., 2021; Vătămănescu et al., 2021, 2022, 2022a). In a climate where social isolation had become the norm, organizations were pushed to discover ways to survive and accomplish their socioeconomic goals, and the first step to be implemented was the creation of hybrid work environments (Bratianu, 2022; Stratone et al., 2022). These environments were viewed as a realistic and sustainable alternative for an immediate adaptation to the new normal. At the same time, they availed unprecedented knowledge processes within and across organizations.

Collaboration in virtual settings has benefitted from the most advanced technologies, hence showing exponential growth. Giving credit to Plavčan and Funta (2020), it can be noted that internet platforms have advanced fast and intricately affecting people and businesses and reconfiguring how knowledge is distributed and consolidated, as well as how technological upheavals affect society as a whole. Once time and location limitations have been eliminated, access to a vast body of knowledge through electronic networks has become increasingly simple and efficient. Despite the fact that many leaders have recognized these developments linked to the disruptions generated by the Covid-19 pandemic, considerable changes are anticipated to meet the challenges posed by hybrid environments where offline communication and interaction cohabitate with their online counterpart (Stratone et al., 2022; Vătămănescu et al., 2022b).

Knowledge management has become very much dependent on the dynamics of communication flows inside and across companies, on how management teams decide to handle the organizational intellectual capital, and on the way employees and all the other stakeholders manage to integrate systemic disruptions in their new routines (Stratone et al., 2022; Vătămănescu et al., 2020, 2022b). Furthermore, the architecture of knowledge sharing is now supported by a diverse range of knowledge types and processes, beginning with the astuteness of organizational area improvement, business strategy and practice development, enhancement of internal processes, the opportunity for strategy shifts, and a better foundation for decision-making endeavors (Vătămănescu et al., 2022a), all of them being part of the organizational and transorganizational accommodation to the new normal.

3 Organizational Knowledge Management Processes: Taking Stock of the Intellectual Capital Wellspring

The concept of intellectual capital was first submitted in 1969 by Galbraith. The term "capital" denotes its economic origin, initially seen as comprising a bundle of intangible or knowledge assets (Martin de Castro et al., 2019). Perhaps the propensity to assess intangible knowledge resources primarily with financial instruments described as intellectual capital accounting (Inkinen et al., 2017) reflected the fact, repeatedly revealed in the literature (Bontis, 1998), that the initial attempts to present information about intellectual capital additionally to financial reports came from practitioners working for companies where individual know-how was paramount, while the academia joined the debate at a later stage (Bukh et al., 2001). Sveiby (1997) then extended the topic to include knowledge organizations.

Bukh et al. (2001) have alleged that intellectual capital is actually a "cohesion" of "heterogenous elements" and "interrelated practices" (p. 88). Kianto et al. (2014, p. 364) have defined intellectual capital as "the sum of all of the intangible and knowledge-related resources that an organisation is able to use in its production processes in the attempt to create value." In opposition to this approach, Rastogi (2003) argued that defining and assessing intellectual capital as a sum of components is flawed since a company is a dynamic system with synergistic and integrative constituents. Structural and relational capital cannot exist or function without human capital. Intellectual capital is sometimes confused with knowledge management. However, intellectual capital could be seen not only as an organization's holistic capability of managing its knowledge resources creatively (i.e., using imagination and insights) with the aim to create value but also as the capability of addressing challenges and opportunities in its environment. Intellectual capital management is both a proactive and adaptive process; it is a systemic and iterative process to create intellectual potential while remaining flexible and renewing capabilities.

Bratianu (2018) has underlined the theoretical difficulties in fathoming the true, intangible nature of intellectual capital as well as devising appropriate measurement models because the concept incorporates the seemingly incongruous notions of "capital" and "intellectual." Using metaphorical thinking, the organizational knowledge capital can translate into organizational knowledge resources. Managing intellectual capital can be seen as purposefully utilizing all the intangible resources available to a company with the aim of adding value reflected in economic interest. According to Bratianu (2018), intellectual capital is an integration of components and not a linear concept; it is dynamic and consistent with the organizational knowledge flows; it incorporates not only rational but also emotional and spiritual knowledge; structural capital is crucial for creating the appropriate framework for the human capital potential fulfilment; the intellectual capital operationalization influences an organization's performance through organizational integrators (technology, processes, management, leadership, and culture); because of its complexity, the value of intellectual capital cannot be captured through traditional accounting systems.

Intellectual capital is built on knowledge and comprises the knowledge resources that can be converted into value (Buenechea-Elberdin et al., 2018). In the knowledge-based view of the firm (KBV), knowledge is considered the main organizational strategic resource, as it is paramount in managing learning, technology, and innovation (Grant, 1996). To achieve organizational purposes and create value, knowledge must be transferred from individuals to the organization, internally and externally. Explicit knowledge (knowing about) is easier to convey through communication, but tacit knowledge (knowing how) is usually transferred through application, as it cannot be directly transferred (Grant, 1996). Thus, uncodified tacit knowledge can be lost, and companies may be required to acquire knowledge from external sources at higher costs. Examples of explicit knowledge include, e.g., data, scientific formulae, principles, procedures (Nonaka & Takeuchi, 1995), blueprints, code (Edvinsson & Sullivan, 1996), and others, whereas tacit knowledge comprises individual insights (Nonaka & Takeuchi, 1995), lore, and experience (Edvinsson & Sullivan, 1996). While explicit knowledge can be codified, namely, logged, structured, compiled, catalogued, organized, drawn, etc., tacit knowledge is usually shared at the individual level (López-Nicólas & Meroño-Cerdán, 2011).

Bontis (1998) described tacit knowledge within an organizational environment as informational flows with inputs and outputs associated with the human capital, which is the "source of innovation and strategic renewal" (p. 65). The intellect of the human capital allows the transformation into structural capital through organizational routines that serve efficiency and innovativeness, while information is codified into structural knowledge. Finally, customer capital is the knowledge brought from outside through marketing channels and customer relationships, and it is the most difficult to develop and codify as it is external to the organization. As Bontis (1998) warned, the employees' knowledge cannot be harnessed if not codified into organizational knowledge. It is the same characteristic of the intellectual capital basis, tacitness, that might prevent it from being measured with economic-financial variables.

The three main components of intellectual capital, as widely agreed upon in the field's literature throughout time, are human capital, structural capital, and relational capital (Bontis, 1998; Stewart, 1997; Johnson, 1999; Petty & Guthrie, 2000; Andriessen, 2004; Nazari & Herremans, 2007). Other classifications included organizational capital, instead of structural capital (Youndt et al., 2004), and customer capital (Edvinsson, 1997; Stewart, 1997) or social capital (Nahapiet & Ghoshal, 1998), both encompassing relational capital.

Kianto (2007, 2008) added another component, namely, the renewal capital. Researchers have described renewal capital as referring to learning and creativity (Kianto et al., 2010), as well as knowledge creation (Nonaka & Takeuchi, 1995). Kianto et al. (2010) have stressed the importance of the organizational renewal capital (RNC), understood as the continuous learning capability of a company, encompassing all other intellectual capital components, with the purpose of innovating and achieving competitiveness by adapting to the changing environment. These resources allow a company to build new knowledge and skills, gain a competitive advantage, innovate, and thus renew its knowledge resources (Inkinen et al., 2017; Kianto et al., 2010).

Nahapiet and Ghoshal (1998) started from the theory of the firm, which is seen by some researchers as a social community that creates and transfers knowledge (Kogut & Zander, 1992), and defined as social capital the resources and advantages deriving from the network of relationships created inside human communities, such as reputation, status, a sense of belonging, etc. Social capital has a structural, relational, and cognitive dimension. From this perspective, the cited authors (p. 245) defined intellectual capital as "the knowledge and knowing capability of a social collectivity." Following the discussion on tacit knowing made by Polanyi in 1966 and later distinctions (e.g., Nonaka, 1994, 2007) between tacit and codified knowledge, as well as considering knowledge at both individual and social levels, Nahapiet and Ghoshal (1998) state that these four elements, together, make the firm's intellectual capital. They also describe the creation of intellectual capital through two processes, combination—referred to by Nonaka as a social interaction—and exchange of knowledge by social interaction, driven by opportunity, value creation, motivation, and capability.

Seleim and Khalil (2011) stressed that intellectual capital and knowledge management (KM) have an interdependent relationship, and therefore, they can enhance or diminish each other, in the latter case, due to inappropriate KM strategies or competing stakeholder interests. KM strategy refers to the guidelines, goals, resources, and long-term plans of KM programs in a company (Bolisani & Bratianu, 2017). According to Bratianu (2022), KM strategies are developed in the space of opportunity delineated by a company's environment while the organization plans for the future and uncertainty.

One of the primary objectives of an organization's leadership is managing human and structural capital to develop renewal capital (Edvinsson, 1997). KM processes refer to knowledge identification, acquisition, creation, capturing, sharing, utilization, and transferring. Some of the KM processes are related to internal knowledge, and some others, to external knowledge. KM practices consist of those knowledge-related managerial activities, systematic and consciously developed and implemented, that aim to build competitive advantage and enhance firm performance (Kianto et al., 2014).

Even when they do not formalize the knowledge management processes—as is the case with smaller companies usually—businesses in knowledge-intensive sectors especially resort to various procedures and practices that allowed them to capitalize on internal and external knowledge resources even during the Covid-19 pandemic (Zbuchea et al., 2022). This is reflected in the acquisition of knowledge from external sources, including information on competitors, collaborative work models for knowledge creation, use of digital technologies for knowledge storage, codification and application, nurturing internal cultures that encourage knowledge sharing and dissemination among staff, proactive collaboration with clients in knowledge cocreation, and so forth (Zbuchea et al., 2022). The knowledge management practices also had to change during the pandemic crisis, as previous manners of doing things were adjusted. Where companies previously relied on face-to-face meetings with internal and external stakeholders, underlying the knowledge-sharing culture, now they switched to virtual meetings and remote work. Moreover, as the digital business flourished and firms providing specialized digital services had sudden opportunities for growth, they faced the reality of recruiting online, even though they had little experience with that. However, companies were confronted with issues related to a specialized skills shortage, the staff's digital fatigue because of prolonged online learning, and even communication challenges. In addition, the work changes brought about by the pandemic led to the discontinuation of certain practices, including the appraisal of knowledge management performance from the perspective of knowledge intake and application (Zbuchea et al., 2022).

4 Gliding from the Organizational Toward Network Knowledge Processes

The SECI model was created to demonstrate how the application of an individual's knowledge may be expanded and scaled up to the level of a group or organization through the use of an integration process that is progressive. Through a process called "externalization," tacit knowledge can be turned into explicit knowledge, which is significant from an epistemological point of view. In addition, through the process of internalization, explicit knowledge has the potential to be turned into tacit knowledge. When viewed from an ontological perspective, individual knowledge is expanded through combination to the level of the group, and from there, it is elevated to the level of the entire organization, resulting in the formation of organizational knowledge (Vătămănescu et al., 2022a). "The SECI Spiral emerges when the process of knowledge generation is repeated over an extended period of time. In the SECI Spiral, knowledge is continually created, expanded, and practiced, and an ever-growing number of people get involved in knowledge creation and practice, hence increasing the size of the community of people engaged in the creation and application of knowledge" (Nonaka & Takeuchi, 2019, p. 59). The SECI model is extensible to the form of a knowledge network, with a particular emphasis placed on the combination process. Individual processes include externalization and internalization, while societal processes include socialization and combination. Because online communication tends to put more of a damper on the free flow of tacit knowledge in a knowledge network, emphasis should be placed on the development of interpersonal relationships. The exponential power of the network, on the other hand, helps to accelerate the sharing of information and the development of new ideas through combination (Vătămănescu et al., 2022a).

Within an organization or a network, the movement of knowledge through time and space is sometimes referred to as "knowledge flows," which is a metaphor for this phenomenon. "To the extent that organizational knowledge does not exist in the form required for application or at the place and time necessary to facilitate work performance, then it must circulate from how it exists and where it is located to how and where it is needed. In other words, if organizational knowledge does not originate in the form required for application, then it cannot be applied" (Nissen, 2006, p. 20). Taking into account the parallel with fluid mechanics (Bratianu, 2019), the flow of knowledge occurs when there are knowledge asymmetries, in which case knowledge from the node that possesses a greater level of knowledge moves toward the node that possesses a lower amount of knowledge. On the other hand, in contrast to the flow of fluids in the physical world, the flow of knowledge is the consequence of human action, which makes the entire process significantly more complicated (Massingham, 2020; Vătămănescu et al., 2016; Zieba, 2021). Hence, the dynamics of knowledge sharing and concealment, as well as the psychological climate in the knowledge network, all contribute to the flow of knowledge between the two nodes.

Knowledge networks share the same core values, as well as principles that acknowledge and safeguard intellectual property and provide incentives for members who make significant contributions to the formation of new knowledge and the dissemination of existing information. The finality of the network will be quite low if the shared vision, values, and principles do not excite the entire dynamics of knowledge integration and knowledge sharing (Curado & Bontis, 2007; Secundo et al., 2017a–c; Vătămănescu et al., 2016). Here, relational capital is the knowledge that is linked with the multilevel relationships that are established both within an organization and across different organizational structures. This knowledge enables members to improve their own acumen (Vătămănescu et al., 2021).

Vătămănescu et al. (2016) developed the notion of network-based IC to highlight the usefulness and distinctiveness of knowledge management processes at the network level. They do this by concentrating on the specific environment and going beyond the intraorganizational perspective. According to Vătămănescu et al. (2016, p. 601), the network-based IC can be defined as the "configuration and process of value creation from the individual's micro-universe to the entire social system, by linking people, knowledge, information, expertise, competence, and know-how within complex and dynamic social networks." The network-based IC provides solutions to a variety of theoretical and practical needs. One of these needs is the individual's aspiration to connect to a higher IC level in order to gain access to new concepts, ideas, and theories. Another need is the network gravity force, which is responsible for attracting new knowledge and increasing the system's entropy. A network-based IC will have a different distribution of knowledge than an organization-based IC will due to the arrangement of links between nodes and the particular knowledge dynamics of these nodes. This will result in the network-based IC having a different distribution of knowledge. Nodes in a generalized knowledge network may take the form of individuals, groups of people, or entire organizations. Therefore, it is possible to establish IC that is built on intra- and interorganizational networks, bringing together individuals who are prepared to share their experience and skills (Fang et al., 2013; Ferguson & Taminiau, 2014).

In light of this reasoning, the propensity toward knowledge network (Bedford & Sanchez, 2021; Mariano & Walters, 2015; Nonaka & Takeuchi, 2019; Phelps et al., 2012; Vătămănescu et al., 2016) has three significant repercussions: (a) access to a useful network-based IC, (b) the potential to improve an individual's degree of IC, and (c) the opportunity to share experience and expertise in all types of knowledge with other members of the network.

5 Network Knowledge Management Processes: The Recapitalization of Knowledge Networks Toward Open Innovation

Pursuant to different researchers (Bogers et al., 2017; Scuotto et al., 2017), the push toward strategic external cooperation in today's complex environment has consequently generated more permeable boundaries and more refined knowledge exchange methods, with innovation being the subject of consistent transfer both inward and outward across enterprises. This situation is representative of the correlation between knowledge management processes and open innovation with its various facets, with the former being accounted as an appealing antecedent for the latter. Paying heed to Martin-de Castro's insights (2015), organizations should rely on external relationships and networks in order to augment their knowledge domains and then produce better and faster innovations.

These issues instill the presumption of a novel approach toward knowledge management processes as relevant knowledge is evermore scattered across various firms, and collaboration between them is increasingly regarded as an important factor for success. The cooperative form is predominantly dynamic, meaning that partners' collaboration is dependent on the exchange of specific resources, ideas, and knowledge, while also maintaining their interdependence in additional areas. In order to participate in the processes of knowledge sharing, one must have a comprehensive awareness of the knowledge fields and the overall dynamics of those sectors (Bratianu & Bejinaru, 2020).

In fact, the open innovation paradigm necessitates active participation in transorganizational collaborations (Lee et al., 2010; Parida et al., 2012; Scuotto et al., 2017) through the utilization of a variety of knowledge-driven factors, mechanisms, and dimensions. Open innovation can be understood as a distributed innovation process based on purposively managed information flows across organizational boundaries, using purely monetary and nonpecuniary processes in keeping with the organization's business model (Chesbrough & Bogers, 2014, p. 17).

In spite of the compelling nature of such processes, various studies hint at a research gap in addressing the cross-fertilizing role of these phenomena, which calls for further conceptual and empirical investigations to be conducted. For example, according to Curado et al. (2018), the existing body of literature on whether and how businesses can leverage relational capital and knowledge sharing for innovation is equivocal. Nakauchi et al. (2017) urge that knowledge management processes have mostly revolved around organizational capabilities, thus somehow overshadowing the importance of the interorganizational level. Moreover, Parida et al. (2012) and Vătămănescu et al. (2020, 2021) notice that few studies fully addressed open innovation, especially in the case of small- and medium-sized enterprises (SMEs).

Engaging in knowledge transfer methods with direct collaborators and network members are crucial, strategic decisions for many organizations nowadays, including SMEs. This is mostly done in order to respond to innovative performance challenges (Bratianu et al., 2021; Vătămănescu et al., 2020, 2021). Many of the new businesses have started participating in extensive coopetition practices, such as the formation of alliances, the establishment of informal business networks, or the selection of direct collaboration, with a view to improving their organizational performance and innovation capabilities (Sroka, 2013). These programs help businesses combat what is thought to be a lack of knowledge regarding turbulent markets and conducting business in highly competitive situations while simultaneously fostering innovation (Mitan & Vătămănescu, 2019).

According to an analysis conducted by Srivastava and Tyll (2021), the success of organizations is often dependent on their networking performance. This performance includes gaining access to and capitalizing on intangible resources such as befitting managerial and employee knowledge (Vătămănescu et al., 2020) and the technological advancements, which help foster a suitable knowledge-centric environment.

Progressively, knowledge has taken on some distinctive characteristics. These characteristics include the following: “1) it is focused on intangible resources rather than tangibles resources, 2) it has a hyper-competitive business environment, 3) it is digital, 4) it is virtual, and 5) it is networked” (Ordónez de Pablos, 2010). Because of this, the act of sharing and transferring knowledge requires connectivity, which is a fundamental component of the network society (Vătămănescu et al., 2016).

The knowledge society and the network society are two primary frames that are more complementary to one another than they are concurrent (Castells, 2000a, b). In contrast to what was formerly known as the “information society,” the knowledge society places less of an emphasis on the informational content itself and more of an emphasis on the promotion of knowledge-sharing and knowledge-transfer flows, favoring, as a result, an approach that is more process oriented. Knowledge societies push the limits of what can be considered an information society even further and capitalize on the ways in which the vast amount of information that is already accessible and the lightning-fast rate at which it can be transmitted may be utilized (Wang, 2015; Fang et al., 2013; Ferguson & Taminiau, 2014).

We are witnessing the rise of new organizations that are open to integrating or interconnecting services from vast networks of collaborators in order to generate more knowledge-driven goods and services. This is especially true given that disruptive digital technologies have also set the stage for innovative platforms and business innovation. Collaboration is at the heart of innovation because of the openness toward knowledge sharing and the catalyzing effect that cutting-edge technologies and their inherent applications have (Vătămănescu & Alexandru, 2018). These technologies and applications include the Internet of Things, social media, cloud computing, data mining, big data analytics, business intelligence, and others. According to Liu and Brody (2016, p. 1), organizations employ this simple type of teaming to chase new opportunities before they have figured out the specific percentages of business value that each partner will give. Companies have been observed to open up their knowledge and tangible and intangible assets, making them available to others with the purpose of creating new (aggregate) business value. Some have even created a venue for sharing knowledge concerning the nature and availability of various organizations’ assets and capabilities.

In other words, social and structural exchanges through active networks and collaboration are likely to increase strategic growth within organizations and, as a consequence, to strengthen their position and access to resources within networks, which are stimulated by a capital of trust and shared interest (Cannone & Ughetto, 2014; Hohenthal et al., 2014). Steadily, many studies have primarily concentrated on the process of knowledge transfer at the inter-unit level. They have done so by building on two overarching premises: first, that knowledge is primarily produced through social interaction (Brown & Duguid, 2001, 2002; Wang, 2014) and, second, that the process of knowledge transfer itself is a key driver for the general occurrence of innovation (Owen-Smith & Powell, 2004; Shu et al., 2012). In this regard, Valkokari et al. (2012) recognize a strong association between knowledge management and networked innovation. They also highlight the importance of collaboration for networked innovation rather than merely the formation of innovation networks, as playing a significant role in the process. Strong links among members, a shared goal and purpose, and the consciousness that one is a component of an organic system are what give worth and substance to the network.

In this light, the competitive advantage should be deemed as system driven and should not depend on remote capabilities or activities. Smart companies endeavor to establish a culture of sharing knowledge through knowledge networks—at both intra- and transorganizational levels, admitting the considerable benefits for individuals, groups, organizations, and networks (Sharkie, 2003; Ordónez de Pablos, 2010; Leung et al., 2013). In addition, virtual connections unite individuals, knowledge, information, ideas, and competencies, which stimulate the spring of collective intelligence. This was emphasized by Soto-Acosta et al. (2014) when they were discussing the influence that web knowledge sharing has on creativity and implicitly on innovation.

6 Conclusions

Looking at the business environment developments lately, it becomes apparent that companies more than ever resort to the knowledge resources embedded in their networks, striving to capitalize on opportunities by reconfiguring dynamic knowledge capabilities and creating new knowledge. By relying on relational capital represented by networks, which facilitates the sharing of knowledge and the buildup of intellectual capital (Paoloni et al., 2022), organizations aim to overcome the uncertainties and challenges brought about by the global health crisis and its subsequent economic and social effects.

At the same time, firms increasingly harness digital technology capabilities to manage internal and external knowledge resources and sustain innovation in products and services but also management and business model innovation. To this end, they employ various knowledge management strategies to develop creative collaborations and partnerships with stakeholders and thus constantly accrue and replenish core knowledge resources through synergic business exchanges. Such knowledge flows nurture the development of innovative capabilities, growth, and performance.

The threat of the Covid-19 pandemic and its aftermath forced businesses to swiftly regroup and adapt to new realities by dynamically transforming their competencies and routines but also accessing the power and safety of networks to exchange knowledge and expertise and overcome impediments in order to survive and even thrive. Though collaborative practices such as alliances or coopetition can have drawbacks like hindering or diminishing competitive advantages, they also provide exclusive advantages such as sharing knowledge and promoting rapid innovation, especially in crucial contexts, as represented by the global Coronavirus disease. A foolproof example is the Pfizer-BioNTech partnership for swiftly developing a vaccine against the Sars-Cov-2 virus for the benefit of humankind (Pfizer.com, 2020) by leveraging joint expertise, technology, and regulatory and commercial capabilities in a highly competitive sector and adhering to shared values.

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Part III

Knowledge Management: A Technology Perspective

Knowledge Management, Digital Transformation and the Resilience of the Firm

Alexeis Garcia-Perez and Mark P. Sallos

Abstract

The drive for digitalization of the global economy has increased the scope of threats faced by businesses and societies. The growing footprint of information and communication technology infrastructures supporting modern societies opens a range of unpredictable challenges for organizations. In this context, the dynamic nature of cybersecurity has redefined the organizational risk climate. In order to address these challenges, organizations are continuously assessing their cybersecurity performance and often reconsider their cybersecurity investments. There is substantial interest and efforts in the research and practice communities in understanding and building organizational cybersecurity. However, there is a particular focus on the technological dimension of cybersecurity, which often has a negative effect on the actions of the organizational decision-makers. With an aim to address this gap, this chapter puts knowledge at the centre of the cybersecurity narrative. We argue that knowledge influences and is influenced by the cybersecurity of organizations, both as a driver of cybersecurity and as a consequence of the impact of cyber incidents. Building upon this premise, this chapter provides a perspective of cybersecurity as a knowledge problem. We argue that an organization's ability to effectively manage risk is rooted in its ability to manage relevant knowledge.

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Keywords

Knowledge management · Cybersecurity · Digital resilience · Cybersecurity knowledge · Cybersecurity capabilities · Cybersecurity competencies · Digital transformation

1 Knowledge, Digital Transformation and Cybersecurity

Knowledge is an abstract concept, a term that has meaning in many and perhaps all fields. Depending on the field, knowledge can be perceived in many ways, such as an attribute of a person, a human process or a tangible or intangible asset. Building on the widely adopted definition of knowledge as "justified true belief" (Nonaka & Takeuchi, 1995; p.87), Bolisani and Bratianu (2018) concluded that in its relation to the context where it exists, knowledge comprises both objective and subjective attributes. Its objective attributes have enabled the scientific and technological knowledge that has driven socio-economic developments throughout the years. Subjective attributes, such as the emotional and spiritual sentiments of the individual, help in the effective adoption and application of new knowledge in business and society (Bratianu, 2017).

Regardless of how it has been perceived by different players, knowledge is what fuels the twenty-first-century economic systems. Knowledge capacity building, knowledge capabilities and knowledge capital are the critical success factors for a transition from an industrial economy to a knowledge economy (Garcia-Perez et al., 2019).

Although knowledge has been part of all economic systems throughout history, recent events and advances have made it more visible and accessible. In the twenty-first century, knowledge has become a primary factor of production. It is equivalent to financial and physical capital in the industrial economy and to land and physical labour in the agricultural economy. Technology developments have facilitated new processes of knowledge creation, dissemination and use. Increased knowledge capacity in organizations and in populations has increased awareness of its value and its power to change economic relationships. A knowledge economy has therefore been so named because the core commodity is knowledge. Despite the importance of other intangible assets—such as data and information—for decision-making processes, the key elements that characterize the knowledge economy are the production, distribution and use of knowledge. As knowledge flows within and between organizations and communities, it plays a crucial role in socio-economic growth and competitiveness.

As business and societies have sought to adapt to the changing needs of a progressively digital society throughout the past few years, digital technologies have gained a place at the heart of organizations and become deeply embedded in our personal lives. Organizations have been pushed to seek digital transformation and functional modernization at an unprecedented pace (Krist, 2022). And there are very few exceptions to this trend; the payment mechanisms, consumer availability and operational record keeping required for most business transactions are digital first in most sectors and regions, affecting even the most traditional industries. Subsequently, companies must generate, effectively utilize and compete using a growing digital/cyber infrastructure.

Despite its benefits, reliance on cyber infrastructure also generates additional dimensions of risk, including security risks, which present unique challenges. The effective management of such risks and the challenges they pose may be key to the sustainability and resilience of organizations on their journey of digital transformation (Garcia-Perez et al., 2021). We argue that building and maintaining digital resilience in this rapidly evolving socio-economic landscape is a knowledge problem (Sallos et al., 2019)—a premise elaborated throughout the following chapter.

1.1 Cyber Risk and Cyber Risk Management

Cyber risk is increasingly perceived as an evolving category of undesirable outcomes affecting the stakeholders of the digital society (WEF, 2019). Organizations are both key subjects and objects in this phenomenon, as makers, users and owners of the technological infrastructure shaping the cybersecurity space. Implicitly, their ability to manage and mitigate the scope of cybersecurity incidents is of increasing societal importance. Moreover, the concepts, approaches and toolkits that they use to frame, structure and respond to such emerging challenges can have a substantial effect on the efficacy of their efforts. Cyber risk management becomes one of the most prevalent constructs used to frame organizational efforts to control this problem space. As well as resilience, cyber risk management entails an expansion of an existing organizational logic (Annarelli & Nonino, 2016; Power, 2007), embodied through tools and structures and adapted to address an emergent challenge. The construct exhibits a practice-driven dynamic and performative effects, manifesting an organizational meaning, which is influenced by and further influences architectures and rationales behind efforts to limit the negative impact of threats to performance.

While the core components of risk thinking predate modernity (Covello & Mumpower, 1985; Zachmann, 2014), Dionne (2013) identifies the origins of 'modern' organizational risk management as the mid-twentieth century (1955–1964). Its emergence is described as a function of organizational activities, most notably self-insurance (i.e. establishing a liquidity reserve for potential adverse events) and self-protection (i.e. addressing the likelihood of such events prior to their occurrence). Following its early applications, a growing set of capabilities and tools enabled organizations to speculate financial risks for profit maximization, increasing the scope of risk management practices. This trend is linked to an increased awareness of the growing variety of largely man-made risks, which require management and control from organizations (Power, 2004). Subsequently, it arguably culminated in the later development of enterprise risk management (ERM) as a systematic, holistic approach to the aggregation and integration of risk (Bromiley et al., 2015). Through its emphasis on strategic support, value generation and holism, the ideal of ERM presents itself as a progression from the siloed approach to organizational risk management. Subsequently, it entails integrating the individual domains of risk management in an enterprise-level risk narrative. From an ERM perspective, cyber risks are primarily considered and managed as a subset of operational risk ('operational cyber risk') (Eling & Schnell, 2016; Kamiya et al., 2018).

1.2 Digital Transformation and Cybersecurity

Alongside pressures on process and business model adaptation, the growing footprint of internet-connected technology places capability challenges for companies. The primary dimensions of such challenges relate to the drivers of digitalization: the exploration of how emerging technologies can improve competitive standing, value creation and profitability. However, the significance of these challenges can overshadow shifts in risk exposure, as companies seek positive returns on their investments in digital transformation. This phenomenon is of particular importance for organizations, which because of their size, sector, or business model, must fill significant skill gaps to undergo operational digitalization. Given that organizational success rests on the generation of market value and comparative efficiency in its monetization, a significant segment of the economy was historically able to generate positive returns with limited technological capabilities. Many actors that fulfil important economic functions and fall in this segment are now undergoing accelerated digital transformation journeys. The resulting shifts in their risk exposures and resilience are of societal importance, particularly in cybersecurity.

Most companies today rely on profit generation as a primary reason for and mode of existence. Security, which on the short-term and under ideal conditions can be inconvenient, seemingly redundant or expensive, emerges as a secondary function. Accurately appraising its deficits requires, paradoxically, capabilities and supporting infrastructure as well as knowledge, generating the potential for a quasi-Dunning-Kruger effect (Dunning, 2011): overconfidence among the underprepared, in the absence of sufficiently detailed models of the problem. This means that most technological decisions can fail to account for security risk adequately, as key decision-makers can be under-equipped to gauge the scope and implications of a changing technological infrastructure. Moreover, organizations able to generate and monetize value in a highly specialized economy can become key societal players based on a limited core cluster of primary capabilities. Systemically, this incentivizes and rewards domain knowledge and value conversion/monetization capabilities differentially from security. This means that both the development and management of knowledge relating to cybersecurity—a key prerequisite for managing associated risks—are structurally yet unevenly scarce in modern companies.

The implications that this carries on risk exposure are hard to estimate, especially in non-local terms. As victims of cyberattacks, companies can further generate ripple effects in their stakeholder communities and sectors. Despite their broader significance, the visibility of cyberattack consequences is often low. For instance, confidentiality attacks can affect users in ways that are individually meaningful but societally—and organizationally—invisible. This can range from the leaking of identifying information resulting in identity theft to the theft of intellectual property.

Over an extended timeframe, the loss of intellectual property has the potential of shifting competitive dynamics and leads to significant opportunity losses. However, such instances can be of insufficient immediate and direct consequence to reprioritize knowledge requirements and the hierarchy of necessary capabilities. Instead, they are the product of counterfactuals—the potential profit had a breach/leak not occurred and, respectively, the competitive positioning had key intellectual property remained exclusive to its developer. In slight contrast, integrity and availability attacks are more immediate and easier to quantify locally (i.e. relative to the company), yet can easily be perceived as a rare *force majeure* event rather than the manifestation of an ongoing probability function emergent from the company's decisions, capabilities and knowledge.

However, under conditions of general systemic stress like those generated by the COVID-19 pandemic, the indivisibility of cybersecurity and resilience from broader performance becomes apparent (Groenendaal & Helsloot, 2021). In the context of the pandemic, operational disruptions and response measures have further accelerated digitalization pressures, increasing the penalties for tentative organizations unable to effectively adapt their operational model. At the same time, the resulting embedded nature of digital infrastructure in everyday operations has diminished the value of considering cybersecurity as an abstract, delineated problem or risk to be managed. While the value of a holistic view of cybersecurity has been advocated for in the context of best-practice standards and frameworks, under conditions of systemic stress, cybersecurity outcomes in digitally enabled organizations become less functionally isolated or domain specific.

For instance, an attack affecting the availability of systems (e.g. ransomware or DDoS) in a healthcare organization, under times of increased stress and decreased capacity can result in loss of life. This, of course, is not an isolated function of the attack itself, which, under different circumstances, generally yields an inconvenient, potentially expensive, yet tolerable temporary outcome. Instead, such an outcome emerges from the disruption of the core function of the system itself, as one of its key elements—the ICT infrastructure—is disrupted under conditions of existing vulnerability. By presenting a broader state of widespread vulnerability and shifting the status quo, the COVID-19 pandemic has arguably diminished the prominence of cybersecurity in the broader societal risk conversation (see, for instance, the WEF Global Risk Reports, 2019, 2020, 2021, 2022a). This partly indicates how, in a digital society, cyber risk is embedded within most other risk dimensions (Garcia-Perez et al., 2021). This can hinder the ability of organizations to effectively gauge the risks faced alongside their digitalization journey, as they can easily reframe incidents while failing to acknowledge and attribute their impact.

Thus, beyond the threat of regulatory intervention, and the somewhat fuzzy threat of reputational damage, many business owners may fail to accurately appraise the risk functions of potential cyber incidents, which accompany the benefits of increasing digitalization. Importantly, this limitation is likely to be heightened further if considering externalities and network effects (Sallos et al., 2019). For instance, cyber criminals can use stolen user credentials, coupled with common poor cyber hygiene practices (e.g. password reuse), to cause other breaches. This negatively affects the overall cyber risk climate (Garcia-Perez et al., 2021). The probabilities and clear consequences of such outcomes, which are impacted by the rapid growth of a company's attack surface, are difficult to gauge, even for well-intended and resourced actors. Notably, this is because of the knowledge problem presented by cybersecurity—a problem which accompanies digital transformation efforts.

1.3 Cybersecurity as a 'Knowledge Problem'

The framing of cybersecurity as a knowledge problem is prescriptively meaningful. Townsend et al. (2018:661) describe a 'knowledge problem' as '… an epistemological obstacle to strategic action that manifests in terms of the novelty being confronted along one or more dimensions of action, including what is being done, who is doing it, why they are doing it, and when, where, or how they are doing it'. This framing proposes that a key barrier to effective strategic action in cybersecurity lies in the underlying epistemic dynamics of the domain. It posits that decision-makers seeking to improve the performance of their cybersecurity efforts, and adequately manage their cyber risk exposures, should first better understand and address the functional (i.e. domain specific) inhibitors of knowledge acquisition, creation, validation and application mechanisms. Without confronting this knowledge problem, the resilience of organizations becomes a passive by-product of its overall characteristics and chance, rather than the output of strategic action.

Importantly, Sallos et al. (2019) differentiate between two categories of such knowledge inhibitors: ontological and epistemic. Both are likely to pose obstacles to effective strategic actions and limit the accuracy of the risk estimates associated with different courses of action in digital transformation. The former is used to describe the high levels of complexity/non-linearity associated with the structure of the cyber domain, given its scope, pace and number of interactions between subcomponents. Coupled with its rapidly evolving pace of change, this makes cybersecurity a difficult problem to model, especially at the level of individual actors. Modelling all the key dependencies to networked third parties (including partners, service vendors as well as software and hardware providers) that could affect the likelihood of a cybersecurity incident can prove to be a difficult/impossible task, given the non-linear effects prevalent in the domain. From an epistemic perspective, there are a variety of limitations, patterns and dynamics within the space, which inhibit the adequate formulation of strategy and risk modelling for organizations seeking to manage their increased exposure to this class of risk effectively. Unlike ontological inhibitors, the prevalence of epistemic inhibitors varies based on the specific context of each organization and its knowledge base. They include gaps in critical capabilities and competencies, informational asymmetries, incentive misalignments, opaque costing of externalities and disadvantageous game theoretic positioning (Sallos et al., 2019).

The role of capability gaps as an epistemic inhibitor emerges from the insufficient market availability of cybersecurity talent, coupled with the difficulties associated with the effective utilization of such talent, if available (ISSA, 2021). While technical, dedicated employees are essential in managing cyber risk, foundational cybersecurity capabilities are needed throughout digital organizations to achieve a holistic, proactive security model often associated with increased cyber resilience. As attackers seek the path of least resistance to cybercrime, integrating and building awareness of security practices in day-to-day operations—that is, technical knowledge sharing and application—is key. This is further supported by the timely identification of meaningful information relating to threat-actor behaviour, available vulnerabilities and attack surface changes. However, the information available for most companies is often either limited in scope, delayed or problematic.

Informational asymmetries and incentive misalignments in cybersecurity are a well-studied problem (Anderson & Moore, 2006; Moore, 2010). They are present at multiple organizational levels, between different classes of actors. For instance, there are foundational informational asymmetries in the adversarial dynamic between attackers and defenders. Attackers benefit from high levels of specialization, effective knowledge sharing communities and extensive trial-and-error campaigns seeking to identify and effectively exploit either unknown or untreated vulnerabilities. In contrast, businesses—and often communities—have a perception of cybersecurity as a secondary function and one that does not directly add to profit but still costs money to operate. Their knowledge sharing partnerships are limited, and they must rely on wide-spectrum commercial products and services to fill skills gaps and mitigate cyber risks. This results in a foundationally advantageous position for cyber criminals.

The hostile informational climate is further exacerbated by the game-theoretic advantage of attackers: to 'win', i.e. breach a target organization, attackers must only be successful once, in a chain of trial and error; whereas a 'win' for the defending organization involves thwarting all the attacker's efforts—a substantially more costly and less likely outcome. Relationships between companies and vendors can also exhibit incentive misalignments and informational asymmetries, as the claims of the latter can rarely be validated, while their profitability depends on the value they are likely to generate relative to the perceived scope of the problem. In other words, vendors are economically incentivized to present a specific, commercially advantageous framing of the problem that is aligned with the solutions that they have provided (Sallos et al., 2019).

The resulting difficulties associated with the effective management of cybersecurity have resulted in calls for an alternative, context-appropriate approach to managing cybersecurity. In this context, cyber resilience emerged as a key notion in policy circles and communities of practice (Alkove, 2021; The White House 2013; WEF, 2022b), which was meant to acknowledge the *pragmatically* unavoidable nature of cyber incidents. Cyber resilience is studied from a security perspective—particularly from a cybersecurity standpoint—in line with the digital nature of the current transformation efforts in organizations from the public, private and voluntary sectors. The term, as defined, is essential for the robustness of digital transformations as it ensures that cybersecurity incidents do not lead to breaking points in the informational infrastructure of organizations, which lead to collapse of the business or its value chain.

The implication of a resilience-based view of cybersecurity is twofold. Firstly, avoidance-based strategies are fundamentally fragile, partly due to the previously mentioned themes. Even capable and well-provisioned companies have proven to consistently fall prey to asymmetric attacks. This would indicate that additional budgets and further technical prowess are beneficial, yet not a panacea (beyond their limited prescriptive utility). Secondly, in the event of an incident, rather than a focus on opportunity costing as a way to gauge impact, the company's ability to absorb and recover its function in a timely manner is of primary importance.

Despite its emphasis on the unpredictability of incidents, a resilience-based approach to cybersecurity does not remove the epistemic gravitas from the problem faced by organizations. Rather, it shifts the primary scope of the knowledge problem from a predictive one—i.e. what attacks are likely to occur, and how could they be avoided—to a structural one, i.e. what is functionally essential within the company, and in the event of a presumed disruption, how can systemic failure be avoided or contained in a reasonable timeframe. While the former is, based on the available evidence, impractical to tackle as a foundation for effective organizational security practice, the latter is arguably not less complex. As core societal functions become digitalized, an effective understanding of cyber resilience and its knowledge dependencies is as important as ever for both organizations and their exhaustive communities of stakeholders. As a sidenote, the implications and complexities of a resilience-based approach to cybersecurity—including considering the locus of the targeted (i.e. sought to be resilient) system—are beyond the scope of the current narrative. However, they too drive the hostile epistemic climate for effective decision-making in organizational cybersecurity.

2 Towards a Knowledge-Driven Approach to Digital Resilience in Organizations

By leveraging internet technologies and integrating digitalization in their operations, companies also increase their exposure to a class of threats, decreasing their overall security. The resulting interdependence and potential tensions between security and interconnectivity, pace of change, and openness highlights the limitations of a narrow focus, may it be security or increased competitive performance. Instead, organizations are increasingly encouraged to use a resilience-based approach that would enable them to adapt and thrive in the rapidly changing digital environment. This carries a range of benefits, including an ability to integrate competing adaptive drivers in a coherent framework: for instance, adaptation to both the economic and the security climate, each playing a key role in the sustainability of the organization. While cyber resilience can depend on structure and conjuncture—both passive factors—attempts to improve resilience depend on the presence of critical capabilities and competencies within the organization.

On the basis that digital resilience is fundamentally a knowledge problem, we argue that effective knowledge management strategies and operations are key to the ability of organizations to build their digital resilience. As organizations increasingly become key players in a digital world, an understanding of digital security is required, which goes beyond protection against threats such as malware or the use of social engineering techniques by cyber criminals. Ultimately, knowledge management can be a vehicle not only for mitigation of cyber risks such as cyberattacks or failures in digital infrastructures in the supply chain. Knowledge management can enable continuous adaptation and recovery from disruptions that can occur in the digital environment of the organization, including those caused by human error, natural disasters or physical security breaches.

2.1 Cybersecurity Knowledge: A Definition

Before we focus on the nature and importance of effective cybersecurity knowledge management, it is important to define what can be understood as cybersecurity knowledge. Although an agreed definition is still missing, the term is referred to in the extant literature as knowledge that helps organizations and individuals ensure cybersecurity assurance (Fatokun et al., 2022; Jia et al., 2018; Raineri & Fudge, 2019). In an attempt to add a practical dimension to this perspective, we define cybersecurity knowledge for organizations as knowledge of the risks—e.g. threats and vulnerabilities—that exist in their internal and external digital environments, as well as the technologies, practices and behaviours that can be developed, adopted and used to protect the organization and its stakeholders against such risks.

Our perspective of cybersecurity knowledge covers a wide range of resources, ranging from information to skills, expertise and experience of individuals and groups within the organization. Our understanding of the concept is aligned with the most recent cognitive theories that integrate managerial decision-making with the motivational elements of employees, organizational culture and organizational behaviour—see the theory of knowledge fields by Bratianu and Bejinaru (2019). Our definition can, therefore, be used to refer to technical knowledge such as knowledge of hardware and software or to knowledge of the digital landscape of the organization, which covers digital assets and related products and services. It also refers to knowledge of cybersecurity regulations and compliance requirements, including those laws, standards and regulations that apply to the organization and its industry, and, finally, to knowledge related to the ways the organization responds to cybersecurity incidents, referring to the processes and procedures used to detect, respond to and recover from cybersecurity incidents—often the sole focus of organizational efforts to remain resilient.

Cybersecurity knowledge can, therefore, be explicit or tacit. Explicit cybersecurity knowledge includes the knowledge resources contained in repositories and documents such as reports, manuals, contracts, case studies, white papers, policies, procedures, etc. Tacit cybersecurity knowledge is embedded in the organization, its people and processes and procedures such as those used to detect, respond to and recover from cyberattacks and other security incidents. Cybersecurity knowledge is, thus, important not only for those in charge of the cybersecurity function but also—and often more so—for individuals and teams throughout the organization. From a wider perspective, it can be argued that awareness of cybersecurity in individuals at all levels becomes the key for the effective management and protection of the organization's digital infrastructure and its stakeholders.

2.2 Cybersecurity Knowledge Management

Our perspective of cybersecurity knowledge suggests that its management is expected to follow the general principles of knowledge management in the organization. In essence, a knowledge culture within the organization and in its relationships with its key stakeholders should underpin knowledge processes that are directly or indirectly relevant to efforts to build organizational resilience. Some of such principles are discussed in the remainder of this section.

2.2.1 Identification and Acquisition of Cybersecurity Knowledge

Identification and acquisition of knowledge are processes related to obtaining new knowledge structures or skills through various means. Within the organization, such processes involve the exploration, acquisition, organization and retention of knowledge that can be used to improve the understanding of a particular domain and the ability to solve problems related to such a domain. These two processes have long been recognized as key requirements for problem-solving strategies and behaviours within the organization (Musen, 1993).

Digital resilience requires the identification and acquisition of those knowledge structures that enable the development and implementation of robust cybersecurity management strategies. For example, knowledge of the organization's digital landscape, which includes its digital assets, internal and external stakeholders as well as their digital interdependencies, is essential for the understanding and mitigation of cybersecurity risks. Similarly, knowledge of cybersecurity-relevant laws, regulations and industry standards is required not only for compliance but also to manage their potential impact on the organization and its business. These and other types of cybersecurity knowledge can be found in different formats and in a variety of sources, from professional organizations and cybersecurity companies to government agencies and universities.

It is essential for the organization—from its management board to its middle management layer and the workforce—to develop an understanding of their digital landscape that enables them to:

- Identify areas where the organization lacks the necessary knowledge or expertise to effectively protect against cyber threats.
- Determine what specific knowledge is needed to fill the identified knowledge gaps and the nature and potential sources of such knowledge.

- Design and implement a cybersecurity knowledge acquisition programme and embed it into the overall knowledge management strategy of the organization. This programme would target different stakeholders and activities such as training, research, and networking with industry and cybersecurity experts.
- Design, as part of its cybersecurity function, a mechanism to ensure that the new knowledge is applied/embedded in the organization's systems and processes to improve cybersecurity.

An essential part of the cybersecurity knowledge base of the organization comes from often automated processes that when regularly performed help organizations maintain a secure and compliant digital environment. A vulnerability scan, for example, identifies potential weaknesses in the organization's digital infrastructure (e.g. in its computer networks, its data storage systems, etc.) such as missing software updates or misconfigured settings. Another example is a threat scan, a process that looks for signs of actual or attempted unauthorized access or malicious activity within the system—be it accidental or adversary—such as malware or unusual network activity. The outcomes of such processes become essential knowledge resources for the organization to act upon, often immediately, to identify and remediate potential security issues before they can be exploited by cyber criminals. Such processes are performed using a variety of software security tools such as security databases, intrusion detection and prevention systems, and security information and event management systems. The fact that the use of such security tools and the understanding of their outputs (e.g. patterns of traffic on a computer network) requires a technical background means that the new knowledge stays within the technology team and does not always reach the strategic layer of decision-making within the organization. The understanding of cybersecurity knowledge assets is key for their identification and acquisition. In many cases, such understanding is either reserved to support functions—information managers and information technologists—or totally relegated to the management board, which prevents the organization from developing a holistic strategy for managing cyber knowledge capabilities and assets. The role of an information security officer as a translator of this knowledge between the security function and the management board, therefore, becomes a key to the organization's resilience.

2.2.2 Organization and Storing of Cybersecurity Knowledge

Core to effective knowledge management strategies are the processes of arranging and managing information and knowledge structures in a manner that facilitates easy access, retrieval and use. Effective organization and storage of knowledge resources can lead to improved productivity, decision-making and innovation within the business (Gadner et al., 2003). At the heart of the management of cybersecurity knowledge assets are those capabilities related to knowledge representation, mapping and preservation, retention and loss, and knowledge quality. This capability often relies on knowledge organization systems and includes all types of knowledge capital assets related to cybersecurity, from human capital assets to structural capital assets and relational capital assets.

As with any knowledge structures within the organization's knowledge base, explicit cybersecurity knowledge resources must be organized and adequately stored for easy access as and when required. The organization of explicit knowledge resources can be described as a process of systematically arranging, classifying and storing cybersecurity knowledge assets in order to make them easily retrievable and understandable. Cybersecurity knowledge organization systems can, therefore, exist as a key piece of the wider knowledge management strategy of the organization.

2.2.3 What Is a Cybersecurity Knowledge Organization System?

From a knowledge management perspective, a cybersecurity knowledge organization system is a system that can be used to store, organize and manage explicit cybersecurity knowledge. It could include databases, knowledge bases and other types of systems that can be used to manage knowledge related to security threats, vulnerabilities and best practices. Examples of cybersecurity knowledge organization systems would include traditional cybersecurity knowledge bases as well as vulnerability, threat and security incident management and intelligence platforms. The latter not only store but also use advanced mechanisms and machine learning algorithms to extract insights from the aggregation and analysis of information about current and emerging threats and vulnerabilities.

Cybersecurity knowledge organization systems provide a central repository of information about known threats and vulnerabilities relevant for the organization and its digital landscape, as well as the necessary evidence that security controls and protocols are in place and properly configured. Their use is key as a mean of supporting decision-makers within the organization as well as those external stakeholders that align with the organization's overall security strategy and objectives. In doing so, cybersecurity knowledge organization systems would be key efforts to improve the organization's incident response capabilities and compliance and, therefore, its overall cybersecurity posture and that of its value chain.

2.2.4 Sharing and Dissemination of Cybersecurity Knowledge

From a knowledge management perspective, knowledge sharing and dissemination are processes that facilitate the flows of knowledge within the organization and between its key stakeholders so that it can be used to improve decision-making and performance. Knowledge sharing and dissemination are essential components of the wider process of organizational learning: a series of collective processes and cultures of many individuals who learn in the context of the organization, leading to institutionalization of concepts in organizational knowledge structures (Reid et al., 2021).

When it comes to the sharing and dissemination of explicit cybersecurity knowledge assets, it can be argued that the use of knowledge organization systems would facilitate access to relevant knowledge by key stakeholders within the organization. However, the nature of the subject and the overall perception of cybersecurity knowledge as technology knowledge may mean that explicit knowledge assets are perceived as a resource for the information security function within the organization. This is precisely where processes that support a learning organization are required for the effective sharing and dissemination of cybersecurity knowledge. These would include learning at individual, group and organizational levels using a range of tools and methods.

Initially, the organization would seek to prioritize the learning that drives cybersecurity governance: raising awareness of cybersecurity in the management board. Equally important would be the provision of regular training and education to employees on cybersecurity best practices. From basic elements, such as password management, phishing and social engineering, to more elaborated areas such as incident reporting and management. Thus, a culture of sharing and dissemination of cybersecurity knowledge within the organization and to its stakeholders could be supported not only by training elements, such as courses or tutorials, but also by more traditional means. These could include cybersecurity awareness programmes that serve to share the results of regular security assessments and best practices and ensuring that the workforce is familiar with the organization's incident response plan and cybersecurity policy and that all feel able to put these into practice, e.g. by reporting cybersecurity incidents involving company's and individual's' devices with access to the organization's digital infrastructure.

2.2.5 Creating, Reviewing and Updating Cybersecurity Knowledge

There are different perspectives on the meaning and implications of knowledge creation as a process in the context of organizations. The concept is referred to in some research as related to constructing new ideas and insights, while a significant number of scholars and practitioners extend this view to include the synthesis and integration of existing knowledge (e.g. Nonaka & Takeuchi, 2001; Nonaka & Takeuchi, 2007). There is agreement in the literature on the importance of knowledge creation for organizations to gain competitive advantage through innovation and growth.

The creation of cybersecurity knowledge brings to the organization benefits beyond other knowledge-related processes such as acquisition or sharing. While acquiring cybersecurity knowledge would enable the organization to expand primarily its explicit knowledge base, engaging individuals and teams in the creation of cybersecurity knowledge has an impact on the culture of the organization. A cybersecurity conscious knowledge management strategy that acknowledges the importance of knowledge creation can foster an organizational learning culture. With it, employees will be encouraged to think critically as they develop their individual, team and organizational cybersecurity capabilities. Cybersecurity awareness enables engagement in cybersecurity practice such as prevention and reporting of cybersecurity incidents, ultimately leading to a positive cybersecurity culture across the organization and with its value chain.

In addition to mechanisms previously discussed—e.g. regular security training and assessments, the organization can take steps to create cybersecurity knowledge creation culture, including:

- Establishing a cybersecurity incident response plan and a continuous monitoring program, which engages all employees in the detection of and response to security incidents in real-time
- Collaborating with other organizations not only in their supply and value chains but also with cybersecurity research and practice institutions, to share cybersecurity knowledge and best practices, through strategies such as:
  - Attending industry events, reading industry publications and participating in online forums
  - Creating and nurturing relevant communities of practice supported, if needed, by a cybersecurity knowledge base

These activities, combined with other key principles of cyber hygiene within the organization, help create a cybersecurity culture based on individual, team and organizational learning. This will, therefore, have a significant impact on the tacit dimension of the cybersecurity knowledge problem across the business.

Continuous review and update of explicit cybersecurity knowledge are essential processes, particularly given the evolving nature of the domain. As discussed in previous sections, threats and vulnerabilities are continuously changing, as are the best practices and industry standards and legislation. There are challenges related to ensuring that the explicit cybersecurity knowledge resources that are either distributed throughout the organization or stored in systems remain accurate and relevant. Dealing with most of these changes is a task often beyond the role and capacity of the employee. Specific expertise is generally required, which can only be found in the technology and information management functions.

In these circumstances, and depending on factors that include the size of the organizations and its business, a dedicated team or department responsible for monitoring and protecting the organization's digital infrastructure from cyberattacks becomes an imperative. An information security function can support the organization in continuously assessing and improving its security posture. In direct contact with all stakeholders, from employees to the board internally, to organizations and communities in the value chain, the information security team will enable a rapid response to early-detected cybersecurity incidents. This would reduce the potential impact and severity of such incidents. Real-time visibility of threats and control of vulnerabilities enables protection of business critical assets and effective management of information risks.

From a knowledge management perspective, the cybersecurity team would help determine the required set technical cybersecurity capabilities and align these with the main business drivers by designing key skills, processes and tools required. They will then work with the relevant functions to ensure the effective implementation of the relevant strategy, supported by the relevant technologies for the creation and update of cybersecurity knowledge that enables cyber capabilities such as the following:

- Improved cyber situational awareness of all stakeholders through effective detection of known and discovery of new/unknown cyber threats and vulnerabilities.

Effective systems would be able to provide the organization with actionable information on incidents, threats and vulnerabilities.
- Secure access to the organization's digital infrastructure, to ensure its integrity, confidentiality and availability.
- Sharing of knowledge about incidents, threats and vulnerabilities, as well as relevant mitigation patterns in a form that enables action by both automated systems and experts throughout the value chain.

2.2.6 Regular Assessment of Cybersecurity Knowledge

Knowledge assessment is an essential part of knowledge management that helps organizations to identify, evaluate and measure their knowledge base. It involves the systematic evaluation of an organization's knowledge resources to determine their value, quality and relevance to the organization's goals and objectives. The results of knowledge assessments can help organizations to identify areas of strength and weakness, develop strategies for improving knowledge management and measure the effectiveness of their knowledge management initiatives.

Knowledge assessment processes for specific knowledge assets often involve an analysis of their relevance and quality, with a view to assessing their currency, value and impact towards the knowledge needs of the organization (Alavi & Leidner, 2001). The assessment results can be used to develop new knowledge management strategies or to revise existing strategies and operations.

Given the dynamic nature of the cybersecurity domain, there is a need for a continuous review and update of the cybersecurity knowledge base of the organization. In particular, the knowledge management strategy would be expected to include the regular review, assessment and update of the following knowledge resources:

- Cyber awareness in the workforce in relation to the latest cybersecurity threats and best practices
- Incident response plan, which determines the organization's ability to detect and respond to security incidents in real-time
- The organization's cybersecurity policies, procedures, and standards to ensure they align with current best practices and industry standards
- Knowledge of the latest cybersecurity incidents that have had—directly or indirectly—an impact on the industry or the organization's stakeholders, as well as emerging external threats and vulnerabilities
- Internal vulnerabilities and areas for improvement, identified through regular technical and non-technical security assessments
- Knowledge of cybersecurity best practices in the sector

The review and update of cybersecurity knowledge within the organization could be supported by a variety of traditional and innovative knowledge management strategies. These would include the creation of individual roles and communities of practice. These can lead to a cybersecurity culture conducive to the sharing and adoption of best practices within the organization, as well as the adoption of employee feedback into the organization's cybersecurity strategy.

Collaboration and knowledge sharing among employees can also be supported by the creation of a cybersecurity knowledge base. An explicit cybersecurity knowledge base would allow for a continuous assessment and updating of the organization's security systems and tools to ensure their effectiveness in detecting and preventing cyber incidents. Finally, these would facilitate the regular review of the organization's cyber incident response and incident management procedures, two of the most important components of the cybersecurity management strategy.

3 Conclusions

Building on the importance of a resilience-based approach to the secure digital transformation of businesses and society, we understand digital resilience fundamentally as a knowledge problem. On this basis, we argue that effective knowledge management strategies and operations are key to the ability of organizations to understand digital security and, ultimately, build their digital resilience.

The presence of an organization in the cyberspace or digital world is shaped by the interaction between software vendors, software developers and system architects and engineers, as much as it is influenced by the knowledge embedded in managerial initiatives and that of technologically active employees, organizational partners and end-users. At the same time, threats in the digital environment can disrupt the security, stability and sustainability of organizations by affecting the confidentiality, integrity and availability of not only their informational but also their intellectual capital.

We argue that cybersecurity knowledge supports key management processes related to resilience in digital transformation, including digital risk management, business continuity planning, digital governance and building a digital-savvy workforce. This chapter has then sought to outline key areas where knowledge management processes and systems play a critical role in supporting digital resilience. Our analysis has described how, by capturing and distributing knowledge about digital risks, vulnerabilities and best practices, organizations can build up their capacity to prepare for and effectively respond to digital disruptions. We have analysed the role of knowledge management systems in capturing and sharing information about cybersecurity threats and vulnerabilities. In addition, we have argued that knowledge sharing strategies can help create a cybersecurity culture that raises awareness of the impact of emerging technologies and helps share best practices.

Knowledge management can be a vehicle not only for mitigation of cyber risks such as cyberattacks or failures in digital infrastructures in the supply chain. Knowledge management can enable continuous adaptation and recovery from disruptions that can occur in the digital environment of the organization, including those caused by human error, natural disasters or physical security breaches. As critical components of effective business strategies and organizational success in the digital age, by keeping a focus on cybersecurity while building their knowledge management capabilities, organizations can improve their digital resilience.

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Broadening the Knowledge Management Horizon: A Case of Distant Reading

Meliha Handzic and Vedad Mulavdic

The task of the present is to correct our understanding of the past.

And that task becomes the more urgent when the past cannot be corrected.

Barnes (2022)

Abstract

This chapter addressed the application of knowledge management (KM) in the largely unexplored context of arts and humanities. A specific KM approach (distant reading) was applied in the study of a literary text (historical Bosnian novel) to uncover the structure and dynamics of its character network. Using Gephi software and social network analysis measures, the study revealed key players, their ties as well as the strength and cohesion within the network. This helped us to better understand socio-psychological aspects of Bosnian society during the

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Austro-Hungarian occupation of Bosnia. Furthermore, the study suggests that a combination of distant reading techniques and tools can provide valuable support for the complex interpretation of a literary work and enable a better-grounded account of European literary history and cultural identity. More generally, the value of distant reading in KM goes beyond literary history for the purpose of exploring emerging patterns in complex domains from many different sectors of social and economic activities.

Keywords
Knowledge management (KM) · Arts and humanities · Literary history · Distant reading · Social network analysis (SNA) · Visualisation

1 Introduction

1.1 Current State of KM

KM has become middle-aged. This phase of one's life is typically marked by stagnation and even decline, on the one hand, or generativity through gradual change and adaptation for future well-being, on the other hand (McAdams & Logan, 2004). Unfortunately, there are differences among scholars regarding the direction in which KM is moving. Some reports claim that KM is in decline, based on the perceptions of a large number of surveyed *chief knowledge officers* (Garlatti & Massaro, 2015). Other reports maintain an even more pessimistic view that KM is dead, because it did not achieve what it sets out to do (Tombs, 2004), or near-dead, gasping for breath (Davenport, 2015). Supporting evidence provided by Davenport includes a GoogleTrends report on the infrequent search of the term KM, the absence of KM in top 25 tools in Bain's Management Tools and Trends survey and the lack of invitations for KM experts, as speakers or consultants. In the attempt to understand why KM often fails to deliver on its promise, Chua and Lam (2005) identified and classified various failure factors into four distinct categories: technology, culture, content and project management. They synthesised their findings into a model that can be used by practitioners as a risk identification tool that allows KM failure factors to be pre-empted. In this way, negative consequences and perceptions of KM may be averted.

On the brighter side, there is growing evidence that allows us to conclude that KM is not dead or dying but is rather evolving (O'Leary, 2016). The analysis of the field using scientometric methods (Serenko, 2021) indicate that there is a healthy research community interest in KM. Findings reveal a growing volume and increasing specialisation of KM publications over time. These positive signs of KM popularity are further reinforced by numerous existing KM associations, conferences that are attracting senior and emerging scholars from all over the world, publishing outlets and academic programs.

Historical chronicles of the field documented in the literature show that KM has made some significant advances since its inception (Bolisani & Handzic, 2015). Perhaps, the most important achievement is integration of various fragmented views of KM. All integrated frameworks consider KM as a complex and multidimensional concept, synthesise the object and human perspectives of knowledge, view KM as both a social and technological concept and recognise the evolutionary and contextual nature of KM. These models provide researchers with a holistic view of KM and practitioners with guidance for selecting appropriate KM initiatives (Handzic, 2017). However, in order to ensure KM survival and advancement, it is important to know which way we ought to move forward.

1.2 Future of KM

There are not many recent scholarly articles that address the issue of the future of KM that would help us chart its course in the next decade and beyond. Handzic (2017) reviewed various views and predictions for the future of KM found in the recent literature and categorised them into three emerging trends termed extension, specialisation and reconceptualisation. These trends differ in the nature and extent of change that they bring to the field through the ongoing broadening, deepening, adapting, repurposing or innovating activities of the KM concept. Extension and specialisation represent evolutionary developments within the existing theoretical frameworks, while the reconceptualisation points to the shifting paradigm of knowledge and science that brings radical change.

The extension trend can be best described in terms of the widening and deepening of the existing integrated models of KM. Essentially, it retains the holistic approach to KM while harnessing the power of new technologies and deeper insights gained into the field for the benefit of all segments of the knowledge society and economy. The specialisation trend may be viewed in terms of the adaptation and repurposing of KM. By focusing on specific aspects of a problem rather than all of it at once, individuals and collectives may better deal with the challenges they face in the world of an ever-increasing complexity, uncertainty and accelerated pace of change. The reconceptualisation trend requires revisiting some fundamentals, such as the concepts of knowledge and the KM process, as well as the exploration of ecological and biological models of the KM environment. Redefining of knowledge and KM in novel ways might give them a much broader meaning. Exactly where the field will be moving from here is open for debate. This volume may provide some much-needed answers to this important question. In the meantime, the purpose of this study is to examine one possible scenario (i.e. specialisation) in one expanded/broadened KM context (i.e. arts and humanities).

1.3 This Chapter

So far, knowledge management (KM) has been addressed mostly in business and government contexts. However, there exists a wide untapped social and cultural landscape open for KM to explore from a fresh perspective. For example, by extending the KM reach to the fields of arts and humanities, it may help us gain new and interesting insights into our common humanity. Some promising examples of the beneficial applications of KM methods and tools have been reported by the contributors to Volume 7 of this book series (Handzic & Carlucci, 2019). Following the above trend, the main objective of this chapter is to explore the application and impact of KM in the case study of literary history. We adopted a special KM approach for analysing literary texts. Essentially, this approach termed 'distant reading' (Moretti, 2000) involves the use of computational methods for knowledge discovery from textual data for the purpose of literary history and theory. Usually, distant reading is performed using large collections of texts, but the same principles may be applied in the analysis of a single text.

In this study, we devised a specific combination of distant reading techniques and tools for the analysis of the character network in a canonical nineteenth-century Bosnian novel. The study of character networks has long been one of the central concerns of literary theory. According to Piper et al. (2017), characters are fundamentally social in literature, and distant reading computational methods can be used to better understand sociability. It was hoped that the analysis of the selected novel's character network would help us better address socio-psychological aspects of Bosnian society during the Austro-Hungarian occupation of Bosnia.

This chapter is structured as follows: after this brief introduction, Sect. 2 reviews past literature on the concept of distant reading, as well as the method's popular techniques and tools. These ideas served as a theoretical basis for devising a combined research method described in Sect. 3 for our empirical investigation. Section 4 presents the results of the empirical study in textual, tabular and graphical formats. It is followed by Sect. 5, which discusses the implications of the main findings for research and practice, their current limitations and future research directions. Finally, Sect. 6 concludes this chapter, with a summary of research contributions and recommendations.

2 Distant Reading Approach

2.1 Concept of Distant Reading

The term 'distant reading' was coined by Moretti (2000) to denote an innovative methodological approach to studying literary history. In its original formulation, the term referred to the study of world literature by relying on secondary sources (other people's research about primary literature), without a direct text reading. The proposed distance from the text was justified by the size and linguistic diversity of the world literature. Later on, Moretti changed the initial conceptualisation of the term to associate it mainly with computational analysis and visualisations of primary literary sources (Moretti, 2005, 2013). In general, Moretti advocated formal analysis of literature through a quantitative study of linguistic units, in order to investigate literary trends and interpret their meaning.

For the purpose of this study, distant reading is defined as an umbrella term that embraces many practices, including data mining, aggregation, text analysis and the visual representations of these practices. Alternatively, distant reading is sometimes called macroanalysis, cultural analytics, computational formalism, computational literary studies, quantitative literary studies and algorithmic literary criticism. Its central principle is performing literary analysis without resorting to the careful, sustained reading of individual texts, known as close reading.

Moretti's ideas and emphasis on a quantitative approach to literary history have influenced many literary historians and practitioners of the digital humanities. Among the most notable examples is a recently completed COST action CA16204 'Distant Reading for European Literary History' (https://www.distant-reading.net/). Grounded in the distant reading paradigm (i.e. using computational methods of analysis for large collections of literary texts), this action aimed to create a shared theoretical and practical framework to enable innovative, sophisticated, data-driven, computational methods of literary text analysis across at least 10 European languages. Fostering insight into cross-national, large-scale patterns and evolutions across European literary traditions, the action facilitated the creation of a broader, more inclusive and better-grounded account of European literary history and cultural identity. Typically, distant reading is performed at a large scale, using computational and data-analysis techniques to identify meaningful patterns within large collections of texts. Thus, results are often wide ranging, telling stories about the progress of literature over the course of a century or longer (Tonra, 2019). However, some scholars have adopted the principles of distant reading in the analysis of a small number of texts or an individual text.

The method is not restricted solely to literary texts. Thus, some scholars made a case for applying distant reading techniques that originate in literary reading more broadly to online, non-literary contexts, such as politics on Reddit (Ven van de et al., 2019). Other scholars employed the method for tracing the evolutionary dynamic of the medical case narrative since antiquity (Pomata, 2014). Furthermore, a group of scholars investigated the utility of distant reading as a research tool for exploring sport history (Phillips et al., 2015). The method has also been successfully employed in music criticism for detecting geographies and sentiment in reviews (Joubert, 2022).

Literary scholars have been joined in distant analysis approaches by their colleagues from sound and visual culture studies. Thus, some authors use what they call distant viewing as a methodological and theoretical framework for studying collections of visual material (Arnold & Tilton, 2019) and artistic productivity (Bender, 2015). Others, focusing on music, applied distant listening to show how performance rhythm and dynamics (Cook, 2014), as well as composition motivation (Handzic et al., 2019), can provide a basis for deeply cultural interpretation. While the term distant reading and its analogy of distant viewing or listening are relatively new and becoming popular in arts and humanities, the idea behind them was introduced earlier in the field of knowledge management (KM). Known as knowledge discovery from data (KDD), this KM approach is defined as the nontrivial process of identifying valid, novel, potentially useful and ultimately understandable patterns in data (Fayyad et al., 1996). These patterns may be trends, associations, clusters and/or classes. This author applied the KDD method in the context of history (Handzic & Dizdar, 2016) and archaeology (Handzic & Dizdar, 2017). In these studies, important spatial, temporal and relational patterns uncovered from data facilitated the interpretation and understanding of our past.

2.2 Tools and Techniques of Distant Reading

As already mentioned, distant reading is used as an umbrella term that embraces many different techniques and tools. A subjective selection of the most popular ones is presented below. Some of these are basic computer-based retrieval practices. Others are generic data mining techniques used for discovering prevalent patterns in textual data including trends, associations, clusters and classes. They also cover common visualisation approaches, such as graphs and maps. For example, Moretti (2013) used graphs, maps and trees as abstract models for his study of national bibliographies.

With respect to software tools, Palladio (https://hdlab.stanford.edu/palladio/) proved useful for spatial, temporal and relational analyses of diplomatic correspondence (Handzic & Dizdar, 2016). Similarly, Gephi (https://gephi.org/) was useful for relational analysis and visualisation of stecci inscriptions (Handzic & Nakas, 2021). Another popular tool for text analysis is Voyant (https://voyant-tools.org/). It offers analysis means for traditional concording and co-occurrence alongside more experimental widgets for the processing and deforming of textual data (Jockers, 2013). Voyant might say something about language by finding the most frequent words in the text, gender representation in the text or rhetorical expressions conveyed by the author.

In addition to these generic types, there is a growing number of techniques and tools specifically geared towards literary material. Thus, there is a body of quantitative work available on computer-assisted text-analysis using Stylometry with R (or Stylo) in authorship attribution, gender identification and what is more generally referred to as stylometry (Maciej, 2022). With respect to representation of texts in digital form, the Text Encoding Initiative (TEI) method was successfully applied for building a multilingual literary text collection (ELTEC) for the analysis of European literary history by the recently completed COST action CA16204 Distant Reading (https://www.cost.eu/actions/CA16204/).

On a much larger scale, Text Analysis Portal for Research (TAPoR) is a particularly well-conceived project that provides a gateway for sophisticated text analysis and retrieval (https://tapor.ca/pages/about_tapor). It enables portal users to explore various tools to use in their research. They can also rate, review and comment on tools, as well as browse and tag curated lists of recommended tools.

Beyond this, there are several other international projects seeking ways to make computational approaches easily usable by the average literary scholar. Among these is DARIAH (https://www.dariah.eu/), an ongoing pan-European project that provides digital research infrastructure for the arts and humanities.

There are many other useful projects and products that have evolved out of collaborations among humanists, linguists and technologists. Together, these projects and products provide a novel macro bird's-eye view on literature that may prove a fruitful alternative to traditional close reading in the times of big literary data. In short, new research questions we may ask in new contexts require new ways of thinking about our literary objects of study and new ways of answering these questions. Of particular interest to this study are research questions presented in the next section.

3 Case Study Description

3.1 Research Questions and Procedure

Of particular interest to this study is the structure and dynamics of the character network in the selected novel. The research questions of interests include key players and their ties, as well as the strength and cohesion within the network. It was expected that below the surface of social interactions, we would find a substratum of love and hate as suggested by Moretti (2013). This would help us to gain an insight into the socio-psychological aspects of Bosnian society during the Austro-Hungarian occupation of Bosnia. In order to answer the above research questions, we devised a specific research method described in the following section.

This study aimed to apply distant reading approach in the analysis of a specific literary text. The text selected was the canonical nineteenth-century Bosnian novel 'Zeleno busenje' (Green Turf) by Edhem Mulabdic. The research focused on the characters in the novel and their experience of the Austro-Hungarian occupation of Bosnia. A combination of manual annotation and computational co-word analysis, followed by social network analysis and visualisation, was used to discover the behaviour of major characters across the text. It was expected that such an analysis would help us better understand the socio-psychological aspects of Bosnian society during the occupation. The selected novel and adopted research method are described in detail below.

3.2 Case Selection

The novel Zeleno busenje (Green Turf) holds a special place in the history of Bosnian literature of the Austro-Hungarian period. Its significance for the development of modern literature in Bosnia and Herzegovina was recognised by many scholars. They point to two important characteristics. The first one is that the novel addresses a contemporary situation and tells the story from a near-past event (published 20 years after the occupation). Thus, it marks the starting point in the development of modern Bosnian literature. The other important characteristic is its relationship with the author. Similar to his novel's characters, the author experienced a personal tragedy during the occupation (Rizvic, 1990). Stylistically, the novel belongs to proto-realism. It combines aspects of romanticism and realism, a trend commonly found among authors from countries under the rule of the Habsburg Monarchy (Mulavdic, 2020). Due to its importance, the work was declared the 'first Bosniak novel' and was given a central position in the literary canon of modern Bosnian literature (Kazaz, 2004). This contributed to an increased interest in studying this novel. The first edition of the novel was published in 1898. Since then, there have been various editions of the novel, as well as many critical reviews. It is a work that deserves the full attention of researchers in the fields of literary history, as well as philology (Mulavdic & Handzic, 2021). Its significance also lies in the fact that it is a work that shows that the understanding of language and literature in a certain cultural and historical moment is concretely reflected in the linguistic and poetic features of the given literature.

The author of the novel Edhem Mulabdic (1862–1954) belongs to the pleiad of prominent Bosnian authors from the end of the nineteenth and the beginning of the twentieth century, who carried the burden of adapting to the new Western European lifestyle brought by the Austro-Hungarian occupation of Bosnia and Herzegovina (Saric, 2002). He was among the first Bosniak authors, who was educated in new, secular educational institutions, where he learned the Latin alphabet. Throughout his life, Mulabdic was a prolific writer and published a wide array of works. In the novel Green Turf, he used some autobiographical elements, such as setting the novel in his birthplace of Maglaj, and he incorporated his own experiences of growing up in this small Bosnian town during the occupation. In this study, we used a digitised version of the novel edition available at (https://archive.org/details/MulabdiEdhemZelenoBusenje) as raw data for carrying out the following steps in our research process.

3.3 Annotation and Co-word Analysis

Text annotation is a frequently used method in the humanities to make texts more accessible and understandable to readers (Wolfe, 2000). Scholars use various practices (e.g. different colours, underlining styles, written comments) to annotate various features of the source text (e.g. entities, sentiments, linguistic elements). In this study, named entities of interest were novel characters, and we used highlight colour to annotate them in the digitised text. A total of 21 different characters were found. They were described and identified using four naming conventions: first names, surnames, nicknames and title names.

The annotation process was followed by co-word analysis. This technique was first proposed by Callon et al. (1986) for mapping the dynamics of science and technology, but it can be used in a variety of contexts. It has been considered an effective method for text mining, as it can reveal the conceptual structure without the need to consult the full text. Co-word analysis is based on the assumption that the co-occurrence of two or more words in the text indicate the correlation between them, and the higher the co-occurrence frequency, the stronger their relationship.

In this study, keywords of interest were names of the novel characters. Co-occurrences of these names were counted whenever they appeared on the same page in the novel. Each appearance of a pair of names on the same page meant a link between these characters. In this way, a total of 813 links among pairs of novel characters were identified

All the identified novel characters and their links were input into two MS Excel files for further analysis, as described below.

21 nodes

Naming conventions:

- first names
- surnames
- nicknames
- titled names

NODES
Ahmet
Ajisa
Alija
Arap
Avdaga
Avdo
Gutic
Hadzi-Selimaga
Ibris
Lazar
Mehmed
Muharemaga
Muharemaginica
Mustafa
Numan-efendija
Omer-efendija
Omer-efendinica
Rasid
Salih
Salihaga
Sefer

EDGES	
Ajisa	Ahmet
Omer-efendija	Mehmed
Omer-efendija	Alija
Omer-efendija	Ahmet
Omer-efendija	Muharemaga
Mehmed	Alija
Mehmed	Ahmet
Mehmed	Muharemaga
Alija	Ahmet
Alija	Muharemaga
Ahmet	Muharemaga
Muharemaga	Ajisa
Muharemaga	Ahmet
Ajisa	Ahmet
Omer-efendinica	Ahmet
Omer-efendinica	Ajisa
Omer-efendinica	Muharemaga
Omer-efendinica	Muharemaginica
Omer-efendinica	Salihaga
Ahmet	Ajisa

813 edges

Fig. 1 Excerpts from nodes and edges files

3.4 Social Network Analysis and Visualisation

For further data analysis, we adopted a combination of social network analysis (SNA) (Scott, 2017) and visualisation techniques and tools to discover the behaviour of major characters across the text. In general, a social network is defined in terms of nodes, representing people or things within the network, and edges representing relationships or interactions between them. In our study, the nodes in a social network were novel characters. Relationships between these characters constituted edges. Figure 1 shows excerpts from the created nodes and edges files.

Gephi (https://gephi.org/) was used as a software tool for constructing and visualising our novel characters' network. It was chosen as a preferred tool as it is considered the leading visualisation and exploration software for all kinds of networks. It is also open-source and free. More importantly, it offers the most common metrics needed for SNA such as centrality, modularity and the shortest path. Centrality

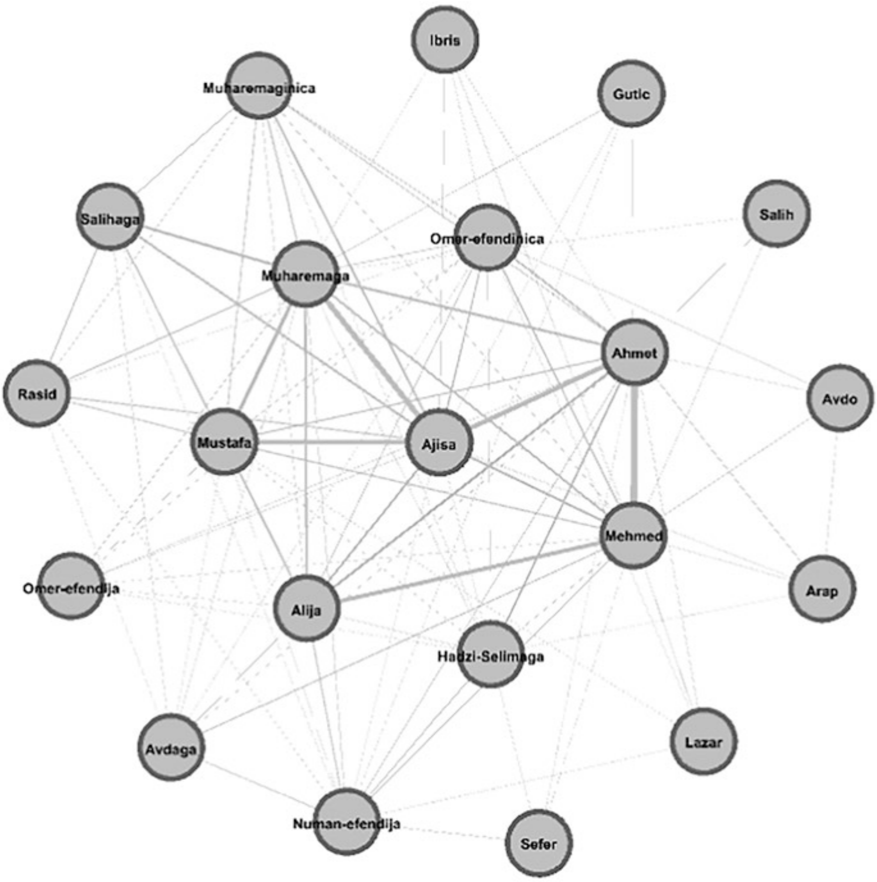

Fig. 2 Character network map (diameter = 3; density = 0.5)

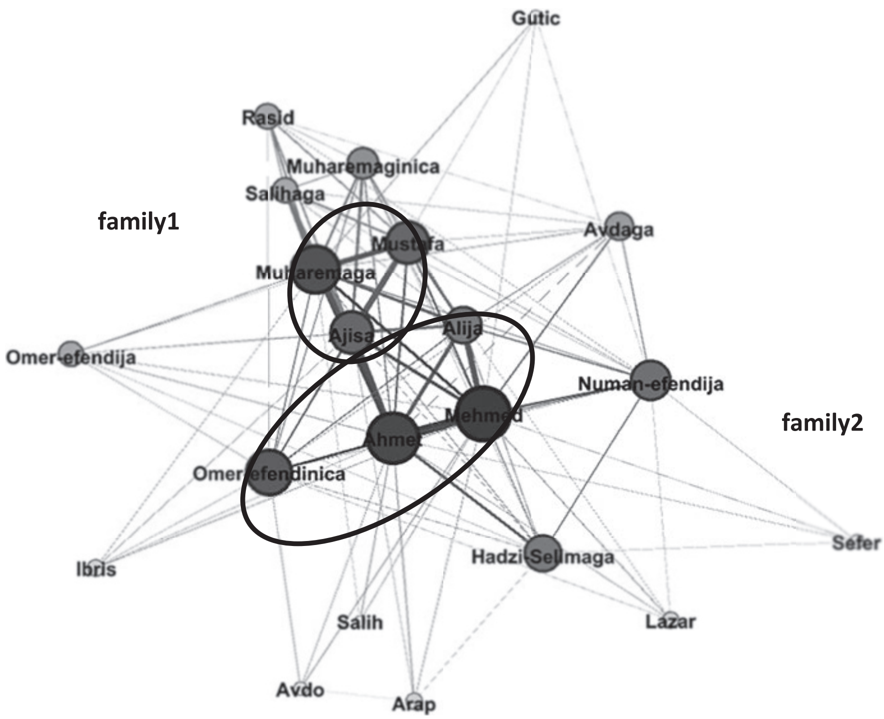

Fig. 3 Key protagonists in the character network

measures enable identification of influential nodes in the network, modularity measures help to identify subgroups, while the shortest path measures evaluate network efficiency. The results of our SNA are presented in the next section.

4 Results

The results of our character network analysis cover different groups of measures: those that measure the entire network, those that measure individual roles in the network and those that identify communities within the network. These are presented visually in Figs. 2, 3, 4 and 5. The following sections describe the most important results.

4.1 Network Efficiency

Our initial analysis examined network efficiency. Network efficiency is understood in terms of ease with which each character in the network can communicate with any other character in the network. It can be measured by diameter or density

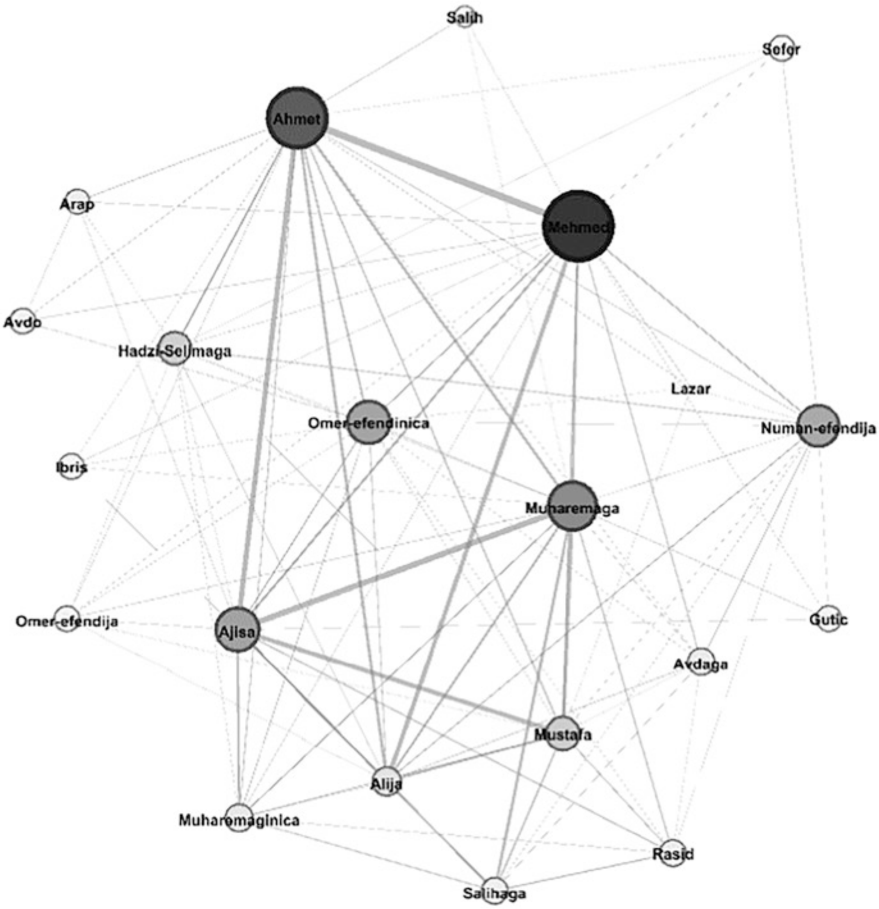

Fig. 4 Brokers in the character network

statistics. In this study, we calculated both measures using Gephi and presented the network visually in Fig. 2.

With respect to network diameter, the obtained result (value = 3) suggests that the spread of information within the network is rather easy and fast, as any member can be reached in just a few steps. The result obtained for network density (value = 0.5) indicates a moderately dense network in which about half characters have common ties, while the other half have unique relationships. In general, those who are closely connected are likely to more frequently share information, ideas and resources but are also more reluctant to change. The following section provides the results of a more detailed analysis of these characters.

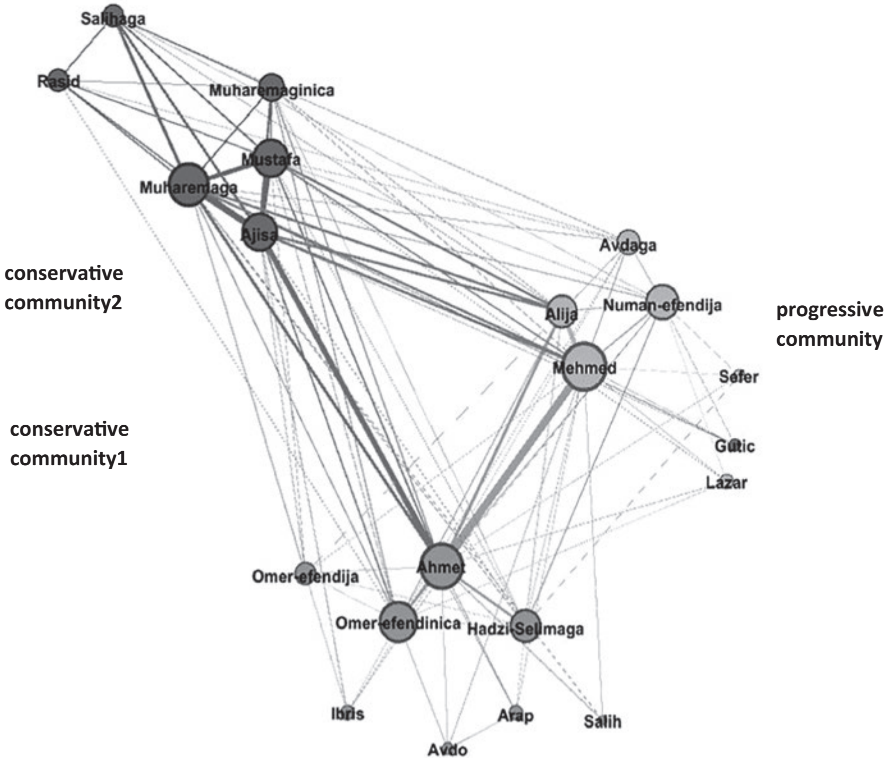

Fig. 5 Communities within character network

4.2 Key Protagonists

The results of our next analysis using degree centrality measures is visualised in Fig. 3. Degree centrality represents an important measure that characterises individual members in the network.

The figure shows no single key protagonist but rather a group of tightly interconnected characters. From reading their names, we learned that these characters are members of two different families. One family (family1) is made up of a father, daughter and son, while the other family (family2) consists of a mother and three sons. Furthermore, the figure reveals the close relationships within each family, between parents and their children, as well as between siblings. The figure also reveals close relationships between two families. These suggest friendship between the two families' sons, as well as the love interest between a son and a daughter. Overall, such results indicate the author's idyllic portrayal of social, family and intimate layers of Bosnian society.

4.3 Network Brokers

The results of another important analysis of individual characters in the network using betweenness centrality measures are presented in Fig. 4. Betweenness centrality is essential for identifying potential brokerage roles in the network.

Figure 4 points to two characters, namely two brothers, as major network brokers. They play an important role for communication between potentially separate subgroups in the network. Indeed, the following section provides confirmation of the existence of such subgroups.

4.4 Network Communities

The results of our final analysis using modularity statistics identified three different modules or communities. They are presented in Fig. 5. The figure reveals the split in society (between two families) and in the family (within family1). These communities reflect the different characters' responses to change: conservative and progressive. With respect to the split family, the results show two separate communities (conservative1 and progressive) formed around two brothers (as brokers) and their circles of friends. The third community (conservative 2) is formed around another family (family2).

Overall, these results suggest that the idyllic picture of life was interrupted by occupation and change. The results are further discussed and interpreted within a wider range of relevant literature in the following section.

5 Discussion

In this section, we summarised and interpreted the results of the analyses performed. Following this brief description of the main findings, we presented their implications for research and practice. In the end, we mentioned current limitations and proposed some plausible directions for future research.

5.1 Main Findings

Our analysis of the character network discovered the following details: efficient network as indicated by its high density; family units as key players with close ties within and between them; complex network structure with several subgroups identified within the network; and network brokers important for communication among these subgroups. Overall, these findings provide empirical evidence that confirm those ones obtained by our review of relevant literature provided in our earlier novel presentation (Mulavdic & Handzic, 2021).

In particular, the findings concerning the characters with their connections and clustering reflect the novel theme of the Austro-Hungarian occupation of Bosnia and Herzegovina very well, as experienced by the small town of Maglaj (Braun, 2009). They also reveal multiple layers of Bosnian society in accordance with the novel's narrative structure consisting of three parallel processes: (a) a social one, which is reflected in the wider historical context and the impact of the Austro-Hungarian occupation on the Bosnian milieu and all the layers of Bosnian society; (b) a family one, presenting the destiny of a respected Maglaj-based family; and (c) an individual one, focusing on an intimate-romantic love and friendship between several characters (Hadzizukic, 2011; Rizvic, 1990).

At a social level, the analysis revealed the split society. The Austro-Hungarian occupation was experienced as a shocking event that fundamentally changed the lives of all citizens of Maglaj, regardless of their social status. In addition, the differing views of the population regarding the occupation are revealed. These are demonstrated by different network communities, as shown in Fig. 5. Through communities, the novel articulated collective identities in the manner characteristic of nationalistic discourse (Vervaet, 2013). Furthermore, using communities as representatives of collective ideas testifies the novel's epic cultural code (Kazaz, 1998).

Communities serve as a frame for a story of the clash between two ideological, social and cultural concepts of Bosnian life at the end of the nineteenth century. The first is conservative, which viewed the act of the occupation as fatalistic, as the end of a determined historical time and life order, and which was very opposed to change from the oriental to the Western paradigm of life and culture (Kodric, 2012). For conservatives, the only acceptable solution for the collective is seen in either armed resistance to occupation (conservative1) or in leaving their homeland (conservative2). The other concept is progressive, accepting the new reality brought about by the Austro-Hungarian administration. The progressive members of the community thought that resistance to the well-organised Austro-Hungarian military was futile and that the new reality needed to be accepted. Adaptation to the Western paradigm of life and culture is considered as the smartest solution for the collective.

At the family level, the analysis indicated that nuclear family units hold a central place in the historical narrative of the novel and the society it portrays. This can be clearly seen from Fig. 3. This finding suggests that the novel can be read as a family chronicle. In particular, it exposes the tragic destiny of a respected family caused by a historic turmoil. In general, the picture of the family presented corresponds to the patriarchal cultural code, in which a male member of the family is the head and the ultimate decision-maker. In one family, it is the father (family2); in another, it is the eldest son (family1).

However, the tension between individual and collective issues caused by the occupation resulted in a split family (family1). Thus, one brother sacrificed individual (love) for collective (duty) will by joining the futile resistance and facing inevitable death, while the other two brothers adopted a pragmatic view and tried to adapt to the new reality. Such findings are consistent with collectivist Bosnian culture as suggested by Hofstede's (1984) cultural dimensions. According to Hofstede, collectivist societies emphasise accomplishments and interests of groups over individuals. In other words, individual destinies are subjected to collective will.

The breakup was also evident between families. The author presented conservatives as fanatical rejectors of everything coming from Austro-Hungary, including education (Rizvic, 1990). For example, the father (family2) forbids his son to go to school and to continue friendship with those on the other side (i.e. progressives), who are seen as traitors. In contrast, two progressive family sons (family1) maintain an opportunistic stand towards the Austro-Hungarian administration, like they had towards the Turkish rule. Their stand is explained by the need for moving with times, social development and overcoming outdated ways of life.

At an individual level, the analysis discovered two interesting relationships, as shown in Fig. 3: (a) an intimate-romantic relationship, involving the love between a son (family1) and a daughter (family2); and (b) friendship between the two families' young sons. Through these characters, the author presented the psychology and motives from Bosnian folk poetry (Rizvic, 1990). In general, folk poetry served as a basis for the development of modern Bosnian literature at the end of the nineteenth century.

The individuals in this love story are presented as victims. The boy chooses resistance and battle over love 'as men are made for war', as the author says. However, the boy dies in battle, without achieving his dream of being with his loved one. The girl is also a tragic character, as she cannot be with her loved one. Instead, she submits to her father's will to marry and slowly fades to death. Such tragic destinies of individual characters have their source in the ethics of the patriarchal society and poetics of folk literature, particularly ballads and lyrical poems in which, as a rule, the main characters end tragically.

With respect to the friendship between the two families' sons, one son (family2) remains imprisoned by the conservatism of his father and wastes his life. The other family's son (family1) makes the most of the new reality, by focusing on learning. Such a choice is presented as the right one. It reflects the author's own favourable attitude towards Austro-Hungary, which he sees as a representative of a modern Western civilisation that could bring his people to a higher cultural level (Vervaet, 2013). Accordingly, the title of his novel is a metaphor conceptualised in relation to the young boy's character and symbolically points to the appropriate future direction for new generations. Overall, the above findings show the novel as both a sign of the tragic and dramatic crushing of souls and destinies and a memorial to the discovery of a new way of life and new perspectives.

5.2 Implications for Research and Practice

The findings of this study imply that distant reading has a great potential as a research tool for literary studies. In this case, it helped us to uncover the structure and dynamics of the character network in the selected work of fiction. This, in turn, provided valuable insights into the socio-psychological aspects of the society and time period it addressed. According to Jockers (2013), a methodology is important and useful if it opens new doorways of discovery and if it teaches us something new about literature. Accordingly, distant reading may be even more valuable for evidence gathering from massive digital text collections and using it for gaining deeper knowledge about literary history, individual creativity and inevitability of influence.

The findings also imply that distant reading can improve the efficiency of the practical process of literary analysis. In this study, Gephi tool was very efficient and easy to use for calculating relevant network statistics and presenting the results visually by a graph. It is important to note that Gephi is just one of many available distant learning tools, some of which are specifically developed for the analysis of literary material. In general, the technology acceptance model proposes that perceived ease of use and perceived usefulness predict the acceptance of information technology (Davis, 1989). Thus, their ease of use may be an important factor in acceptance and use of distant reading tools by practitioners who are not technologically savvy.

Beyond literary studies, these findings have wider implications for KM in the knowledge-intensive society and economy (Milkova, 2022). According to Cross et al. (2003), most organisations do not know how to effectively analyse their employee networks and their impact on performance. The set of tools for social network analysis (SNA) can be used to map employee networks, make visible otherwise invisible relationships, allow for powerful assessment of knowledge sharing within the network with relatively little effort and help managers make better informed decisions for improving organisational performance. Distant reading can also be helpful to decision-makers for dealing with cognitive overload by extracting the most relevant topics for their decision problem from large collections of available sources (Milkova, 2022).

5.3 Current Limitations and Future Directions

This study exhibits several weak points due to which its findings need to be interpreted with caution. Firstly, one of the major weaknesses of distant reading is the lack of context. Thus, some researchers recommended combining distant with close reading to alleviate their weaknesses and maximise their strengths (Handzic & Mulavdic, 2022; Taylor et al., 2018). Secondly, the study focused on only one aspect of the novel (character network) and applied only one specific distant reading technique (SNA) using one specific tool (Gephi) for the analysis.

Future research may look at other aspects of the novel, such as its language. According to Mulavdic (2020), this novel is significant for the study of many aspects of Bosnian life and culture, including its literary language. Some of the questions of interest may be the author's linguistic expression, whether it comes from the structure of language or literary and linguistic tradition; what, if any, features are specific solely to the Bosnian language; and what the grammatical aspects of different editions are. Finally, the study applied distant reading to a single novel. Yet, by applying distant reading to collections of literary texts, a wider range of questions that would otherwise be inconceivable may be asked and explored. Here, we mentioned only a few plausible future directions, while there are numerous ways we might access, read and make meaning of the literature.

While this chapter addressed only one way (i.e. literary history) in which KM can expand its horizon, there are many other plausible directions for future KM research in arts and humanities, and beyond. In general, exploring emerging patterns is the key to managing complex domains that we face in the world we live in today (Snowden, 2002). It holds true for most sectors, whether sales, strategy, public policy, safety, cultural heritage, education or international development, to mention just a few. Irrespective of the direction KM may take in the future, it seems that interesting times lie ahead.

6 Conclusions

This chapter demonstrated how KM can expand its horizon beyond business and government contexts and reach the world of arts and humanities. In particular, we applied a specialised knowledge discovery approach (distant reading) to the analysis of a literary text (historical novel) to uncover the behaviour of the novel's characters over the text. The main findings revealed the prevalent structure and dynamics of the novel's character network that helped us interpret socio-psychological aspects of Bosnian society during the Austro-Hungarian occupation of Bosnia.

These findings make two important contributions. For literary history, they contribute to the working group 2 (https://www.distant-reading.net/wg-2/) of the COST action CA16204 by sharing, evaluating and improving methods and tools for distant reading research. The main findings suggest that a combination of different KM techniques and tools can provide valuable support for complex interpretation of literary works and enable a better-grounded account of European literary history and cultural identity. For knowledge management, the findings provide empirical evidence of the value of a distant reading approach in facilitating knowledge discovery from texts.

However, these findings and contributions need to be interpreted with caution, due to existing limitations in terms of the specific case, research process and tools used in this study. Future research is recommended that would combine distant and close reading to alleviate some of the current limitations. Future research may also expand to applications of distant reading approaches to other types of literary studies, such as linguistic analysis. Overall, the evidence presented in this chapter suggests that KM may have a bright future, by expanding its horizon from primary to tertiary sectors, from commercial to government to non-profit contexts, from personal to global levels. It also needs to embrace different notions of KM and, thus, allow the idea of KM to thrive.

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Visualising Knowledge for Decision-Making: A Framework for Selecting Visual Templates

Dmitry Kudryavtsev, Tatiana Gavrilova, Giovanni Schiuma, and Daniela Carlucci

Abstract

Digital technologies and AI have led to an increase in the automation of work, resulting in computers solving structured problems, while humans are responsible for ill-structured problem-solving, now and especially in the future. Several visual collaboration and knowledge structuring tools, such as Miro, Visio, and Lucidcharts, can help managers and experts to analyse ill-structured problems and co-create solutions. However, selecting the appropriate knowledge visualisation template for a comprehensive description and representation of knowledge remains an open research field. Although well-designed visual representations can improve decision-making, they can also introduce bias if not well conceived. They may constrain the attention to a limited set of decision variables, highlight only less important variables, alter the salience of knowledge, or inspire inappropriate comparisons. The use of well-conceived visual templates can reduce this risk by being easy to use, facilitating pattern recognition, and providing means for knowledge transfer, sharing, codification, and creation. This chapter

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explores the use of visual templates to support knowledge management activities, problem-solving, and decision-making. It suggests a new approach to the selection of visual templates, which support the decision-making process, and proposes a framework to help scholars and practitioners select the appropriate visual template for representing knowledge associated with a problem, taking into account the level of formality, knowledge type, and other dimensions. It also introduces new criteria for choosing visual knowledge templates, e.g. mental scenarios, knowledge content, and domain dependence. Given the exponential development of AI, the anticipated future steps in knowledge management research and practice are associated with a combination of visual knowledge structuring and AI-driven content recommendations and assistance.

Keywords

Knowledge visualisation · Diagrams · Visual templates · Knowledge modelling · Decision-making support

1 Introduction

The rapid technological advancements and the increased complexity, uncertainty, and accelerated pace of change of socio-economic scenario are transforming how organisations manage, integrate, and deploy their knowledge and take strategic decisions. In today's globalised environment, organisations have to leverage the knowledge and expertise of their employees across different geographies, facilitate cross-cultural collaboration and knowledge-sharing culture, and ensure that their knowledge management systems support communication and data sharing in real-time from different parts of the world. This is particularly important for new organisational forms, such as virtual teams, networked organisations, and communities of practice, and remote work, which have increased due to the recent pandemic. These new forms of work rely heavily on an effective knowledge management that facilitates remote collaboration and learning in a virtual environment and maintains knowledge continuity despite physical separation. The technological advancements are pushing organisations to explore and adopt new and more and more efficient tools and ways to manage knowledge. Organisations are increasingly exploiting digital technologies and systems to make it easier for people to access information from anywhere and at any time as well as to collaborate and share knowledge with each other, allowing more quickly and efficiently cross-fertilisation and knowledge dissemination across different teams and organisations. Digital technologies and systems are revolutionising the way of processing and analysing large amounts of data; capturing and storing massive amounts of data in real-time, from various sources, such as social media, sensors, and IoT devices; and quickly handling them. This means employees can have access and share relevant information fast and easily and, thus, make more informed decisions as well as work more effectively, focusing on higher-value activities. Digital technologies can facilitate collaboration and communication between team members and engage with customers and stakeholders, breaking down silos and fostering a culture of knowledge sharing. The potential of these technologies in supporting knowledge processes is closely connected to visualisation.

Data storing or analysing alone are, indeed, not enough to support knowledge processes and make informed decisions. Visualisation is essential to make sense of data and turn it into understandable and actionable insights (De Regt, 2014; Scott et al., 1999). By visualising data, it becomes easier to identify trends, relationships and connections, patterns, and outliers that may not be apparent from raw data as well as to communicate complex ideas and concepts in a clear and concise manner and convey complex ideas to a wide range of stakeholders. By providing a common visual language that enables individuals and teams to work together more effectively, visualisation facilitates collaboration among team members and help in identifying problems or opportunities that may not be apparent from data and develop new ideas and strategies for addressing VUCA challenges. Nowadays, this is particularly crucial as managers and policymakers need to handle the data and information 'explosion' (Gavrilova et al., 2017); overcome the limitations of relying only on their own experience, intuition, or feeling in decision-making (Eppler & Bresciani, 2013; Eppler & Burkhard, 2004, 2007; Tan & Platts, 2003; Zhu & Chen, 2008); and expand the range of options before making their decisions in a context extremely volatile (Tan & Platts, 2003). Visualisation shapes people's experience with data and information; changes the perception and the attention we pay to investigate reality, phenomena, and problem; and, through an appropriate representation, makes knowledge engaging, accessible, meaningful, inspirational, and even more manageable (Keller & Tergan, 2005; Scott et al., 1999). This point outs two critical dimensions of visualisation, i.e. the functional dimension and the aesthetic one (Gaviria, 2008; Lau & Vande Moere, 2007). The functional dimension concerns usability and visualising and communicating a message to the user. The aesthetic dimension encompasses the users' purely intuitive or emotive attraction. The common thread between these dimensions is to support users in their tasks by acting on their rationality or intuition and emotions. The functional and aesthetic dimensions are the distinguishing characteristics of visual representations.

Visual representations can concern data, information, and knowledge, resulting in a different typology of visualisations that focus respectively on data, i.e. symbols and facts, which are isolated and not yet interpreted (Ackoff, 1989; Tergan & Keller, 2005); information, i.e. data that has been processed and therefore contains some potential meaning providing the basis to answer questions like 'who', 'what', 'where', 'why?', or 'when'; and knowledge, one step beyond information, which has been cognitively processed and incorporated into an existing organisation's knowledge domain (Ackoff, 1989; Tergan & Keller, 2005). Visualising knowledge involves gathering and processing the information to be displayed and defining the graphical elements and their relationship in order to display the collected knowledge. Numerous visual representations are available to enhance knowledge processes and cognition in decision-making by offloading the internal mental representations on to an external medium to relieve the cognitive load and speed up processing (Tudoreanu, 2003). However, only those visual templates that are easy to use and understand and are appropriate to a decision problem can facilitate searching and recognising hidden patterns and provide means for knowledge transfer, sharing, codification, and creation, thus supporting the perceptual and rational thinking of decision-makers (e.g. Duke et al., 2005; Eppler, 2013; Eppler & Burkhard, 2007; Falschlunger et al., 2016; Munzner, 2014; Schiuma et al., 2022). The choice of appropriate knowledge visualisation templates for comprehensive description and representation of knowledge associated with the problem is still an open research field.

Although visual representations can enhance knowledge processes and decision-making, they may also introduce bias if not well conceived. They may constrain the attention to a limited set of decision variables, highlight only less important variables, alter the salience of knowledge, or inspire inappropriate comparisons. The choice and use of well-conceived visualisation templates can reduce this risk. This research suggests a new approach to the selection of visual templates, which support the decision-making process, and proposes a framework to help understand and select the appropriate templates for a comprehensive description and representation of knowledge associated with the problem. The proposed approach consolidates and extends previous work by including systemic support for multiple representation forms, effectively converting and defining main domain concepts and relationships.

The chapter is structured as follows. Section 2 addresses the relevance of visualisation for decision-making. Section 3 outlines the scope and characteristics of knowledge visual templates, and Sect. 4 describes the proposed framework. Finally, the key findings are discussed together with the future development of the research.

2 The Relevance of Visualisation Supporting Decision-Making

Visualisation concerns three main domains: i) 'data visualisation', which refers to the practice of using graphical representation to organise data and provide the path for visual insights in sets of data; ii) 'information visualisation', which mainly refers to the use of computer-supported, interactive, and visual representations of abstract data (Card et al., 1999) and the use of graphs to present the combination and elaboration of raw data; and iii) 'knowledge visualisation' that uses a visual means of representation aiming to transfer knowledge between at least two persons or a group of persons (Burkhard, 2004) and, more widely, supports cognitive processes in generating, representing, structuring, retrieving, sharing, and using knowledge (Tergan et al., 2006).

There are currently no defined boundaries between the cited visualisation domains (Masud et al., 2010). Frequently, in the visualisation context, data, information, and knowledge are used extensively in an interrelated way (Chen et al., 2008), so they can be considered overlapping, although conceptually they refer to different objects. In practice, the distinction between data, information, and knowledge visualisation can be challenging because all visualisations use symbols and facts acquired and appreciated by human perceptions. So, what differs is the scope and goals of a visual representation. According to Scott et al. (1999), data visualisation's primary objective is to gain insights into information space. Card et al. (1999) argue that information visualisation is 'the use of computer-supported, interactive, visual representation of abstract non-physically based data to amplify cognition' (p. 637). Similarly, Fayyad et al. (2002) state that information visualisation is for data mining and knowledge discovery. These examples suggest that data, information, and knowledge can be both the input and output of a visualisation process and highlight a certain ambiguity of the terminology used in the visualisation field (Chen et al., 2008; Cui et al., 2006). Whether considering data, information, or knowledge, visualisation supports, enhances, and catalyses human cognition.

It is widely known that visualisation generates a balance between perception and understanding to fully exploit the brain's abilities. Visual perception is handled by the visual cortex located at the back of the brain. It is very fast and efficient. Cognition is dealt with mainly by the cerebral cortex at the front of the brain. It is much slower and less efficient. Visualisation shifts the balance towards more excellent visual perception, taking advantage of our powerful eyes whenever possible (Few, 2013).

Visualisation is crucial to catalyse and support cognitive processes in decision-making (see, e.g. Chen, 2010; Platts & Tan, 2004; Sackett et al., 2006). It extends the decision-makers' working memory and cognition and enhances their ability to process information and knowledge (Coury & Boulette, 1992). During the decision-making process, individuals have (i) to establish objectives, (ii) to generate ideas, (iii) to explore alternatives, and (iv) to choose the best option (see, e.g. Harrison, 1995; Simon, 1987).

The availability of information and knowledge properly visualised can help decision-makers to understand the problem, identify objectives, ideate, and formulate alternatives, thus improving the outcomes of the decision-making process by reducing uncertainty.

Numerous visualisation representations can be used to collect and transform information and knowledge in a visual form that enhances decision-makers' ability to evaluate, understand, and discern. According to Cleveland and McGill (1985) and Meyer et al. (1999), these representations 'work' only if the visual decoding by the decision-maker is accurate and efficient. More specifically, only when visualisation is consistent with the decision-makers' mental representation of a decision problem can it effectively support decision-making. Thus, as underlined by Zhu and Chen et al. (2008), the decision-making process results from the interaction between the decision-maker and the visualisation. Several factors can affect this interaction and the worthwhile use of visual representation in decision-making. Among these is the efficient achievement of visualisation's functionalities (Sackett et al., 2006). These functionalities concern the fact that visual representations help decision-makers to focus their attention on a specific area of interest, make connections among past events, share their thinking with colleagues, overcome self-imposed constraints, look at a problem in a new way, capture key factors characterising the problem, and identify structure, trends, and relationships. Effectively accomplishing these functionalities depends on how the visual representation impacts the decision-makers' visual perception.

This explains how appropriate visual representations and decision-making steps are essential in successfully supporting decision-makers in their cognitive processes.

3 Knowledge Visualisation Templates

Making knowledge visible so that it can be better acquired, shared, transferred, valued, or generally managed is an essential dimension of modern knowledge management (Eppler & Platts, 2009; Foil & Huff, 1992; Lohse et al., 1994; Lurie & Mason, 2007; Miah et al., 2017; Schiuma et al., 2012; Tan & Platts, 2003; Tufte et al., 1990). To date, several scholars have published studies about the use of visual representations to improve the management of knowledge on all levels: personal, interpersonal, team, organisational, inter-organisational, and societal (see, e.g. Eppler, 2013; Eppler & Burkhard, 2007; Gavrilova et al., 2019; Isokpehi et al., 2020; Meyer, 2010; Tergan et al., 2006).

These studies broadly denote the research field of knowledge visualisation. They intersect research fields such as knowledge management studies, computer science, psychology, and design. According to Eppler and Burkhard (2007), 'knowledge visualisation designates all graphic means that can be used to construct, assess, measure, convey or apply knowledge' (p. 112). These 'means', if well-designed, can help reduce the cognitive load, misinterpretation, misuse, underutilisation, or inability to use information and allow externalising knowledge to share it with others, generating new knowledge, and supporting decision-making (Burkhard, 2004, 2005; Tergan et al., 2006). Renaud and Van Biljon (2019) argue that knowledge visualisation can help share, transfer, and communicate experience, insights, and potentially complex knowledge to support someone in decision-making and action.

In recent years, many knowledge visualisation templates have emerged. Among them, the most important are conceptual diagrams, visual metaphors, heuristic sketches, knowledge maps, visual metaphors, images, matrices, canvases, visual modelling languages, interactive visualisation, and visions/stories (Berinato, 2016a, 2016b; Eppler, 2008; Eppler & Bresciani, 2013; Eppler & Burkhard, 2007; Gavrilova et al., 2019; Kudryavtsev & Gavrilova, 2017; Renaud & Van Biljon, 2019). The use of these visual templates has become fundamental for managers and policymakers in modern knowledge management. Gavrilova et al. (2017, p. 8) point out that 'modern knowledge management is inconceivable without extensive use of diagrams, graphics and schemas'.

Whatever form it takes, knowledge visualisation has to guarantee the effective creation and transfer of knowledge. In this regard, according to Eppler and Burkhard (2007), at least five questions should be considered to define a visual knowledge template: 1. What type of knowledge is visualised (content)? 2. Why should that knowledge be visualised (purpose, knowledge management process)? 3. For whom is the knowledge visualised (target group)? 4. In which context should it be visualised (participants, place/media)? 5. How can the knowledge be represented (method, format)? The scholars argue that listing possible answers to these critical questions leads to a conceptual framework for visual representations in knowledge management. This framework systematises visual knowledge templates and guides their selection and application in a knowledge management setting.

A further contribution to the systematisation of visual knowledge templates is provided by Bresciani et al. (2008). Focusing on collaborative knowledge work, they explore how conceptual visualisations (such as diagrams, visual metaphors, charts, and sketches) can be constructed and used as cognitive artefacts that support collaborative knowledge work. They introduce a framework that systematises visualisation properties to design collaborative knowledge work. The framework's dimensions are visual impact, clarity, perceived completeness, directed focus, inference support, modifiability, and discourse management.

Referring to the selection of a visual template or the design of a new one, Dix (2012) recommends taking into account three main factors: i) visual 'affordances' (what we can see); ii) objectives, goals, and tasks (what we need to see); and iii) aesthetics (what we like to see). According to Dix, visualisation occurs within a broader human and organisational context. It helps individuals or organisations make decisions, which lead to actions that modify the world, and thus, the data, information, and knowledge being visualised.

Eppler and Platts (2009), by examining how visualisation can be used in the strategic planning process, propose a conceptual framework to group and position visual representations of information along the strategic planning process. The cited studies reveal increasing attention to the relevant design of visualisation forms in different fields and the need for frameworks to support the systematisation and selection of visual knowledge templates for various purposes.

4 Towards a Framework for Selecting Knowledge Visualisation Templates

In organisational settings, decision-makers use visual templates such as diagrams, canvases, or matrices for multifactual analysis to solve a complex business problem or make sophisticated decisions. Often the choice of such conceptual visualisations is intuitive and not fully clear. More than a hundred visual knowledge templates in the literature support decision-making processes. This contributes to increasing uncertainty about the best form of knowledge visual template to choose in solving a decision problem. On the other hand, as pointed out by the cognitive fit theory (Vessey, 1991) and task-technology fit theory (Goodhue & Thompson, 1995), the effectiveness of problem-solving and decision-making depends on the fit between the knowledge representation format and the task. Both theories state that any technology (template or new pattern) can be adopted if it suits the task (situation).

In this vein, we propose a framework to understand and select the appropriate visual templates for the comprehensive description and representation of knowledge associated with a decision problem. The framework suggests a set of new classifications of visual knowledge templates. The classifications are based on four important criteria encompassing crucial issues and questions that need to be considered when selecting knowledge visualisation templates (see Fig. 1).

These criteria are as follows:

- *Level of formality*: This criterion describes the formalisation level of a problem description. It embraces questions such as how formalised can we explain our problem? How strict and precise do we want to be? Do we want to describe mathematical dependencies accurately, or do we want to identify the major components of a problem and the connections between them?
- *Level of domain dependence*: This criterion describes the degree of universality of the templates. It covers questions such as can we apply the template to any problem, or is it highly specialised and works only in certain areas, e.g. in marketing or computer science?
- *Content types*: This criterion defines the semantics of the problem. It embraces questions such as what question does this template contribute to answering in terms of what-knowledge (about problems, main concepts, ideas, etc.), how-knowledge (models of reasoning, procedures, etc.), or where-knowledge (map of the location of objects, such as people, equipment, etc.)?
- *Form of knowledge*: This criterion defines the syntax and describes the mental scenarios initiating the selection and application of a visual knowledge template against a decision problem. It involves questions such as what do we do when we apply a visual knowledge template? Do we want to group objects or concepts (e.g. customers, products and their features, channels, etc.) or link objects from different groups? Do we want to use existing metaphors or identify the connections between the objects and their network? Do we want to evaluate and compare objects?

The proposed framework extends the ideas of Eppler and Burkhard (2007) by suggesting new classification dimensions. The categories of visual knowledge templates for each criterion are outlined below.

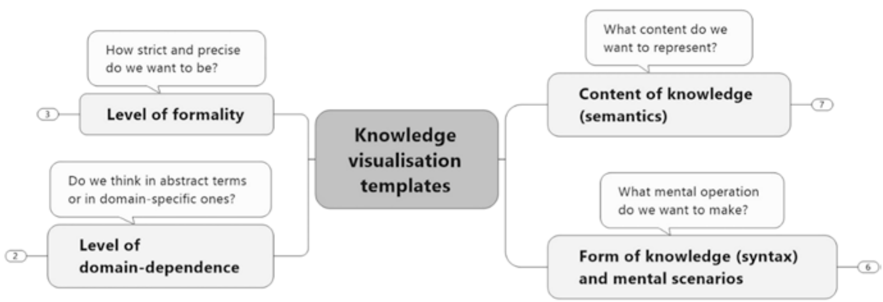


Fig. 1 Framework for selecting knowledge visualisation templates

4.1 Level of Formality

To assess the formality of visual templates, we used the structural characteristics of templates described in Gavrilova et al. (2018). Three levels of formality are suggested: informal, semi-formal, and formal. Considering Newton's law of universal gravitation as an analogy, it can be described in words (informal representation) or via formulae (formal representation). The informal level (one extreme) implies freedom in knowledge externalisation; for example, random boxes and arrows can be used here. Such templates are better when it is required to structure the problem and make sense of the situation; they help define relevant objects, group them somehow, and identify some links. Informal templates help to derive an intuitive understanding of the domain and start the conversation. Unfortunately, knowledge visualisation using these templates is ambiguous and imprecise.

The formal level (the other extreme) implies strict typisation of objects and relationships between them; for example, whether the hierarchy of objects means classification or the structure of some object (constituent parts) or whether yellow elements with an arrow icon on the diagram are business processes, business functions, or business capabilities. A formal level may also imply some quantitative relationship between objects with corresponding values (e.g. causal diagrams in management research papers demonstrating one variable's influence on another). A higher level of formality reduces ambiguity and increases precision, assuming users are familiar with the language adopted to formalise the entity. Formal templates may also enable automatic (machine-assisted) analysis and model quality evaluations, e.g. elements of a specific type can be linked via certain relationship types. However, formal templates require more time for making models and training in creating and using them. Although the analytic power of formal templates is higher, they present some difficulties in their use. Semi-formal templates lie in the middle regarding freedom of knowledge representation, ambiguity, and precision. Table 1 presents the possible grouping of the most popular visual templates according to the formality level. It reports the key features and the related illustrations describing the main objects or elements and their relationships for each formality. Finally, it provides examples of visualisation templates.

According to Volkova et al. (2015), any problem analysis starts from its verbal or abstract (informal) statement. It ends in the formulation of a formal description of the problem. In the case of relatively simple questions, this analysis takes place in the mind of a person who often cannot explain how he/she did it. As the problem becomes more complicated, this analysis and the proof of its adequacy become more complex. The required level of formalising the description of the problem can increase. This, in turn, affects the choice of visual knowledge templates best suited to analyse a problem and support decision-making. Therefore, if the verbal articulation in natural language or the construction of verbal descriptive models of a problem can be supported by visual templates, such as a mind map or word cloud, as the problem becomes more complicated, a further qualitative or quantitative analysis could be required to gain a better knowledge elicitation of the problem. In that case, we need to accurately describe the major components of the problem and the

Table 1 Visualisation templates and level of formality (based on Gavrilova et al., 2018)

Level of formality	Features	Examples of visualisation templates
Informal	Freeform knowledge externalisation Main objects are identified Informal groups of objects (e.g. using associations) Unspecified links between objects (e.g. using associations)	Word cloud Mind map Boxes and arrows Sketches
Semi-formal	Types of objects are specified/defined Types of relations are specified/defined Qualitative or quantitative assessment of objects and relationships	Concept map, goal tree, strategy map, SWOT analysis matrix, business model canvas, value proposition canvas, BCG matrix
Formal	Strict types of objects Strict types of relationships Strict attributes Specified notation (syntax and semantics)	ArchiMate Modelling Language Unified Modelling Language (UML) Petri Nets

connections between them or even describe mathematical dependencies, e.g. the extent of mathematical models in operations research or computer algorithms of artificial intelligence. Indeed, however formalised, we can explain the problem that drives the choice of visual knowledge templates.

4.2 Level of Domain Dependence

Domain dependence of knowledge visualisation templates defines whether a given template is created and suitable for all domains (domain independent) or is intended for a specific domain (or domain specific or dependent); see Table 2. Domain-independent templates usually come from knowledge engineering, pedagogy (teaching methodology), system analysis/engineering, operations research, and corresponding problem-solving, decision-making, and communication theories. Such templates suggest abstract concepts for knowledge representation, such as node, concept, object, factor, state, alternative, activity, input/output, and argument.

In management, domain-specific templates usually come from different disciplines such as strategic management, operational management, marketing, and product management. Such templates allow manipulation of domain-specific concepts. For example, strategic objectives, business capability, strategic business unit, and value proposition are the template elements used in strategic management. Although domain expertise usually requires domain-specific templates, they are studied and implemented in software tools by knowledge engineering and conceptual modelling specialists (Karagiannis et al., 2016).

Table 2 Levels of domain dependence

Levels	Disciplines	Objects in templates (examples)
Domain independent	Knowledge engineering, pedagogy (methodology of teaching), systems analysis/engineering, operations research, problem-solving theory, decision-making theory, theory of communication	Node/concept, factor, state, alternative, activity, input/output, argument
Domain specific	Strategic management	Objective, strategy, business capability, strategic business unit, value proposition
	Operational management	Business process, organisational unit, input information, output information
	Marketing and product management	Market, customer, segment, product, customer experience, channel
	...	…

Figure 2 distinguishes between domain-independent and domain-specific visualisations, providing examples to be used for management purposes. This division of visualisation templates using domain-dependence levels is in line with the corresponding differentiation of knowledge management tools (Kudryavtsev et al., 2018).

4.3 Content of Knowledge (Semantics)

The content of knowledge classifies visual knowledge templates by focusing on the semantics of the problem. Specifically, this criterion categorises the templates according to the knowledge types proposed by Kudryavtsev and Gavrilova (2017). The knowledge types are identified by a set of 'W' questions that help view and analyse knowledge associated with a problem from several perspectives (see Fig. 3). Each of these perspectives entails a specific representation of knowledge, i.e. WHAT-Knowledge involves conceptual representation, WHAT_FOR-Knowledge regards motivation representation, HOW_TO-Knowledge entails functional representation, WHO-Knowledge regards organisational representation, WHERE-Knowledge concerns spatial representation, WHEN-Knowledge entails temporal representation, and WHY-Knowledge regards causal representation. Drawing on these representations, visual templates can be classified by knowledge type (see Fig. 4).

To select a template appropriate to a given decision problem, the decision-maker should formulate his/her focus question, find the corresponding knowledge type

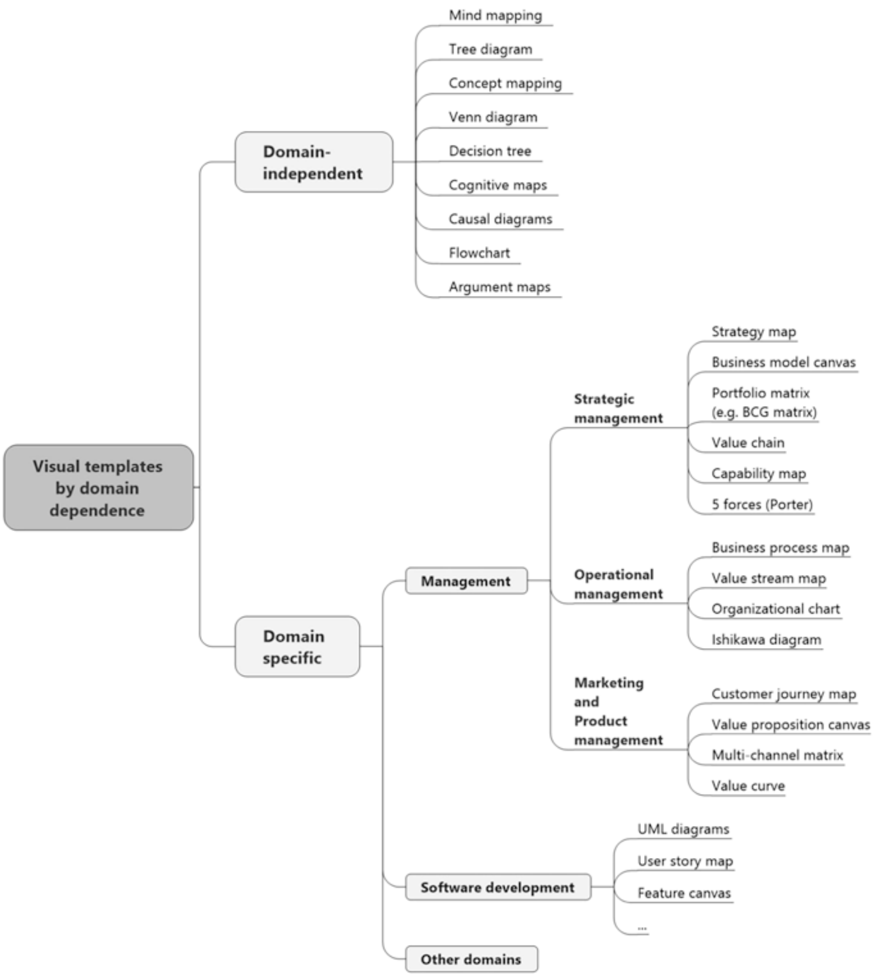


Fig. 2 Examples of universal and domain-specific templates

using Fig. 3, and finally identify a list of possible diagrams for this knowledge type as outlined in Fig. 4. This logic is represented in Fig. 5.

Some templates may be associated with more than one type of knowledge, e.g. templates for technological roadmaps may answer several questions such as what for, how, and when.

4.4 Form of Knowledge (Syntax) and Mental Scenarios

The 'form of knowledge' classifies visual knowledge templates according to the decision-maker's mental scenario, i.e. his/her thought process about building

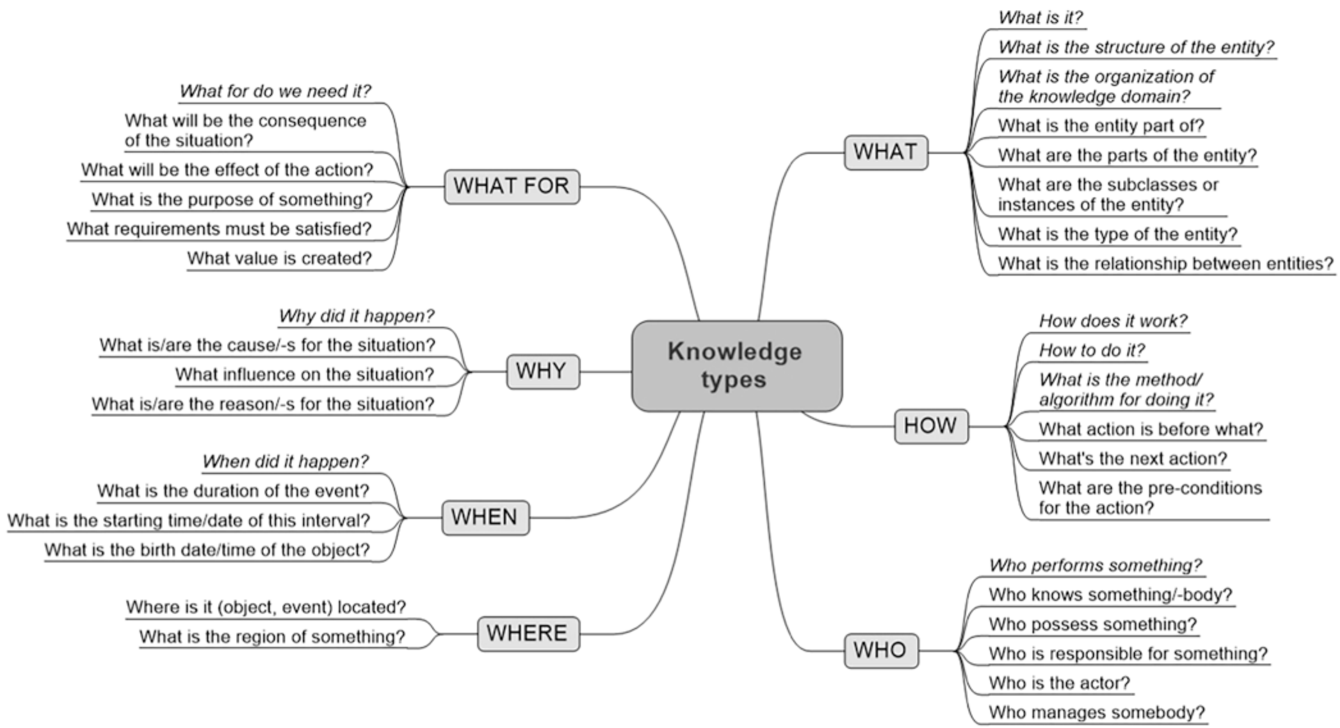


Fig. 3 Description of knowledge types (based on Kudryavtsev & Gavrilova, 2017)

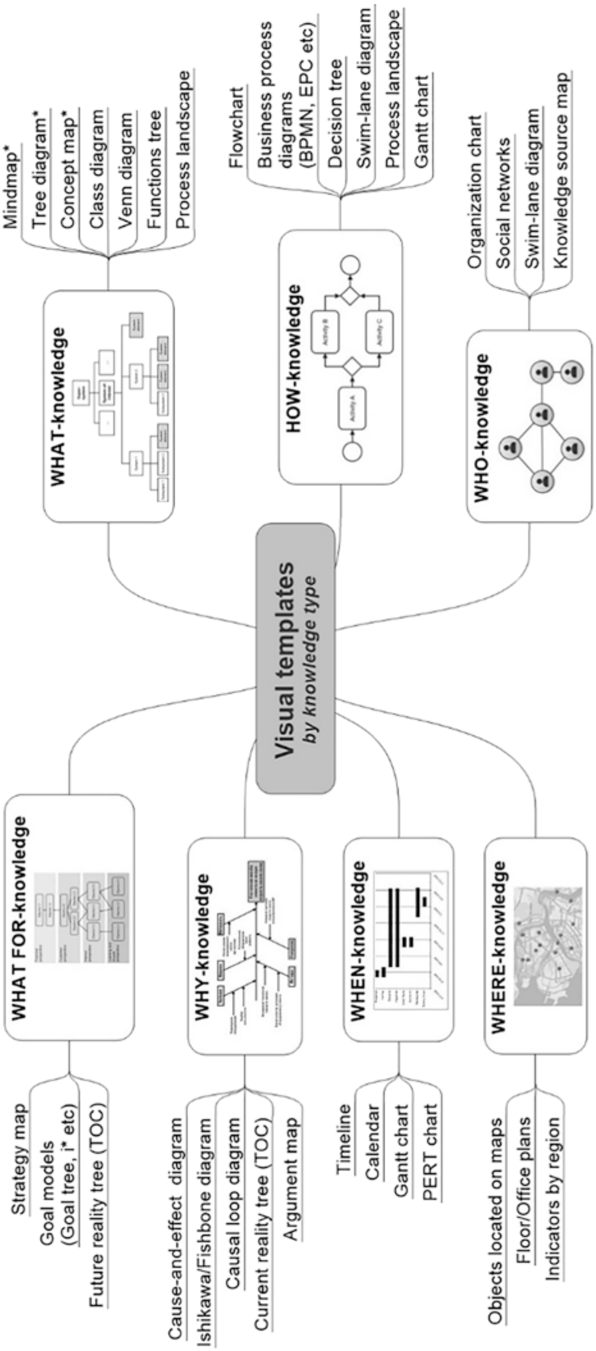


Fig. 4 Classification of visualisation templates by knowledge type (based on Kudryavtsev & Gavrilova, 2017)

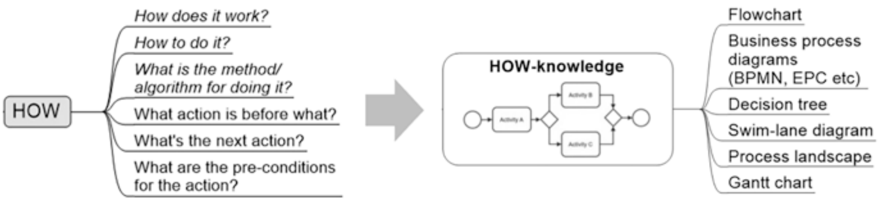


Fig. 5 Selection of visual templates based on the knowledge type

visualisation templates suitable for the decision problem, by combining several forms of knowledge representation.

Various forms of knowledge representation are also actively used for many templates in popular diagramming software (e.g. Visio, Miro, etc.) (see Table 3).

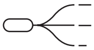
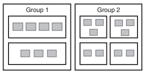
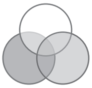
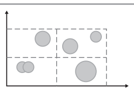
These forms can be used and combined by decision-makers according to different processes, such as 1) grouping of objects, 2) adding objects for specific groups, 3) linking objects with each other, 4) using metaphors for conceptualisation, 5) evaluating and comparing objects, and 6) demonstrating thought evolution (dynamics). These logics reflect some possible thought processes about how to build visual templates to match the decision problem.

The combination of such processes with the knowledge representation forms shown in Table 3 allows for classifying visual knowledge templates by forms and mental scenarios, as depicted in Fig. 6.

5 Discussion

Choosing a suitable visual template that adequately reflects the problem has always been creative and subjective. This chapter outlines possible ways in which to objectify this process and proposes a framework to help understand and select the appropriate knowledge visualisation templates for comprehensive description and representation of knowledge associated with a problem. The framework suggests a set of new classifications of visual templates based on four criteria, i.e. level of formality, level of domain dependence, content types, and forms and mental scenario. These criteria encompass a set of questions that need to be considered when selecting knowledge visualisation templates to support decision-making. Answering these questions can direct decision-makers to choose one or more templates. The framework outlines a set of visual knowledge templates for each criterion that can be selected and used alone or in a group. Indeed, choosing an appropriate visualisation template against a decision problem is not straightforward. Frequently, decision-makers do not know precisely what they are looking for and hence what to emphasise visually in order i) to establish objectives, (ii) to generate ideas, (iii) to explore alternatives, and (iv) to choose the best option. Moreover, selecting or designing an appropriate knowledge visualisation template typically requires choices and tradeoffs between factors, such as the objective/goals that the visualisation is to assist,

Table 3 Knowledge representation forms of visualisation templates

Knowledge representation forms	Image	Description	Example templates
Tree diagram		Hierarchical structure with nodes and links	Mind map, goal tree, Ishikawa diagram
Nested diagram		Hierarchical structure of nested boxes	Capability map Application landscape
Set intersections diagram		Overlapping objects, that show the logical relation between sets	Venn diagram, Euler diagram
Canvas		Workspace that is divided into sections with specific meaning for further population	Business model canvas, value proposition canvas, city model canvas
Acronym-based template		Workspace that is divided into sections with acronym-based meaning for further population	PESTEL SWOT SIPOC
Node-link diagram		Network of relationships between objects	Concept map, causal diagram, strategy map
Flowchart		Sequence of objects (activities, events, states etc.)	BPMN diagram EPC diagram IDEF0 diagram
Relationship matrix		Relationships between elements from two groups	RACI matrix CRUD matrix QFD matrices
Metaphor		Image of a concept (metaphor) with associated elements	Iceberg Tree metaphor Bridge
Metaphoric template		Metaphor-shaped workspace that is divided into sections with specific meaning for further population	Funnel Pyramid
Matrix		Two (mostly)-dimensional structures for positioning objects within the dimensions	BCG portfolio matrix Eisenhower matrix Prioritisation matrices
Scored profile		Categories are evaluated along the scale	Line charts Radar/spider charts Heat maps
Video scribing/ whiteboard animation		Combination of drawings, texts, and diagrams for visual storytelling	(Scriberia, 2016) (Davis, 2021) Storyboards
Animation & simulation		Step-by-step demonstration of visualised knowledge	Explainer videos Dynamic (system) simulation Instructional videos

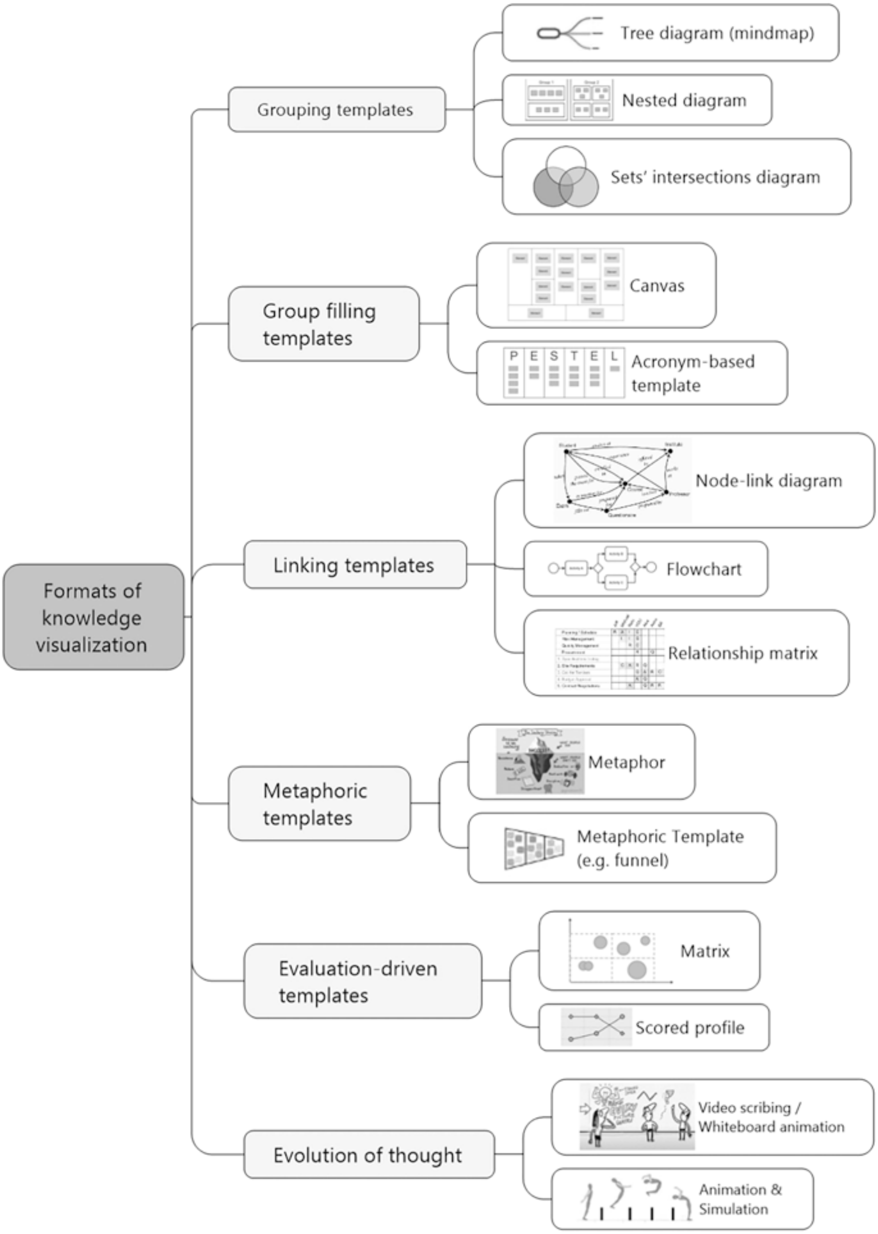


Fig. 6 Knowledge visualisation templates classification by form and mental scenario

the aesthetics (especially for persuasive graphics), the broader context where individuals make decisions and take actions, the decision-makers' mental model, and other possible factors (Dix, 2012).

The proposed framework and classifications attempt to provide decision-makers with criteria and questions that can encourage them to choose the visual knowledge template most appropriate to the decision problem. From a theoretical perspective, the chapter enriches the existing understanding of using knowledge visualisation in decision-making. It suggests a set of dimensions and corresponding questions when selecting templates. Indeed, any choice of visual knowledge template remains open to the question of its correct perception and understanding. However, referring to criteria and questions to match the best knowledge visualisation template against a decision problem is an essential first step.

6 Conclusions

For several years, scholars have been developing approaches and models to design appropriate knowledge visualisations against specific individual and organisational needs in different contexts. This study focuses on decision-making and attempts to shed more light on how decision-makers can select knowledge visualisation templates to construct, assess, convey, and apply knowledge for better informed and shared decisions.

There is broad acknowledgement of the potential benefits of using visual representations to support decision-making. A plethora of visualisation templates based on advanced computer graphics design is currently available and will be further developed by infographic and design specialists. However, selecting the appropriate knowledge visualisation forms to support the decision-making process effectively remains a crucial managerial question. In this regard, it is essential to point out that although visual representations may improve decision-making outcomes, they may also increase bias in interacting with visualisation. Misleading behaviour, defocusing behaviour, altered behaviour during group interaction, and cultural sensitivity (see, e.g. Bresciani et al., 2008; Eppler & Platts, 2009; Tufte, 1986; van Wijk, 2005, Ware, 2004) are some potential problems often overlooked and not yet well documented that visualisations could produce. The appropriate visual representations can reduce these risks and support the creation of insights for decision-making. Indeed, choosing a suitable visualisation technique that adequately reflects the problem has always been and remains a creative and subjective process. However, it seems possible to outline ways to objectify this process and help practitioners choose. From this perspective, the study proposes a framework to assist researchers and practical decision-makers in understanding and selecting the appropriate knowledge visualisation templates for a comprehensive description and representation of the knowledge associated with the problem.

The chapter enriches the extant understanding of how knowledge visualisation templates can be classified and provide decision-makers with a framework that can best match the visualisation forms with the decision problem. This chapter has several limitations that could be addressed in future research. Firstly, the study is theoretical as it aims to understand the state of the art of visual knowledge templates and suggest a way to select them. Future analysis could investigate the extent to which the proposed framework is relevant in public and private organisations' decision-making processes. For this purpose, some empirical research (e.g. case studies) could be implemented. Thus, different empirical methods could be adopted, whether qualitatively, such as ethnographic research to observe the use of visualisations in practice, or quantitatively to collect through survey information about the what, why, and how of visual knowledge templates. Secondly, drawing on empirical research results, the framework could be refined, and some additional components could be considered.

Useful knowledge visualisations can extend our thinking, improve our sense-making capabilities, and enhance communication and our cognitive processes. Human-computer interface devices' rapid and continuous evolution confirms that knowledge needs to be 'seen' today more than in the past. We are still only beginning to tap into the potential of knowledge visualisations. The combination of visual knowledge structuring with AI-driven content recommendations and assistance may well be the next trend in knowledge management research and practice.

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Learning from the Future: Knowledge Management Systems in the Twenty-First Century

Eric Tsui

Abstract

Despite technologies having an important role in supporting the management of knowledge, progress in (technical) knowledge management systems (KMS) in the past three decades has been uneven, incremental, and discrete. In the twenty-first century's age of digitalization, comprehensive management of knowledge occurs in a far more complex environment, and overall speaking, current KMS are grossly inadequate in supporting knowledge workers and organizations in performing proactive and comprehensive knowledge-intensive activities and making decisions. A short summary and review of the evolution of KMS in the past three decades is outlined. Based on the rapidly advancing knowledge and technology landscape in the digital era, together with the gap between current and foreshadowed KM practices, the characteristics of both near- and long-term future KM systems, services, and delivery platforms are discussed. Such platforms are needed to support knowledge harnessing, learning, and innovation in a highly personalized and digitalized world. Particular emphasis is on reimagining the role of search as it is a crucial and common knowledge process that underpins many KM initiatives. The future state of search is purposely elaborated in the context of smart KM together with a reframing of cloud computing, which leads to the concept of a knowledge cloud that acts as an e-canvas supporting dynamic capabilities, knowledge/expertise location, harnessing, and assembling new business models for the orchestration and delivery of knowledge services. Prototypical systems on peer-based personal lifelong learning and an intelligent workbench that facilitates chance discovery via serendipity over topic maps are presented as a glimpse to what future KMS will take shape.

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Knowledge management systems · Cloud services · Search · Knowledge-as-a-service · Evolution of KM · KM eras

1 Introduction

Knowledge management system (KMS) has always been an integral part of any knowledge management (KM) programs and projects as it is generally the component that carries out knowledge processes and often does so in an automated or semiautomated fashion embedding reasoning capabilities like search, verification, classification, deduction, explanation, and more. Unlike information systems, which are traditionally designed for the collection, analysis, and reporting of planning and operational data in an organization, KMS also, among other things, connects people with people as well as harnesses and shares tacit and explicit knowledge among the identified stakeholders. In a wider sense, a KMS is a kind of socio-technical system that not only has technical components, but its usages are guided by a defined set of processes often requiring human input (including interventions). However, in the rest of this chapter, we focus primarily on the technological aspects of KMS (hereon just referred to as 'KMS'). Furthermore, despite technological advances in standards and integrations, KMS in today's organizations are still not necessarily integrated systems; more often than not, the technical components of a KMS is a set of loosely coupled systems in an organization. Users often need to access various systems before they can achieve their goal e.g., generating a recommendation, making a decision, performing an analysis, etc. These shortfalls slow down the execution of KMS and made them more error prone (than fully automated systems) as human input may contain mistakes.

The development and evolution of KMS in the last three decades turned out to be very much aligned with the three eras of KM (Dixon, 2023), i.e., from connecting people with documents to connecting people with people, and to creating a conducive environment for free flow of knowledge on open platforms. Despite noticeable advancements in systems architecture, networking, artificial intelligence, process automation, standards, it is felt that, however, the gap between capabilities of current KMS and carrying out comprehensive KM in the digital twenty-first century is widening. KMS today, including academic and research prototypes and commercial systems, are grossly inadequate to support knowledge workers and organizations to manage knowledge proactively in the twenty-first century.

Adopting both the 'Back from the Future' and 'Forward from the Past' approaches (see Fig. 1 below), this chapter explores the current gaps and inadequacies of today's KMS and what KMS in the twenty-first century, especially from the architectural and functional perspectives, should be. We also explore, based on current progress, how the next-generation KMS in the near future (in a decade's time) will benefit and impact KM practices and the growing body of knowledge (BoK) in an organization.

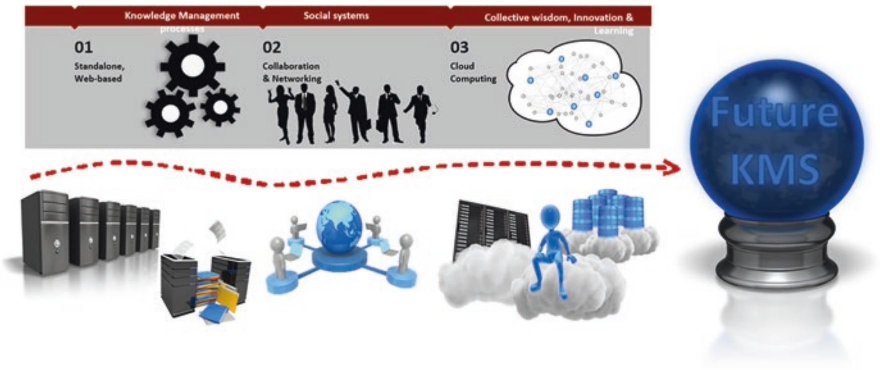

Fig. 1 Past, present, and future KMS

2 Evolution of KMS

As mentioned above, the evolution of KMS largely paralleled the three eras of KM in the last three decades. KMS in 1990 to 2000 are designed to support predominantly the codification of knowledge assets. Search engines and document management and workflow systems are typical KMS in this era. Characteristics of KMS in this era are as follows:

- *Process based*: Typically these are workflow systems allowing documents/files to be attached. They support collaborative work inside an organization with a predefined sequence of tasks.
- *Standalone*: Applications are installed (also called “thick client” application) into a workstation; hence, access is confined to selective workstations that have the software installed.
- *Individual user sessions*: A user needs to logon to the system in order to use the application installed in the workstation. User data are stored in the workstation by default.
- *Connect people with information*: After all, these KMS are all interfacing human beings with information (explicit assets including documents, data, links, media files).
- *Some are web based*: A small number of the KMS during this period are web-based applications. They can be accessed via the browser or via installation of a small piece of software (i.e., a “thin client” application) on the local workstation.
- *Lack of integration*: As mentioned above, these KMS are built for specific functions/purposes, and as such, they are not composite systems. In other words, if the user needs to conduct several knowledge tasks/processes, it is highly likely that several KMS need to be used, and data may also need to be transferred manually across these systems.
- *Proprietary database/format*: Typical of the evolution of information systems, when the first wave of systems come out, due to a lack of standards, coding are

often hard wired with little attention paid to interoperability and reusability across systems/platforms. Early KMS also suffer from this drawback, individual KMS adopt proprietary (closed and non-shared) standard and file formats. In others words, systems are not componentized, and it is extremely tedious, if not impossible, to transfer data and information between proprietary systems and platforms. Furthermore, knowledge (both tacit and explicit) that have applied to develop and configure a KMS are locked and cannot be transferred out from the original system.

By the turn of the last century, researchers and practitioners soon realize that codification, due to its inability to contextualize the (knowledge) environment, is a weak method (Boisot, 1998). The reason is that as there are numerous dimensions in a context, codified assets (e.g., best practices documents and lessons learnt inventories) are never created with their complete original context; hence, they always appear more generalized than what they are meant to be. As external factors (i.e., the context) change, they render the codified assets to become less and less relevant or even obsolete. Personalization, an approach that supports harnessing and sharing of knowledge by principally linking people with people, rose to the fore and became the dominant approach in KM from 2000 to 2007. Development in KMS has followed this evolution, and the main characteristics of KMS during this period include the following (Tsui, 2002):

- *Web-based collaboration system*: Users at same/different locations can collaborate via file sharing, document editing, messaging and more (Lee et al., 2007) (Tsui & Lee, 2004).
- *Web/videoconferencing system*: Real-time communications with audio/video among users.
- *Electronic document management system* (*EDMS*): Support document-centric collaborations including authoring, routing, review, annotation, and approval of documents in a predefined workflow sequence.
- *Content management system*: Supports the hosting of a repository (internal and external) of explicit assets with functions for supporting and automating the creation, approval, rendering, update, and retirement of content.
- *Instant messaging system*: Yet another type of messaging system that also indicates the current status (e.g., online, active, away, offline) of a user
- *Project/high-performance workspaces*: Typically, these are online systems that are configured to support projects. As such, these systems support the location of experts, project planning and tracking, online discussions, project reporting, and links to other useful material.
- *Community platform*: Community is a principal KM tool in the personalization approach, and community platforms are designed to support the harnessing and ongoing support for a community. As such, these platforms provide functions for locating potential members, news announcement, recording of forthcoming events and events held, hosting of private and public discussion spaces, and community administration functions covering reports on the activities/activeness of

individual members, conversion rate from guests to members, and membership status and growth.

- *Knowledge visualization system*: This type of system displays data, information, and knowledge via visually expressive protocols, often in an interactive way and in three or more dimensions. Typically, they are designed to help users to navigate over a large volume of data and identify and explore, among others, relationships, magnitude, and orientation of the displayed objects. More often than not, artificial intelligence, simulation, and multimedia technologies are used to enhance the surrealism and/or information richness of the displayed environment with the purpose of enhancing user's understanding (e.g., via virtual manipulations) or inspiring user to generate creative ideas (e.g., connecting seemingly related nodes).
- *Enterprise portals*: Systems that provide integrated and personalized access to (internal and external) information, applications, and tools. Over the years, portals have evolved from global intranets to platforms for custom development of services for individuals, groups, organizations, and the public to use (e.g., e-commerce portals).
- *Learning management system*: Systems that are specifically designed for the authoring and hosting of learning objects for users to access. Many also track and report on the progress/completion of course(s) by learners.
- *Matching people with people*: Many KMS in this era are starting to support connections among people, e.g., instant messaging systems, community platforms, and expert locators.

Then in early 2000s, KMS entered its third era. Web 2.0, a concept that allows bi-directional sharing and flow of knowledge and codified assets, became popular. As a result, many Web-based KMS are Web 2.0 sites. On these platforms, KM is very much about collaborations, connections, harnessing preferences, advocating ideas, and asserting influences at the individual and organizational levels. KM activities are highly socially oriented. Characteristics of KMS between 2007 and now are as follows

- *Web 2.0/Enterprise 2.0 tools*
  – Blogging/microblogging (short- to medium-length journals written by individuals)
  – Wiki (collaborative editing of Web-based documents)
  – RSS (Really Simple Syndication—content aggregation and push to subscribed users)
  – Social networking (connects people with personal updates and information sharing in a social sense)
- *Enterprise portals* (more features than in previous era and delivered via a cloud)
- *Learning management system* (delivered in the cloud)
- *Mobile devices and mobile applications* (a wide range of devices and applications to access Web-based applications, some with custom software specifically designed to facilitate mobile access)

In terms of the architecture/platform of KMS, over the last three decades, it has evolved from stand-alone systems to client-server systems, to Web-based applications, to Web 2.0 applications, to cloud-based services (Sabetzadeh & Tsui, 2011).

Interestingly, nearly two decades ago, Gottschalk (2005) has largely predicted this evolution of KMS as depicted in the Table 1 below:

It is important to point out that the development of the abovementioned KMS in the four eras is not mutually exclusive. In fact, these KMS often complement each other, and there are also overlapping functions among them (e.g., search engine exists in portals, in document management systems, and in intranet). An organization may adopt one or more of the above KMS to support its KM activities and program. However, having multiple but identical functions across various systems is in fact dysfunctional to organizations as this often causes confusion and compromises the corporate KM effort (Tsui, 2016).

In the next section, we shall discuss the characteristics of a digitalized twenty-first century and identify, with reasons, areas where existing KMS are inadequate for supporting managing knowledge comprehensively in the twenty-first century.

3 Shortfalls for KMS in the Twenty-First Century

Good knowledge management can enhance a firm's organizational performance and innovative capabilities (Vidal et al., 2013). Innovation is especially important for organizations as we are now in the Fourth Industrial Revolution (I4.0) and unlike the previous revolution where the critical success factors are speed, cost and automation, competition, and excellence among organizations. In I4.0, success for an organization is based on, among others, the ability to swiftly generate new markets and new business model(s) leading to new value creation for a dynamic changing set of stakeholders (Ustundag & Cevikcan, 2018). Therefore, to better appreciate the shortfall of current KMS and to identify the gap between the current and the target states for KMS architecture and functions, we discuss the major advancements of

Table 1 Prediction of the evolution of KM technologies by P. Gottschalk (2005)

Period	Stage	Focus
1990–around 2000	One—End-user tools	Development of general tools for users to accelerate/automate their work
Around 2000–prior to 2010	Two—Who know what	Development and maintenance of an expert directory so that people know who to turn to for what type of expertise
Around 2010–around 2015	Three—What they know	Concept representation and knowledge mapping of decision-making knowledge and expert's knowledge
Around 2015 to 2000 and beyond	Four—How they think	Development of reasoning paradigms, encoding of reasoning knowledge into machines, artificial intelligence

accessibility, connectivity, advancement of tools, and organizational development in the twenty-first century.

Advancements in ICT technologies in the last two decades have led to extensively and increasingly connected digital networks worldwide. These networks are indeed hybrid computer and human networks. Each node in the network can be data, documents, computational resources, software, human beings (individuals as well as groups of people), and more. ICT tools are readily available to locate and operate (e.g., verify, connect, share, assemble services, test, deliver services, etc.) (Sabetzadeh & Tsui, 2011) on these networks typically for expertise location, dynamic expansion of capabilities, and development of business models. These networks and tools have greatly accelerated and enhanced the impact of globalization—digital infrastructures can be replicated rapidly and economically, the inconvenience of doing businesses far apart is greatly reduced, and organizational structure becomes flatter (leading to increased flow of knowledge especially bottom up sharing). In the past decade, advancement in the miniaturization of sensors and Internet of Things (IoT) have led to the mass generation and collection of data from parts, tools, products, locations, human bodies, and more. Analysis of such data, especially in real time, can help to monitor, benchmark, report, mass customization, and predict peak demand and even potential failures of equipment and plants.

The above successes and impact do not come without challenges, however. In addition to the massive and rapid proliferation of data and information, which obviously lead to problems with information awareness, location, and retrieval, there are also inconsistency, misinformation, and redundancy of information to deal with. Assessing the truthfulness of a piece of information, determining whether it came from a trustworthy source and presenting/interpreting them in the right context are, among others, hard problems that remain unresolved. Based on the above description of the challenges and opportunities in a digitalized twenty-first century, we can identify the shortfalls in current KM initiatives/programs and KMS. These shortfalls are summarized below (and we shall discuss the remedies and recommendations for each of the shortfalls later):

Current KM initiatives/programs are almost entirely internally focused: In the author's personal experience in tackling more than 200 KM projects in the last two decades, not one project involves any input (people, documents, data) from outside the organization. Typically, good practice guidelines and lessons learnt are entirely based on intraorganizational knowledge and experience. Absorptive capacity (Schilling, 2020) is a measure for gauging an organization's ability to assimilate external knowledge into its internal knowledge base, and research has long proven that organizations with good absorptive capacity generally are more innovative.

Organizations under-explore the use of data to generate new knowledge: Though many organizations have a business intelligence (BI) and process/continuous improvement (PI/CI) units, the work in these units is separate from KM operations. Furthermore, these teams generally work with only data generated and possessed by the organization. For domain experts, good practices and lessons learnt are often derived from observations rather than from detailed data analysis. Other than some specific projects, discoveries made by the BI, PI, and CI units are not communicated to the KM team but are often operationalized as business rules or process changes. IoT applications are still new and few in organizations (Tripathy & Anuradha, 2018). Given the increasing availability and complexity of data, knowledge discovery activities should not be limited to specific departments/units in the future. A paradigmatic shift in leveraging data (internal and external to an organization) is very much needed in order to achieve smart and comprehensive KM in the twenty-first century.

Inadequate for supporting comprehensive KM in the twenty-first century: The current state of KMS is grossly inadequate for meeting the above challenges and in exploiting the massively connected digital networks in the twenty-first century. More specifically, these inadequacies are summarized below:

- *Designed for harnessing and processing intraorganizational knowledge*: As mentioned above, KMS development over the years largely paralleled the focus in the different eras of KM; hence, except for search engines and enterprise portals, KMS operate with internal data and are internally focused.
- *Insufficient focus on leveraging data to create new values and business models*: Again, BI, CI, and PI systems aim at achieving operational excellence. While these systems are still useful in an organization, they are not designed to support an organization to excel in the era of I4.0.
- *Cannot cope with the speed and scale required to process a large volume of data*: Many KMS, including search engines, are analyzing real-time data; they may be working with only a subset of the data and/or relying on preconfigured indices for fast access. New architecture and functions are needed to operate with Big Data and IoT applications current KMS, both academic/research prototypes and commercial systems, have yet to adopt these new architectures. One exception is cloud computing and nowadays many KMS are “in the cloud” delivering X-as-a-service. More on this topic later.
- *Not designed to process massive heterogeneous data in different modalities*: The base architecture of current KMS was designed before I4.0; texts are still considered to the principal source of codified knowledge. Very few KMS can handle audio and video files (other than storage, indexing, and retrieval).
- *Scattered functions across multiple systems and platforms*: There is a plethora of KMS in the market; these systems range from providing specific/individual functions to bundled systems with composite functions (e.g., enterprise portals). As mentioned above, this is indeed an undesirable situation as duplicated functions/systems often cause confusion and distraction and led to data/knowledge stored in disparate locations (which in turn causes problems in retrieval)
- *Requires constant human interventions for verification, rectification, and sometimes entering missing data*: While this is surely a sensible design principle for all KMS in the past, the whole decision-making framework needs to be revisited especially in the light of increased availability of data due to IoT advancement, access to external data/knowledge (for verification), and

advancement in artificial intelligence (AI) and machine learning (ML) algorithms, more automations based on higher confidence/certainty can be enabled in future KMS. More and more decision points will be automated in future KMS.

No doubt many of the above shortfalls will be remedied in the years or decades to come, still there is a considerable gap between what KMS *can* do and *should* do in the twenty-first century KM. In the next section, we focus on the Search function in KMS in order to gain a deeper appreciation of this gap. Search is a crucial and common process among many KM activities and initiatives; search engine(s) are embedded inside many KMS, e.g., intranet, document management system, enterprise portal, collaboration tool, etc. To better appreciate this gap, in the next section, we discuss the changing and expanding role of the search function in order to support comprehensive KM in a digitalized twenty-first century.

4 Reimagining the SEARCH Function

Search is a crucial and commonly executed knowledge process in nearly all KM initiatives; search plays a key role in both the codification and personalization approaches to KM. In codification, search and directory navigations are two common ways to retrieve/local stored assets (e.g., best practice guides, lessons learnt documents, after action reviews). In personalization, search is often applied to locate people (via names and expertise) as well as to locate texts in discussion forums.

Up till now, still there are many design, configurational, and operational problems compromising the value of search engines (Tsui, 2016). However, going forward even with partial or full rectification of these problems, the current search function and search behavior are still inadequate for supporting proactive and comprehensive management of information and knowledge; indeed, the whole topic of search (as a function) in a digitalized twenty-first century really needs to be *reimagined* as remaining with the current interpretation would somewhat inhibit one's inspiration and drive to provide a search function that supports comprehensive and smart KM in the twenty-first century. Six categories of changes are indeed proposed for the reimagination of the search function:

Active: This is one sure behavior that future search engines need to help humans to change. Current search behavior is reactive/passive, and the search function is often initiated manually. More often than not, a search function is normally only triggered when we have a need to locate one or more pieces of data/information (be it a link, a document, a photo, a video, a connection, etc.). Besides the power and accuracy of search engines, this reactive/passive behavior of triggering a search also has several drawbacks. Firstly, it takes time and effort to compose the search query including the keyword(s) and operand(s), and as it is subjective, they may not be an appropriate query for the search on hand. Secondly, contextual information is often excluded from the query, and this omission may well compromise the relevancy/accuracy of the search result. Thirdly, a reactive/passive approach to search slows down the execution of the search process as the user not only needs to compile the search query but also needs to review (typically many pages) search results to complete the search function. In contrast, twenty-first-century search needs to be more proactive and largely automatic (transparent) with the aim to (pre-)gather the needed data and information for decision-making (by both human and machine) and presentation.

*Heterogenous***:** These days we do not have full control on where and when we what to store a piece of information as information arrives in no predefined order and is stored across a multitude of devices and systems (e.g., phone, email, shared drive, USB, cloud storage, hard copy, portals, etc.) Yet all the devices and systems should be part of the "search space" (i.e., the collective area where all the stored materials can be found and matched). To further complicate the situation, information may be in different modalities (e.g., voice, texts, pictures, videos) and saved in different formats. Common shortfalls with current search engines are that search is not a-l encompassing, and certain search engines can only work with specific search spaces. To overcome this, users need to possess prior knowledge of "which search engine covers which search space," and very often duplicate searches need to be carried out, which obviously are undesirable for comprehensive KM in the twenty-first century. A smart search engine should not impose such prior knowledge on the user. In this aspect, twenty-first-century search engines need to be all-encompassing penetrating through a large number of possibly disjoint search spaces and be able to deal with a wide variety of information media and formats especially when searching multimedia content.

Context: This is a very important dimension of knowledge. Context helps to bring out the meaning, purpose, and application of a piece of knowledge. A key reason why codification is inferior to personalization is the lack of (or rather the impossibility of) including all the contexts (or "dimensions of knowledge" as covered in Boisot (1998)'s I-Space theory of knowledge transition) when codifying a piece of knowledge, which lead to the overgeneralization of the codified knowledge. Coupled with a rapidly changing external environment, the relevance and applicability of such codified assets decline sharply. Although there are multiple ways to trigger a search, current search engines are initiated mostly by keyword(s) with operand(s). As such, context (especially context in which the search is required/originated) is often ignored in search algorithms. As a result, again, relevancy and accuracy of search results are often compromised. It is also important to note that attention to context should not be limited to searching codifying assets but also in presenting search results as well. To help efficiently and effectively convey the results of search to a human, search results should always be presented in context (i.e., in a situated way) to ensure relevancy and accuracy.

Relevant: The principal function of search is to match (both syntactically and semantically) input query (the cue/probe) with what's stored in the search space. Relevancy, or similarity measure, is a function that determines the extent of a match (from completed unrelated to an exact match). Applying relevancy in the search algorithm also helps to determine the order in which search results are being displayed/returned to the user. The search engine may actually find what the user is looking for, but if the matched entry is not shown high on the list of search results, the user may terminate the review and rated the search unsuccessful. Most internet users would normally only review up to two pages of search results from a public search engine. Relevancy in search engines has been improving over the years, thanks to the invention of new indexing and matching algorithms. However, to meet the agile and customized need of each individual search, future search engines need to be adaptive to the user role type and the context in which the search was being initiated. For example, in a corporate environment, the same search query may yield different results for each invocation because the role/rank of the user and the context in which the search was initiated are included to determine relevancy. Relevancy can be determined by conducting further checks and/or taking into consideration of user preferences and input.

Evaluate: As mentioned above, there is a data and information explosion in the twenty-first century. As such, data and information are coming out from numerous sources and as a result, among others, duplicated, redundant, inconsistent, contradictory, and misinformation riddled throughout the internet and other information spaces (e.g., corporate repositories). Search engines should not limit to just operating on the relevancy and frequency of matched items in the search process but also incorporate the verification/validation of the authenticity of the source(s) of the stored information as part of the search process. Evaluate is closely associated with the determination of "relevancy" and paying consideration to the "context" as mentioned above. Evaluation can help to "differentiate" the relevancy or even eliminate potentially matched item(s) from further consideration, which is always desirable for the user as this reduces the list of search results to review. The ultimate goal of evaluation is to identify the trustworthiness, fit for purpose, and perceived usefulness of the matched item(s) in the context in which the search was initiated.

Seamless: Although many existing enterprise applications already embedded a search engine and automatically invoke it to execute during an operation, many search requests are still being carried out discretely and are human driven. There are two major drawbacks with human-initiated searches: first, the search query entered may not be the most appropriate one; hence, accuracy and ranking of results are compromised; secondly, results need to be reviewed by a human being, and this intervention invariably shows down an otherwise automated process. Of course, there will still be human-initiated discrete searches in the future, but it is felt that with the advancement of artificial intelligence especially reasoning paradigms and the increasing availability of data (often in real time) collected by sensors (aka the IoT and IIoT applications), more and more searches can be carried out with less or no human input/interventions, which in turn lead to more automated tasks. As mentioned above, smart searches in the twenty-first century should be proactive; at times, a search needs to be carried before a human initiating it, e.g., gathering anticipated information for decision-making, generating

Fig. 2 Reimagining search: Smart search in the future

predictions based on knowledge of past situations, and alerting humans of some pending high-risk incidents or crisis.

Incidentally, the above aspects of search also share the acronym of "SEARCH" (meaning "*Seamless-Evaluate-Active-Relevant-Context-Heterogenous*") as shown in Figure 2 below:

A short video explaining the reimagined SEARCH is available for replay at https://youtu.be/KRlykDqkX6k . While there are constant efforts to develop and improve the above aspects of search (Croft et al., 2010; Levene, 2011; Li & Liu, 2013; Turnbull & Berryman, 2016), there needs to be a holistic and synchronized effort in implementing and operationalizing the above in the next generation of search engines in the twenty-first century.

Recent emergence of generative AI tool ChatGPT can be seen as the first wave of proactive KMS coming on the market. Although ChatGPT's responses are by no means always accurate and comprehensive, it nevertheless offers an excellent platform for the study of the abovementioned crucial for judging the performance of future KMS—especially relevancy, self-evaluation, and the contextualization of information. Garnering the same popularity as ChatGPT is the metaverse (Ball, 2022), a real-time always on three-dimensional virtual environment that supports extensive collaboration and personalization, the reader is encouraged to also peruse another chapter in this book on the topic of knowledge management in the metaverse.

5 Reframing Cloud Computing

The onset of cloud computing has accelerated KM practice as well as enabled organizations and individuals to be more innovative (KS in the cloud). According to the US National Institute of Standards and Technology, "Cloud Computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction." From this definition, it is clear that cloud computing is not a technology but rather a new way of composing and delivering online services via the use of existing technologies. Most users would look to the cloud as scalable online repositories (containing primarily files and applications) that can be accessed instantly anytime and anywhere. While this is all true, the power of "networks" and "relationships" harnessed in a cloud are often ignored. In fact, these two "underexplored" characteristics of the cloud, together with the basic characteristics of cloud computing (i.e., on-demand, elasticity, standardization, device independent, ease of access, pay-as-per-usage), facilitate the application of KM as well as stimulate innovation. To appreciate these, one needs to adopt a reframing of the cloud computing concept.

Following the perspective on assessing a KMS, a KMS is not deemed to be successful unless it has garnered mass and sustained adoption by users. Applying the same perspective to cloud computing, a cloud is not deemed to be successful unless its applications/services are hugely popular and have attracted a massive number of users and in a sustained manner. In other words, a cloud consists not only hardware, software, computer networks, databases, and information repositories but also people (users) and the networks people create. More specifically, there are three types of networks in a cloud (Tsui, 2015): (also see Fig. 3 below).

- *Computer networks*: These are the hardware connections and software linkages between and inside the cloud infrastructure.

Fig. 3 The knowledge cloud

- *People to computer networks*: These are linkages between users and the cloud. For example, when a user creates an account on a software installed in the cloud, there is a link between this user and the cloud.
- *People to people networks*: These are people to people networks created/agreed by the users in the cloud. Very often, these networks are built with some trust (e.g., friends, associates, followers, members, etc.)

On a broader perspective, leveraging on the basic characteristics of cloud computing, the cloud offers the following benefits to KMS and its development:

- Reduce/remove the need to design internal IT or knowledge infrastructure for an organization; many of the needed modules are componentized and available in the cloud.
- Enable the development of integrated software services.
- Extend Q&A and problem-solving beyond organizational boundary as external parties, upon authorization, and can also sign up to become a member of the knowledge cloud
- Enable access to massive data for analytics and discovery; this is a significant advantage that no internal KM program and infrastructure can rival.
- More explorations on disruptive innovations by leveraging the cloud as an e-Business Model Canvas (see below).
- Natural expansion into customer KM as consumers and customers data can be harnessed from the knowledge cloud.

Following on from the above, by reframing to include the users (and their networks) in the cloud, the cloud is no longer just a scalable repository of computing resources but in fact is a much more powerful entity. Expertise, knowledge, experience, and trust reside in the cloud; they can be located, connected, and "call to action"—indeed, this is a "Knowledge Cloud," which can support, among other things (Tsui, 2015),

- *Crowdsourcing*: Calling for input (ideas, preference, resources, etc.) from the entire network
- *Harnessing expertise*: Locating the needed expertise/skills and then leverage on expanded capability to, for example, solve a problem
- *Knowledge discovery*: Working with the data and tools in the cloud to explore the generation of new knowledge
- *Co-creation*: Collaborate with selective (groups of) individuals on the network to develop a solution/deliverable together

The cloud is also increasingly become an integrated platform for the collection and analysis of data in real time. This ability has profound implication for businesses especially by making further use of the data collected from IoT and IIoT applications, as such data are voluminous, real time, among others, and can be used to monitor operation and detect anomalies, benchmark overall performance with

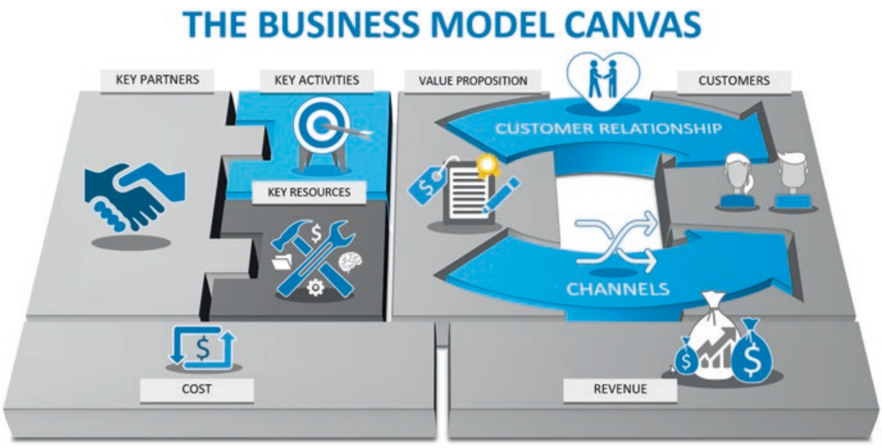

Fig. 4 The Business Model Canvas by Osterwalder and Pigneur (2010)

established yardsticks, and predict potential risks and even pending crisis. Furthermore, a cloud can connect individuals and organizations in all industries worldwide so it is truly an electronic Business Model Canvas (Osterwalder & Pigneur, 2010) (which enables nine dimensions of a business with respective interactions to be visualized and studied) (see Fig. 4) for the development of new business model, orchestration, testing, and delivering of on-demand services, i.e., the so-called X-as-a-Service XaaS (Tsui et al., 2011).

More examples of XaaS are as follows:

- *Community building*: Leveraging on the network in the cloud to locate/invite members, conduct activities, solicit opinions, share and learn together, and jointly make decisions
- *Search*: Issue a search across the network by selecting, for example, the type of search engine and the search space and document formats
- *Analytics*: Specify what tools/algorithms to analyze specific volume(s) of data and present findings in a custom format
- *Quality assessment*: Specify the quality checks to be applied to a specific procedure/process/guideline, report on the compliance, shortfalls, exceptions, and violations encountered
- *Benchmarking*: Comparison between two or more sets of metrics and report on correlations and deviations
- *Testing*: Carry out testing on a part/product/process/database based on a standardized test and report on the result including any abnormalities

Furthermore, after migrating from a Web application to a (software) service in the cloud, the following types of KMS have added functions with expanded capabilities, which are especially beneficial for global organizations with a distributed workforce due to improved consistency, governance, adaptability, and integration:

- *Document and management systems, repositories*: Collaborative editing and tagging of content, enhanced navigation, centralized security policies/rules, and integration with desktop applications.
- *Search engine*: More applications/databases are searchable via cloud APIs, collaborative search, social search, discovery, integrated search across the Web, intranet, personal devices, etc. User may select to use a particular search engine for a particular task.
- *E-learning system*: Sharing of learning objects, discovery of subject matter experts, expertise location and sharing, peer-based, social and lifelong learning, setting up learning communities.
- *Taxonomy system*: Collaborative tagging, collaborative editing and maintenance, multiple taxonomies in the same domain, enhanced navigation, and benchmarking taxonomic structure and performance (Kiu & Tsui, 2010) (Kiu & Tsui, 2011).

As for enacting innovative knowledge services in the cloud, an example is that new knowledge can be generated from collected data, boundaries and relationships between dimensions of an existing business may be altered (by removing and creating new linkages in the cloud (the e-Business Model Canvas), and services are represented by business processes, which are created by customizing and collating the operations powered by the tools installed in the cloud. Tencent, Huawei, Amazon, among others, operate their "AI cloud"; these clouds are opened for the public to explore, apply existing and create new algorithms to develop services, and even integrate into their own enterprise applications; platform providers benefit from harnessing the operational statistics as well as the routines created by the users (Adebayo, 2023).

6 KM Practices, KMS in the Near Future, and Challenges

Traditionally, technologies do not lead a KM journey but a supporter and an enabler to it. However, the twenty-first-century KMS, leveraging on the advancement in technologies and increased availability of data, will impact KM practices in a positive way. In this section, based on existing progress in KMS, we project KMS' advancements in the next decade. In particular,

- Increasing availability of tools to automatically assign meta-data and tags and create taxonomy to explicit assets, e.g.. Microsoft Viva Topics
- Emergence of intelligent (automated, adaptive, proactive) content management with customized presentations, e.g., SharePoint Syntex
- Intelligent process management system (monitoring, benchmarking, rectification, automation, prediction) based on the application of AI and data analytics
- Enhanced knowledge discovery functions with the advancement of smart searching (see above)
- Orchestration, testing, and execution of knowledge-intensive activities via cloud-based knowledge services, i.e., XaaS (Tsui et al., 2011)

Invariably, the above KMS advancement will impact on the expansion of KM practices in the future:

- *KM Practices will expand from internal to both internal and external operations*: There are significant benefits in doing this. Firstly, the internally harnessed body-of-knowledge can be further expanded to incorporate outside knowledge, e.g., good practices, lessons learnt, and stories. Secondly, expanding into network(s) outside the organization (with trust) extends the dynamic capabilities (hardware, software, people skills, knowledge, and expertise) of an organization, which in turn enables it to create and pursue more opportunities. Thirdly, assimilation of external knowledge into the existing body-of-knowledge can enhance an organization's innovative capacity (Schilling, 2020).
- *Good/best practices to be continuously refined by analytics*: Harnessing best practices is a very common KM initiatives adopted by organizations. Up to now, such practices are almost entirely developed (and maintained) by subject matter experts or assigned stakeholders as they are often the people who have numerous encounters, therefore possessing deep experience in the domain. In the industry, a person is rated an "expert" in a field most probably because he/she has received appropriate training, possesses specific skills, and demonstrated a specified level of competencies in carrying out certain tasks and/or solving specific problems. Not only knowledge and skills but an expert also possesses a wealth of experience in their domain of knowledge. That experience is gained from encountering/solving, probably over the years or even decades, lots and lots of cases in the problem domain. In other words, experts are people who have encountered significantly more cases than other practitioners in the field. With the increasing availability of large volumes of data (and cases can be represented by data tuples), analysis can be further performed to validate best practices and to reveal more. This is analogous to codifying the "missing dimensions" in Boisot (1998)'s I-Space model of knowledge codification, diffusion, and flow in an organization. With appropriate further analysis of data, the collection of best practices can be further refined (so as to avoid overgeneralization) and expanded. For example, the original "best practice" statement may only specify the setup of the equipment and the quality procedures to follow but after further analysis of large volumes of IoT/IIoT data, the statement can be further qualified by additional conditions, constraints, and cases of exceptions.
- *New source to groom "subject matter experts"*: Continuing on the above point, "subject matter experts" are no longer confined to those who have accumulated significant practical hands-on experience in the domain over a long period of time but also those who have access to and carried out deep analysis on large volumes of data collected. After all, data (when constructed into a "case") represent "snapshots of situations," which, when validated and sufficient, can be converted into earned "experience packs." "Experience factories" can be set up in the future to harness these packs and accelerate the transfer of experience between individuals. The implication of this is that in the future, organizations can groom subject matter experts from data scientists as well as further enhance

the knowledge of existing subject matter experts by enhancing their data management skills.

To achieve the above, knowledge workers need to enhance digital literacy skills (raising information awareness, knowing where to search, analyze quality, select sources, etc.), networking skills (brokering external networks with trust, leveraging expertise, and learning from networks), data science skills (especially on predictive capabilities and deriving new knowledge from data), and computational intelligence skills (on developing, assembling, and adjusting knowledge-enabled XaaS in the cloud).

7 Prototypical KMS

In this final section of the chapter, we outline two prototypical KMSs that help to overcome one or more of the problems involved in pursuing KM in the twenty-first century. The first system helps users to raise information awareness, combat information overload, and nurture a lifelong trait for peer-based social learning system. By providing an interactive and explorative environment, stimulate user(s) to identify relationships among discrete pockets of information by "connecting the dots" among a large repository of tagged documents. Such kind of explorative environment has proved to be effective in stimulating user's creation of new ideas and reviewing and connecting otherwise unrelated nodes in a large network of linked information. Both systems rely on existing technologies but adopt different paradigmatic approaches to locating and presenting information.

Responding to the above-described "information glut" situation with digital information increasingly available on the Internet, it is extremely demanding, if not impossible, to expect knowledge workers to constantly keep abreast of their interest area(s). Besides information awareness, knowledge workers also need to share, discuss, and learn with their peers (see Fig. 5). As such, through a paradigmatic shift from the "pull" (user searches) to the "push" approach (system discovers then alerts user) and the use of RSS (Really Simple Syndication) technology, a personal learning environment and network (PLE&N) has been configured for users to customize and adopt (Tsui et al., 2013) (Tsui & Sabetzadeh, 2014). The PLE&N functions like a "semiautomatic" online discussion forum bringing relevant and update information to the user (based on the pre-chosen feeds, i.e., information sources). Users join the PLE&N as group members in specific topic(s). Typically, PLE&N users review incoming articles, annotate some articles, and share it out again to other members and other groups. The collective viewing of articles by PLE&N members is a force to be reckoned with; the PLE&N is the "eyes and ears" of each group of users (see Fig. 6). The PLE&N operates with software in the public cloud; hence, it needs no special infrastructure nor maintenance (by users nor their organization); RSS feeds carry only public domain information; hence, there is no concern for privacy issues. At the Hong Kong Polytechnic University (PolyU), the PLE&N has been deployed

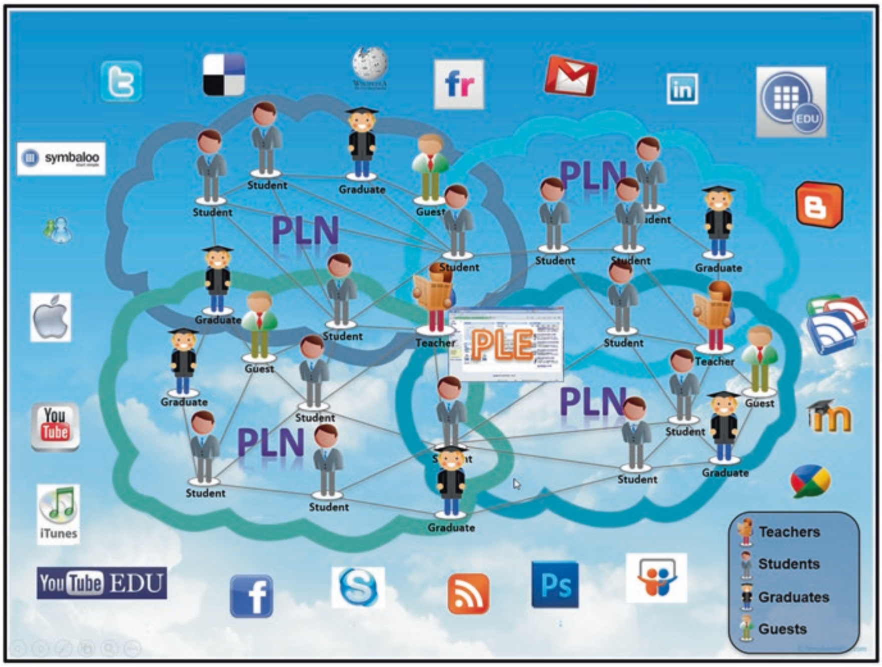

Fig. 5 The personal learning environment and network (PLE&N)

Fig. 6 Collective power in combating information overload

for more than 13 years, and over 2,500 students/graduates have configured their own PLE&N. A small proportion of users continue to use the PLE&N after their graduation. Research has proved that the use of the PLE&N helps the user to develop a trait on lifelong learning (Tsang & Tsui, 2017).

The second KMS described below is a research prototype that was developed at PolyU. Responding to shortage of systems for chance discovery and again tackling the information glut, the purpose of the system is to help users to "connect the dots" as in the twenty-first century; information is abundant but not necessarily connected/related. Serendipity occurs when dots are connected. Therefore, using a range of proven machine learning and clustering algorithms, an intelligent innovation workbench was developed to mine large repositories of documents (e.g., library databases and Wikipedia pages) and generate, among others, key graphs, topic maps together with their distributions, and frequency of occurrence statistics for the user to review. Associated keywords, terms, and phrases among documents are also highlighted to facilitate easy spotting by the user. The system provides an interactive, navigational, and explorative environment for the user to review existing and ascertain any additional connections (and the nature of their relationship, e.g., temporal, casual, functional, parent-child). Furthermore, a serendipity measure is also defined to show to user, in a descending order, the perceived value and innovation of the newly added connections (see Fig. 7). Trials have been conducted with this intelligent workbench, and feedback from users is that the system has enhanced users' creative thoughts as well as triggered them to focus on areas/topics that they would otherwise have missed (Li & Tsui, 2020). It is expected that until full automation is achieved (if ever), systems like this are representative and valuable for the next stage of human-computer cooperative exploration (and problem-solving).

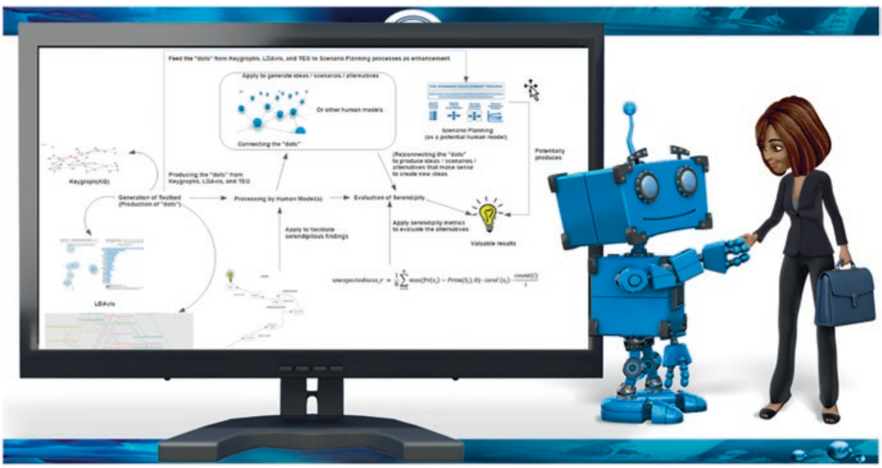

Fig. 7 An intelligent workbench for human-machine cooperative exploration

8 Conclusion

Started with a summary of the evolution of KMS in the last three decades, this chapter adopts a "back from the future" and "forward from the past" approach to identify the gap between current and the end states of KMS in an increasingly digitalized and connected twenty-first century. Cloud computing and search, among other topics, are singled out for more in-depth discussion due to their pivotal roles in readily building and delivering quality and versatile knowledge services. Through reframing, successful clouds are indeed knowledge cloud compromising not just software, hardware, and data but also links to people and people networks (often with trust). A knowledge cloud is in fact the perfect electronic Business Model Canvas for exploring, assembling, and reconstruction of business models to yield new value creation through the offering of various knowledge-as-a-service (KaaS). This is already happening, often in the form of platforms, e.g., AI cloud platform. In contrast, comprehensive KM in the twenty-first century demands a *reimagined* search, which needs to be proactive, in-context, with improved algorithms for measuring relevancy and evaluating intermediate results; future searches should also operate seamlessly and cover diversified search spaces with data in multiple modalities and formats.

No doubt, these needed advancements may take at least a decade to accomplish. Two prototypical KMS are also outlined—one is a cloud-based social and peer-based system that supports information awareness and collective combating of information overload as well as nurtures a lifelong learning trait. The second system is an academic prototype that discovers, links, and displays connections between concepts, phrases, and terms in large corpuses of documents across repositories. As a kind of human-computer interactive explorative system on innovation, the second system provides a navigational interface and an indicative "serendipity measure" for human-augmented connections to assess the value of new connections.

In a complex world with rapidly changes, for the future of KM and KMS, nothing is certain except that definitely exciting times ahead!!! To realize the abovementioned quantum improvements in KMS, there are significant challenges to overcome. Among others, how analytics can enhance best practices and lessons learnt databases, how to accelerate practitioners especially domain experts' acquisition of experience, how to ascertain the authenticity and truthfulness of information, how to contextualize a piece of knowledge and factor this into future machine reasoning and knowledge visualization algorithms, and how to build trust in human-computer cooperative problem-solving in a virtual environment.

Once again, exciting, very exciting times ahead!!!

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Knowledge Management in the Metaverse

Vincent Ribiere

Abstract

The Metaverse is becoming a hot topic of discussion and speculation. Its application in many fields is likely to affect the way we interact, socialize, get entertained, work, learn, and even conduct research. The Metaverse offers shared immersive 3D virtual spaces that are based on the integration of various technologies, including virtual reality and augmented reality. After an introduction to the Metaverse, this chapter presents how the Metaverse could help support knowledge management (KM) activities and practices in various aspects. An adaptation of the popular and well-accepted Knowledge Management SECI model from Nonaka and Takeuchi is used as a support to investigate how the Metaverse could help support the flow of knowledge in an organization. After reading this chapter, the reader will better understand all the potentials that the Metaverse can bring to support KM if the Metaverse ever takes off and keeps its promises!

Keywords

Metaverse · Knowledge management · Virtual world · SECI model · Virtual reality · Web 3.0

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1 Introduction

The Metaverse is becoming a hot topic of discussion and speculation. Its application in many fields is likely to affect the way we interact, socialize, get entertained, work, learn, and even conduct research. The word and concepts of "Metaverse" are not new; they originated from the science fiction novel "Snow Crash" written in 1992 by Neal Stephenson (1992). There is not yet a universal unified definition of the Metaverse. We selected three among the others. The Metaverse can be shortly defined as "A shared digital space with digital representations of people, places, and objects" (Lenovo, 2022). Another selected definition is "Metaverses are immersive three-dimensional virtual worlds in which people interact as avatars with each other and with software agents, using the metaphor of the real world but without its physical limitations" (Davis et al., 2009). For an additional informative purpose, here is a more detailed definition provided by ChatGPT "The Metaverse is a collective virtual shared space, created by the convergence of virtually enhanced physical reality and physically persistent virtual space, including the sum of all virtual worlds, augmented reality, and the internet. The word "Metaverse" is a portmanteau of the prefix "meta" (meaning "beyond") and "universe" and is typically used to describe the concept of a future iteration of the internet, made up of persistent, shared, 3D virtual spaces linked into a perceived virtual universe."

We can find a lot of overlap between these three definitions of the Metaverse, and in fact, we should even say MetaverseS because there will be different virtual spaces/worlds that will be created and that might be able (or not) to communicate with each other. In order to be able to interact and immerse ourselves in this virtual digital world from our physical world, we need to use devices that will allow such interactions through our virtual representation (our avatar). Metaverses can usually be accessed directly from a computer screen, a tablet, or a smartphone. The most common devices are virtual reality (VR) and augmented reality (AR) headsets, but we will see in the future more and more advanced types of devices like haptic feedback devices (that can provide a sense of touch and physical feedback, allowing users to feel the sensations of interacting with objects in the Metaverse), motion tracking devices (tracking the movements of users' bodies and limbs, allowing for more natural and intuitive movements in the Metaverse), exosuits, brain-computer interfaces (BCIs) (allowing users to control virtual objects with their thoughts), and even neural implants (implanted directly into the user's brain), a bit scary!

The reality-virtuality continuum developed by Milgram, Takemura, Utsumi, and Kishino (1995) presented in Figure 1 illustrates that there are different levels and combinations possible when it comes to interacting with virtual objects and virtual worlds. The area between the two extremes of this continuum (reality and purely virtual) is called mixed reality. Interactions with Metaverses can happen at different levels of this continuum depending on not only the expected intent and expected level of immersion but also the interactive devices available to the user.

In order to better understand the structure of Metaverses, we can use the seven layers of value chain market representation (Fig. 2) from Jon Radoff (2021), which begins from the experiences that people seek out to the enabling technologies that

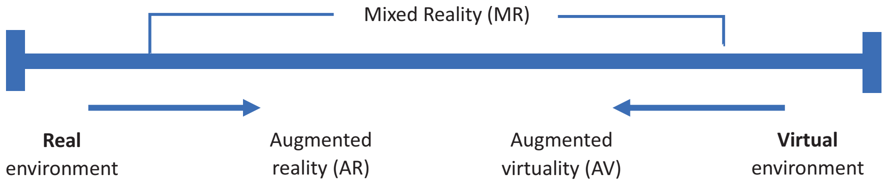


Fig. 1 Reality-virtuality continuum (Milgram et al., 1995)

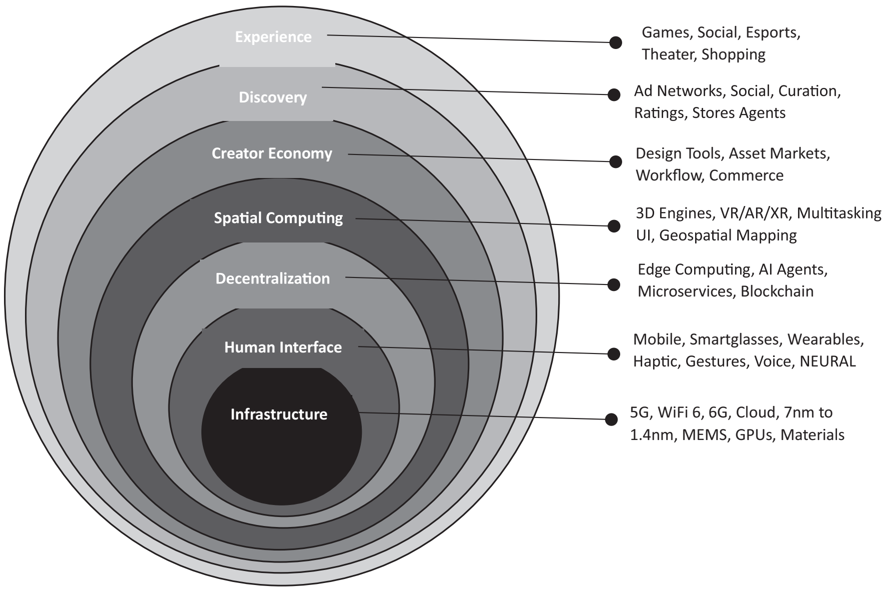


Fig. 2 The seven layers of the Metaverse (Radoff, 2021)

make it possible. Without getting into detailed explanations, we can realize that the first layer “experience” is often the layer that currently gets the most media attention. Still, other layers also need to be present to make Metaverse worlds immersive, valuable, and sustainable. Metaverses are a component of the virtual economy where the dematerialization of physical spaces is happening. Everything gets dematerialized even social interactions where we will see a shift from asynchronous “social networking” to real-time “social activity” (Radoff, 2021). Dematerialized content will be created not only by developers but also by users and through their social interactions. Technical layers are necessary to create such infrastructure, particularly Web 3.0 technologies like blockchain and non-fungible tokens (NFT). IBM (“A Case Study of Knowledge Management based on SECI,” 2003, 2023) defines blockchain as “a shared, immutable ledger that facilitates the process of recording transactions and tracking assets in a business network. An asset can be tangible (a house, car, cash, land) or intangible (intellectual property, patents, copyrights, branding). Virtually anything of value can be tracked and traded on a blockchain network, reducing risk and cutting costs for all involved." Gartner (2023) defines an NFT as "a unique programmable blockchain-based digital item that publicly proves ownership of digital assets, such as digital art or music, or physical assets that are tokenized, such as houses, cars or documents." Artificial intelligence will also play an important role at different levels. The challenge will be for different Metaverses to be interoperable with each other, so they can interact and share information with each other, and so users can seamlessly carry on tasks and pass intangible assets to others. That is the big challenge ahead since no standards have yet been defined and every large software development company is developing its own Metaverse environment more or less independently.

At this early stage of the Metaverse, everyone is wondering if the Metaverse is here to stay or if it is just another hype/fad. One way to answer this question can be to look at projected investments in the Metaverse industry. The past few years have seen impressive investments and attractive market forecasts for the Metaverse. As GlobalData estimates, the Metaverse industry will grow from USD 22.79 billion in 2021 to USD 996.42 billion in 2030 at a CAGR of 39.8% from 2022 to 2030 (GlobalData, 2022). It might be too early to be sure that these financial projections will realize, but they for sure indicate a certain level of confidence from investors that Metaverses will be part of our future and may not just be a hype.

Another way to answer this question is to look at it from a strategic and value-creation perspective. Previous attempts to create virtual worlds, like Second Life, didn't keep their promises (Hendelmann, 2022), so why will new generations of Metaverse be different? Are new Metaverses providing a paradigm shift or not? Are we really doing different things, or are we just doing things differently? Some of the current Metaverse offers solutions that simply try to replicate what we are doing in the real world into a virtual world without really bringing some additional and novel value. Simon Powell said "Investors need to think about the Metaverse as nothing less than the digitization of human activity and the disruption of everything that hasn't yet been disrupted" (Lewis et al., 2022). It goes back to the difference between value innovation and technology innovation, which is at the core of the Blue Ocean Strategy differentiation (Kim & Mauborgne, 2014). Are Metaverses just new technologies that are being pushed to users in the hope that they will adopt them as "Build it and they will come," or are they really bringing some new disruptive value propositions? As of today, the current offers are still at the technology innovation level, trying to find the right new value propositions to gain wide user acceptance, hoping for rapid consumer behavior changes, and trying to move away from the Internet 2.0 paradigm where users are visiting the content to Internet 3.0 where they will become part and immersed in it (Fig. 3).

As of today, it is difficult to clearly predict when the Metaverse will become a reality, but it will for sure become one, in the near or distant future. From a knowledge management perspective, it will be good that lessons could be learned from the initial failure of virtual world creations, like Second Life. Based on what worked and what didn't work so well, new Metaverse worlds should not repeat the same original mistakes or dead ends! Nevertheless, it looks like Second Life, didn't yet

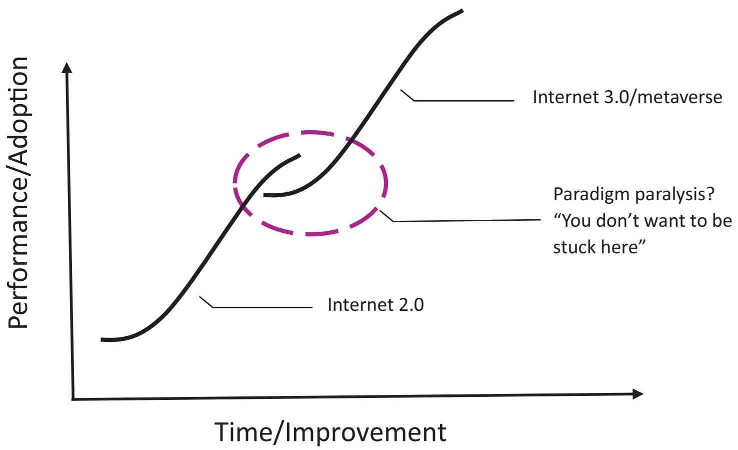


Fig. 3 S-curve from Internet 2.0 to Internet 3.0 (Matt Bond, Andrew Kim, & Riquier, 2022)

say its last words, and it for sure did gain a lot of knowledge from its initial "failure" much more than any other current Metaverse company (Warzel, 2022) and will soon give itself a second life (Bastian, 2022)! Long live Second Life!

To conclude, we could say that the value-added of the metaverse can be summarized by increased viewing and navigational pleasure, enriched and easier access to needed knowledge, ubiquitous access to the environment, scale of the setup, personalization, easy/swift assembly of rooms and spaces, and offering a new dimension of experience that there is no physical equivalent (Tsui, 2023).

Now that the Metaverse has been introduced and defined, we might wonder in which ways it could benefit the field of knowledge management. That is what the remaining part of this chapter will attempt to address.

2 Knowledge Management and the Metaverse

Due to space limitations, we will not introduce what knowledge management is all about, but we will provide our sharp vision of it to place the rest of this chapter into perspective. We can think of knowledge management as the management of the flow of knowledge inside (and outside) of an organization. Different tools, processes, behaviors, and practices can support this flow of knowledge in order to provide the right knowledge to whoever might need it whenever they need it. Suppose knowledge remains stuck in organizational silos or in people's heads. In that case, it is at risk of being lost; it generates inefficiencies since people have to re-invent solutions; and knowledge cannot be easily leveraged for innovation. So, this is in a nutshell what knowledge management (KM) is trying to address.

We can look at knowledge management through different lenses/frameworks/models, but for this book chapter, we decided to go back to the basics and chose to use an adaptation of the well-known and most cited KM model, the SECI Model

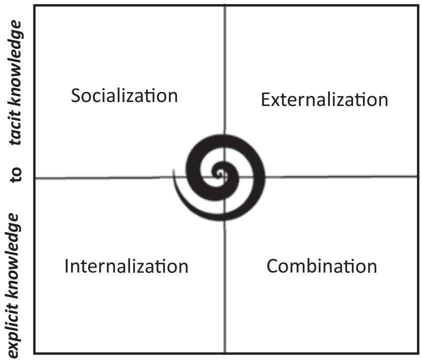


Fig. 4 The SECI Model (Nonaka & Takeuchi, 1995)

from Nonaka and Takeuchi (1995). We mention an "adapted" version of the SECI model, since we are using a new and expanded semantics for interpreting tacit knowledge and socialization and externalization.

The idea is to investigate how the Metaverse could help support the four quadrants of the SECI model, (Fig. 4) which lead to flows of knowledge in the organization, which is at the core of what knowledge management is all about. An adapted version of the SECI model is also part of the current KM ISO 30401 standard, under the section "4.4.3 Knowledge conveyance and transformation."

2.1 Socialization in the Metaverse

The first quadrant of our adapted SECI model is socialization. The objective of activities in this quadrant is the sharing and transfer of experiential (tacit, uncodified) knowledge, which is difficult and often impossible to codify. It is based on the exchange and co-creation of uncodified knowledge through conversations and interactions between individuals in teams across the organization. It can be made possible through the implementation of communities of practice, brainstorming sessions, collaborative teams, knowledge/world cafés, shift handover, succession planning, mentoring, sense-making, storytelling, etc.

Metaverses will provide teams with new ways of managing and overcoming geographic and other barriers to collaboration. These new environments will have the potential for rich and engaging collaboration and knowledge exchanges. The two-dimensional (2D) virtual collaboration tools we started to use heavily during the Covid-19 pandemic, like Zoom and Microsoft Teams, are the first step into democratizing virtual collaboration and making it easier for remote members to interact and collaborate. Nevertheless, this early experience showed us that engaging people in such kinds of discussions or meetings remained challenging—we know that after an hour (or less), participants lose attention and get some natural fatigue. Pushpak Kypuram, Founder-Director of NextMeet (India), stated, "With the shift to remote working from the pandemic, keeping employees engaged has become a top challenge for many companies. You can't keep 20 people engaged in the flat 2-D environment of a video call; some people don't like appearing on camera; you're not simulating a real-life scenario. That is why companies are turning to metaverse-based platforms" (Purdy, 2022).

Metaverses can offer a more engaging and more gamified environment that will make virtual team members less passive, make interactions and collaboration activities more dynamic, and provide an environment with a much richer context than just seeing their colleagues on the small window on the screen (Fig. 5)!

So, what kind of collaborative environment and features can we expect in the Metaverse? First, users will have to create their avatar, a graphical representation of their character or persona. It may look like them, or not, and they can wear different clothes, haircuts, and accessories based on the situation. Their avatar will be navigating and interacting in the 3D virtual world with other avatars, devices, and/or intelligent agents. Content could be shared like we currently do by sharing our screen with other members of our virtual team, but 3D Metaverse environments will allow us to bring in simultaneously various contents, every team member, for instance, being able to share content at the same time and being able to compare them, dragging and dropping content, and co-creating some new content.

During team discussions, you could interact with virtual experts (intelligent agents), asking them questions to investigate further, explore, or better understand some aspects discussed among the team members. We could think of having a virtual expert join your virtual team, like ChatGPT. While listening to the exchanges between team members, it could provide/push additional relevant information that could be presented to the team to enrich their discussion. This information provided by the virtual expert could come from existing information available on the Web and/or from internal organizational information/knowledge repositories. That way, the virtual expert could also potentially help connect live discussions to previously existing materials, experts, and past project resources, making the team aware of what is currently available, who in the organization has expertise about this topic, and who could potentially help and share their previous experience on the topic

Fig. 5 Example of virtual context for teamwork and collaboration from nextmeet.live

discussed. All these interactions happening in a virtual/digital world will allow for automatically capturing them as well as the knowledge shared and could potentially, easily, and automatically generate the minutes of the meeting by not just repeating what was said but also by adding much more context around it, by summarizing other relevant knowledge resources available, that might currently not be captured in written minutes format.

Another limitation of current virtual meetings is that they are scheduled, leaving you few opportunities to informally interact with your peers before or after the meeting. Similarly, when you attend a virtual conference, compared to a physical conference, you do listen to speakers the same way, but attending a conference is not just about that; it is also about engaging with your peers, socializing with new people that you may randomly meet at a coffee break or at the conference dinner. Currently, some virtual conferences are trying to create similar spaces (breakout rooms) in parallel or after conference tracks for people to socialize, but based on our experience, few participants feel comfortable joining such spaces because they might not also be very easy to navigate (one of the limitations of current 2D environments) but also because participants may experience fatigue from having listened to speakers for hours in front of their screen and just need a real break away from it!

So how can Metaverses help with re-creating these lost social and serendipitous interactions available in the physical world? Röcker (2012) demonstrated that the lack of physical proximity affected distributed teamwork and that existing communication technologies (at the time and still now) were not adequate for supporting awareness and informal communication in future work environments.

According to Henn (Remmers, 1999), 80% of innovative ideas created in offices are a result of informal communication among colleagues, despite worldwide data and communication networks. Metaverses can recreate such informal communications by offering opportunities for people to have unscheduled, serendipitous, and spontaneous conversations with colleagues or strangers like they have in physical office settings. In Metaverses, you can see your colleagues' avatars in real time, you can go to visit them in their virtual office and bump into another colleague and engage in a discussion like you do in the physical world around the water cooler or while smoking a cigarette outside. Offering the opportunity for serendipitous encounters is very important since they lead to informal discussions and all their benefits (Fig. 6). The Metaverse might also be able to manage and organize serendipitous encounters. By analyzing your interests, past discussions, ongoing projects, etc., intelligent Metaverse systems may get your avatar to bump into people that it thinks would be good for you to talk to and gain insights, recommendations, and suggestions from, resulting in experiential knowledge transfer.

Another important mechanism supporting socialization is the practice of communities of practices (CoPs). The traditional CoP objectives are to foster learning; to develop competencies; to stimulate interaction and informal learning where experiential knowledge can be shared; to manage, preserve, and create new knowledge; to socialize new members; and to build trust among them but also to identify and share good, best, and also bad practices as well as lessons learned. As Nonaka and

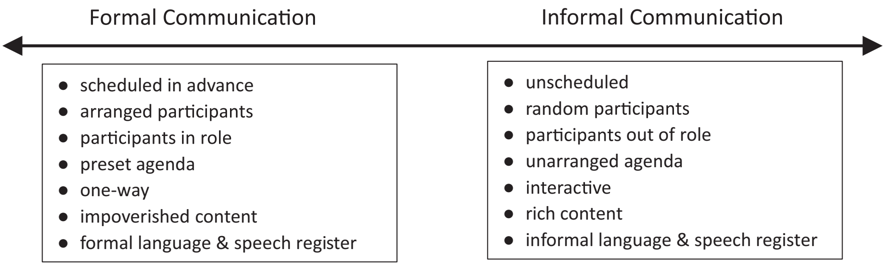


Fig. 6 The formality dimension of communication (Kraut et al., 1988)

Konno (1998) presented, a "Ba" (a shared space) is necessary for emerging relationships and knowledge sharing and creation to be happening. This shared space can be physical (e.g., office, meeting room, social space, etc.), virtual (e.g., videoconferencing, online discussion groups, etc.), mental (e.g., shared experiences, ideas, ideals), or any combination of them. We believe that the Metaverse can help provide much richer Ba environments by combining these different types of Ba into one. This could be done by providing very realistic virtual spaces with the same advantages/opportunities as physical spaces (and much more), where members of a CoP can better identify and relate to the mental spaces of their colleagues since a dynamically created mental profile/persona could be made available to them to consult so they can better understand who their colleagues are, their experiences, values, etc.…

Through their collective learning activities, CoP members develop, over time, repositories of knowledge assets. We can imagine that in the Metaverse, such repositories will become three dimensional (3D), bringing much more richness and context to the knowledge assets that have been developed and captured. The 3D will facilitate knowledge asset visualization and navigation for us to better and more rapidly understand and learn what was done in the past (history of the CoP and the evolution of its knowledge assets) as well as what was tried before, what worked, and what did not. Such 3D knowledge repositories will be accessible 24/7. We can also imagine avatars of subject matter experts (AI agents) accessible at any time, so we are able to ask them questions or to listen to or visualize some of the recommendations they previously shared. Even though they might no longer be working for the company, former subject matter experts knowledge legacy has been captured and made available for the next generations to learn from.

As we know, knowledge is context specific and situation dependent. What current codified knowledge assets (documents, reports, best practices, …) can offer fail to address such knowledge nature since knowledge is often captured through a single point of view and often detached from its original context and situation. Consequently, someone who comes from a different background or is unaware of the context might not be able to fully understand or comprehend what a specific knowledge asset might be all about, limiting its value and reuse. Metaverse environments could help in this matter by providing the capability to look at a knowledge asset from different levels, from a microlevel to a much more macro level. If we use an analogy to illustrate this idea, from a micro point of view, we could think of a knowledge asset as a grain of sand. This is what we can see when we access a knowledge asset detached from any context and situation. If we change the point of view to a more macro level, we could slowly see the beach to which this grain of sand belongs, providing a better understanding of the context.

At a higher level of observation, we could discover the sea/ocean around it, the country it belongs to, its continent, its planet, and its galaxy. The Metaverse could provide a similar way to navigate various levels of context by linking a knowledge asset to a virtual context and other relevant knowledge assets. For example, we could imagine that a project report (knowledge asset) could be linked to a project context, which itself will be linked to a client context and to a team context (which completed this project), linked to a family of project context, to a company business unit(s) context, to a company context, to an industry context, to a country context, to a regional context, etc. By navigating through these different levels of context, the knowledge seeker can better understand the context and history around a knowledge asset, and consequently, they can better absorb such knowledge and act on it. It will be the equivalent of providing a systemic view of knowledge by providing a way to easily and visually navigate (zooming in and out) through its interrelated components.

2.2 Externalization in the Metaverse

Now let's explore the second quadrant, the adapted externalization quadrant of the SECI model. Externalization are activities intended to codify, document, and capture experiential knowledge so it can be later shared or transferred to a larger group of people. Writing procedures and guidelines, capturing lessons learned and best practices, recorded job handovers, and knowledge books are some examples of externalization activities.

This knowledge transformation remains a challenge for KMers to best capture and articulate experiential knowledge. Various techniques exist, including knowledge engineering approaches, that can be used to capture/articulate/codify experiential knowledge, but they all have their limitations. Furthermore, we know that only a small percentage of an expert's experiential knowledge can be captured, even though experts are fully open and willing to share all they know since "We know more than we can tell" (Polanyi, 1966). Experts know how to conduct a task but can't fully explain/articulate how they do it. This can be partially explained by the fact that experts have acquired embodied knowledge, muscle memory, as well as unconscious steps that, over time, become obvious to them and that they will perform without even realizing it. Additionally, we may not be aware of what we know until we need to use it! So how can Metaverses help? Suppose we get an expert to perform a task or make a series of decisions through their avatar in a Metaverse or in our physical world while equipped with sensory recording devices connected to a Metaverse environment. In that case, this will allow us to collect a multitude of data regarding contextual information, human behavior, technical gesture/movement, etc.

In the physical world, experts can be equipped with a headgear, a video camera, and VR gloves, speaking out loud describing what they are doing while doing it, being recorded simultaneously, and their actions/steps being converted into text and captured in real time. Devices can also capture emotions along the way.

Source: Freepik

This multitude of data sources collected will help better understand, capture, model, and transfer experiential knowledge. The ability to model experts' actions and behaviors is very important because it will help identify and understand what leads to what action/decision. Furthermore, if information related to performing a particular task is collected from different experts, patterns might emerge, but also different approaches can be identified (more or less effective) that will lead to successful outputs (or not!). All these experts' data analyses and the learnings attached to them will help provide better guidance, better advice, and better forecasting services to newcomers and will re-reduce their learning curve to perform a similar task. It will also allow us to preserve experts' knowledge that can be made available in a CoP knowledge repository."Now we're surging towards the Web 3.0 era allowing computers to learn and understand us, what we are interested in, and critically, recognize the relationship between people, places, events, companies, products among other things" (Matt Bond et al., 2022). For sure, Metaverse environment will collect much more and much richer data about users that will have to be used for the "good" cause, like for better understanding human behaviors and gaining new knowledge, and not solely for marketing or other malicious purposes. The objective of this chapter is not to discuss privacy issues, but they will for sure become an important concern in Metaverses.On a side note, Metaverse environments could become a very useful tool for researchers to collect data by immersing participants in realistic contexts and observing their behaviors and choices going through various predefined scenarios. New generations of research experiments ran as serious games.Oscar Wilde once said, "Man is least himself when he talks in his own person. Give him a mask and he will tell you the truth." The use of avatars in the Metaverse will provide a similar "mask" to users. We may expect people to act/

behave differently when they are not physically in the presence of others or not easily identifiable (anonymous). We can imagine that in a virtual world where almost everything is possible, and soon, hopefully, some international rules, regulations, and policies will prevent people from doing things that might negatively affect others. Nevertheless, we can expect more “freedom,” openness, and risk-taking happening in the Metaverse than in the real physical world. This may help experiment new ways of doing things with limited risks (like simulation environments). More importantly, Metaverses may help people who are shy or introverted or who might have some level of handicaps, to express themselves more easily than in a real-world environment where they may not be so comfortable sharing their knowledge and ideas or even where they may not be given the opportunity to do so. So, we hope that Metaverse environments will be more inclusive than real/physical worlds.

2.3 Combination

The third quadrant is the combination quadrant, the transformation of codified knowledge into other forms of codified knowledge. It involves activities like synthesizing, curating, formalizing, structuring, or classifying codified knowledge, making it more easily accessible and findable.

One early and simple definition of KM was to be able to provide the right information, to the right person at the right time, in the right format so they can make the right decision. Accomplishing such an objective remains a challenge to deliver.

The Metaverse will offer the opportunity to visualize and experience situations, information, and environments in three dimensions (3D). This will allow moving away from the 2D display/visualization limitations, where instead of looking at things (Internet 2.0), you will become part of them (inside) (Internet 3.0). Such an immersive environment will facilitate the push of relevant information in real time to people based on their context and situation. As we gave an example earlier, you could think of an AI agent listening to conversations between two people or listening to conversations during a team meeting happening in the Metaverse and providing in real time useful and actionable information on the side, like currently, someone will put a comment/idea in the chat box during an online meeting. The AI tool could bring to our attention some relevant information by asking questions like have you seen this, are you aware of that, or are you aware of this new product from our competitors? The AI agent will act as a well-informed and potentially knowledgeable agent to raise awareness about the existence of some existing information on the topic that the person/team might not be aware of (or may have forgotten) while tapping into internal or external information and knowledge repositories. The AI agent could also recommend contact teams that have previously worked on similar challenges or a particular person who previously worked with a particular relevant client/supplier.

The Metaverse will provide a context-rich environment that will help better understand what people are interested in, based on their behavior or based on their past discussions, being able to push them some interesting, valuable, and actionable information. Safety information could also be pushed to them based on the dangerous situations they may encounter.

If the user is operating in the physical world equipped with virtual gears (glasses) through the use of augmented reality technology, information can be displayed to them on top of the real object/environment (Fig. 7). This can be very useful for operators operating or maintaining machinery by providing them, in real time, visual information in their headsets like historical information about a machine, operating manuals, maintenance manuals, or information about the potential defect or potential problems/risks. Companies like Aramco in Saudi Arabia started to implement such kind of augmented reality gears and head-mounted with a video camera (for visual recognition) to help new generations of operators learn much more rapidly about how to safely perform some particular complex tasks empowered with relevant information so they can make the right decisions.

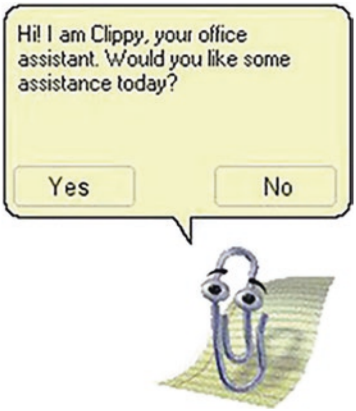
Future smart interactive components of the Metaverse might be called "elves," which are artificial intelligence assistants, coaches, or advisors (advanced versions of chatbots) and may become your future digital colleagues! Elves will be able to deliver smart answers to your questions and provide the knowledge you need. They will follow and learn on a daily basis someone's activities, behaviors, and preferences in both the physical world (through devices we are wearing (i.e., smart watches, phones, bands, electronic wristband, …) and the digital world, so they can best understand/predict your needs, preferences, and mood and will be able to answer any question you might have based on information available on your corporate knowledge repositories, from the Internet and advanced neural networks like GPT-4.

These "elves" may take different shapes and looks, from the well-known and missed "Clippy," the Microsoft Office help clipboard, to more humanoid or human

Fig. 7 Augmented reality

appearance like digitalhumans.com. It will be up to you to customize the look of your digital assistant.

Providing the right information to the right person in real time has always been one of KM's main objectives, and we believe the Metaverse will finally be able to provide such real-time knowledge service in a 3D interactive and immersive environment.



2.4 Internalization

The last quadrant is internalization, where explicit/codified knowledge is internalized so learning can happen, and recipients can apply/practice their newly acquired knowledge to gain the experiential/tacit knowledge attached to it. Practices and tools like e-learning, simulation, and how-to manuals before action review can support this knowledge transformation.

The way and approaches we use to learn have changed a lot over the past decade, as well as the access to educational resources. These changes were mainly driven by the use of fast-evolving technologies. Among them, we could cite:

- *Online learning*: Online learning has become increasingly popular over the past decade, with the rise of Massive Open Online Courses (MOOCs), online degree programs, and other forms of digital learning. These online learning options provide flexibility and accessibility to learners who might not be able to attend traditional in-person classes.
- *Mobile learning*: With the proliferation of smartphones and tablets, mobile learning has become increasingly popular. Many educational resources and online learning platforms now have mobile apps allowing learners to access content on the go.
- *Gamification*: Gamification involves using game design and mechanics in non-game contexts, such as education, to engage learners and motivate them to learn. This approach has gained popularity in recent years and has been applied to a variety of educational contexts.

- *Personalized learning*: Advances in technology have made it possible to personalize learning experiences for individual learners. Adaptive learning technologies, for example, can adjust the content and pace of learning to match learners' individual needs and abilities.

These technologies provided learners greater flexibility, accessibility, and interactivity in their educational experiences. The next step is what can fit under "immersive learning" technologies. Immersive learning technologies, such as virtual reality (VR), augmented reality (AR), and Metaverse environments, can provide more interactive and engaging learning experiences by simulating real-world environments and allowing learners to interact with virtual objects and digital twins.

The use of augmented/virtual reality and Metaverse can turn novices into experts in a much more efficient way by adequately preparing learners to make good decisions when facing new, unexpected, dangerous, atypical, or even extraordinary situations. Experts can spot patterns hidden in the data that we all see. Information that has been jumbled up is better reorganized and understood by experts. Experts are able to read and respond to circumstances rapidly, unlike novices who rely on rules and norms to make decisions. Experts are able to identify critical signs that indicate how a situation is behaving. It appears that developing flexible mental models that help explain why systems behave the way they do rather than memorization of information or facts is the key to becoming an expert (Demarinis, Calligaro, Harr, & Mariani, 2018).

The Metaverse can help forge such a flexible mental model by presenting learners with immersive and realistic situations, over and over again, in a safe and low-cost environment. Like airplane pilots using flight simulators, the Metaverse can allow the practice and acquisition of various soft and hard skills in a safe environment where learners can be exposed to different situations and acquire habits and positive reactions but also learn when they get it wrong. They can receive customized feedback based on the analysis of their decisions/actions/behaviors during their journey in the Metaverse's simulation. The customized feedback they will receive would explain why they made the wrong decision, maybe what piece of information they were lacking or didn't ask for, what aspects they didn't consider, or why they didn't prioritize things in the right way.

Deloitte Analysis developed a decision framework (Fig. 8) to help determine when and how to use VR in learning based on the type of knowledge that the learners need to acquire and what they need to do with it.

Investments in extended reality or Metaverse can help reduce training costs, improve job performance (better efficiency, quality, and value, lower accident rate), and also increase employee engagement (reduce turnover and improve talent acquisition).

Pushpak Kypuram, Founder-Director of NextMeet (India), said, "If you're onboarding ten new colleagues and show or give them a PDF document to introduce the company, they will lose concentration after 10 minutes. What we do instead is have them walk along a 3-D hall or gallery with 20 interactive stands where they can explore the company. You make them want to walk the virtual hall, not read a

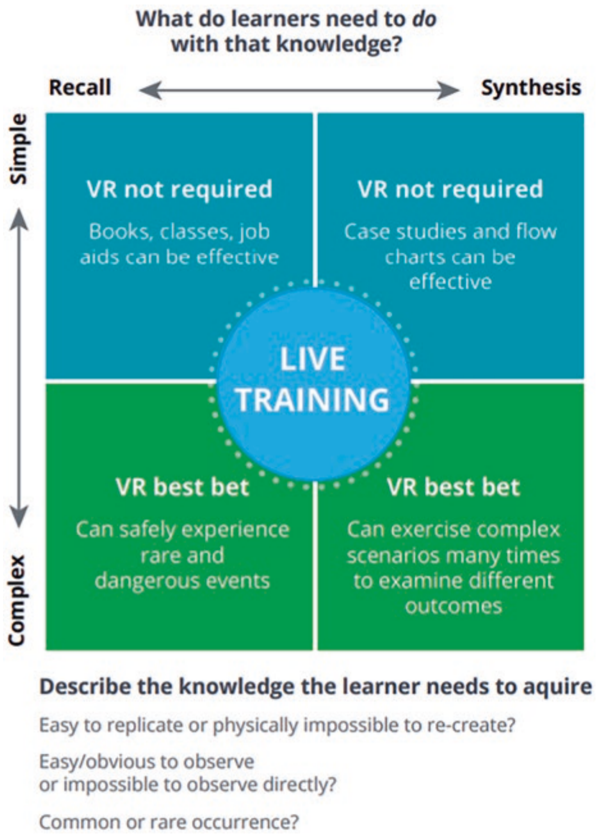


Fig. 8 Deloitte decision framework on when and how to use VR in learning (Demarinis et al., 2018)

document" (Purdy, 2022). This is a great illustration of how, by providing an immersive and engaging and maybe also gamified learning environment, like the Metaverse, it can help improve the level of engagement and eagerness to learn of your employees. In his White paper (Gronstedt, 2022), he presents, with real-life case stories, the learning implication of the enterprise Metaverse. He explains what he calls the nine superpowers of virtual learning, as presented in Figure 9.

As we can see, new immersive environments, like the Metaverse, will disrupt the way we learn (acquire new knowledge). We suddenly can experience situations, experiment, and learn from the impact of our actions and behaviors in a safe and low-cost environment. The learning curve will be reduced, and skills (hard and soft) can be developed more rapidly, benefiting onboarding, reskilling, and upskilling learning and development practices.

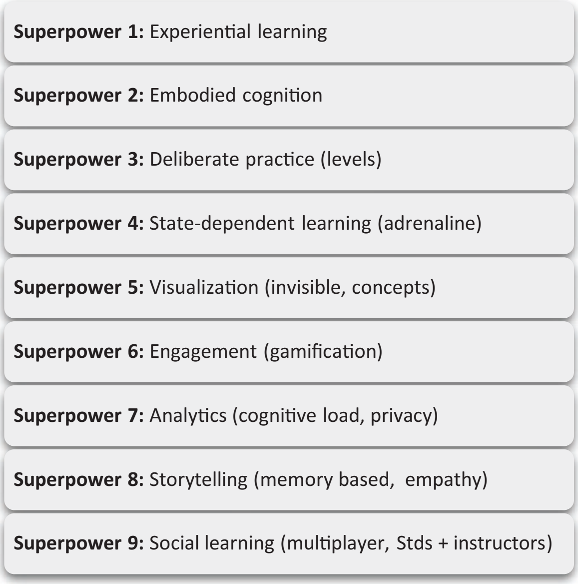


Fig. 9 The nine superpowers on virtual learning (Gronstedt, 2022)

3 Conclusion

Through this chapter, we tried to illustrate how the Metaverse could help support the flow of knowledge in an organization through the lens of an adapted version of the popular SECI Model. If we look at the KM ISO 30401 standard, particularly in Section 4.4.2, “Knowledge development,” the KM process is described by four sub-processes: 1. acquiring new knowledge, 2. applying current knowledge, 3. retaining current knowledge, and 4. handling outdated and invalid knowledge. We could have similarly used such a perspective to describe how the Metaverse could help support knowledge development and found similar benefits.

What we presented might sound like a rosy and idealistic picture of the Metaverse, and we do realize that since it is too early to be confident that the forecasted Metaverse worlds will be able to deliver (at least in a short time frame of 3–5 years) what is nicely portrayed by software companies. A Lenovo study (Lenovo, 2022) reported that 44% of employees would be willing to work in the Metaverse and believe that it can deliver benefits like increased productivity in the workplace. But also, 43% think that employers do not have the knowledge or expertise to enable them to work in the future in the Metaverse. So, we can start to see some behavioral changes that will be required to get a high level of Metaverse acceptance. In an experiment of having a team working full time in a virtual-reality environment, findings reported that they had lower productivity and well-being and increased anxiety (Sparkes, 2022).

We are really at an early stage of the Metaverse and virtual 3D environments that might not yet be engaging and valuable enough. In any case, we don't expect people to work full time in Metaverses. Some activities might be worth or valuable to be conducted in Metaverses, but this might be just for some limited period of time.

In conclusion, the Metaverse has the potential to become a great additional tool to support knowledge management, learning, and innovation activities. The Metaverse could bring the "context" dimension of knowledge, difficult to represent in two dimensions, to a new higher level. As with any other IT tool, it would be important to properly assess and communicate where it could bring the most value and don't think that it is a magic tool, a virtual Swiss knife, that could apply to every situation. Last but not the least, as the Gartner group had properly stated, "KM is something you do not something you buy!" So, the Metaverse, as any other information technology tool, remains an enabler of knowledge management, a very powerful one, but at the end of the day, it is the people who use and interact with it who possess the knowledge. We will end this chapter with two wishes: Long live the Metaverse, and long live KM!

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