Managing and Measuring Knowledge Assets in Organizations – a theoretical approach

Masterarbeit
von
Mimoza Allaraj

eingereicht am
Lehrstuhl Wirtschafts- und Betriebswissenschaften
der
Montanuniversität Leoben

Leoben, May 2016

Aufgabenstellung

Frau **Mimoza Allaraj** wird das Thema

Managing and Measuring Knowledge Assets in Organizations - a theoretical approach

zur Bearbeitung in einer Masterarbeit gestellt.

Ziel der Arbeit ist es, auf Basis einer umfassenden Literaturrecherche Instrumente und Modelle des Wissensmanagements vorzustellen und Best-Practice-Kriterien zu identifizieren.

Im ersten Teil der Masterarbeit sind die Begriffe Knowledge und Knowledge Management eingehend zu beschreiben und bereits bekannte Assessment-Modelle zu untersuchen. Darauf aufbauend ist der Frage nachzugehen, welchen Vorteil ein gut funktionierendes Wissensmanagement für Unternehmen hat. Des Weiteren ist zu untersuchen, wie die Ressource „Wissen" in Unternehmen bewertet werden kann.

Als Ergebnis der literaturbasierten Untersuchungen soll im zweiten Teil der Arbeit ein Kriterienkatalog entwickelt werden, welcher als Vorschlag für Organisationen zur Implementierung eines Wissensmanagements dienen soll.

Leoben, im Jänner 2016   o.Univ.-Prof. Dr. mont. Hubert Biedermann

Eidesstattliche Erklärung

Ich erkläre an Eides statt, dass ich diese Arbeit selbständig verfasst, andere als die angegebenen Quellen und Hilfsmittel nicht benutzt und mich auch sonst keiner unerlaubten Hilfsmittel bedient habe.

Affidavit

I declare in lieu of oath, that I wrote this thesis and performed the associated research myself, using only literature cited in this volume.

[Ort], [Datum]	([Vorname] [Nachname])

Gleichheitsgrundsatz

Aus Gründen der Lesbarkeit wurde in dieser Arbeit darauf verzichtet, geschlechtsspezifische Formulierungen zu verwenden. Es wird ausdrücklich festgehalten, dass die bei Personen verwendeten maskulinen Formen für beide Geschlechter zu verstehen sind.

Principle of equality

For better legibility the masculine form has been chosen in this text: Nevertheless, the details provided refer to members of both sexes.

Acknowledgement

O.Univ.-Prof. Dipl.-Ing. Dr.mont Hubert Biedermann is the first person I would like to thank for approving this research topic and for his valuable feedback in improving the quality of the thesis.

I would further like to thank my supervisor Mrs. Doctor Susanne Lind-Braucher for introducing me to the topic and for her excellent professional support. I would also like to thank her for her constructive comments, remarks and engagement throughout the learning process of this work.

It was difficult to find words to thank my loved ones who have supported me with their unconditional love and unlimited motivation.

First, I wish to thank my Austrian sui generis friend Mrs. Doctor Erika Augustin for her exceptional support during my studies in Leoben. What a great honour to have met you.

My true friends Chris and Sharon introduced me to their brilliant and inspiring Australian way of interacting, communicating, being, loving and living life. My friends, thank you for injecting me with unlimited positive thoughts.

I express my never-ending love to my sisters Majlinda, Amarilda, and Rudina who with their uniqueness gave me new inspirations and made my work a lot easier.

This work wouldn't have been completed without the unique emotional support and the professional academic advice of my partner Julian Mindel. Thank you for encouraging and inspiring me to reach my goal and never settle for less.

Finally, I would like to thank my mum Afërdita. Mum, thank you for helping me become who I am today, for always believing in me, and for teaching me how to persist and stand up stronger after a stumble or fall. To you I dedicate this work.

"The art of living is more like wrestling than dancing, in so far as it stands ready against the accidental and the unforeseen, and is not apt to fall." - Marcus Aurelius

Kurzfassung

Wissen stellt unbestritten eine der wichtigsten, wenn nicht sogar die wichtigste Ressource von Organisationen dar, um langfristig im Wettbewerb bestehen zu können. Wissen ist ein sehr weit gefächerter Begriff. Jede Person und jede Organisation kann unter Wissen etwas völlig anderes verstehen. Unter den Begriff Wissen fallen somit nicht nur Erfahrung, sondern auch alle anderen Kenntnisse, Fähigkeiten und Fertigkeiten. Ziel ist es, das vorhandene Wissen innerhalb eines Unternehmens zu vernetzen und in Wertschöpfungsprozessen anzuwenden. Aus diesem Grund ist ein geeignetes Wissensmanagement notwendig, das sich mit der unterschiedlichen Definitionen des Wissens über die Nutzung bis zur Speicherung und Beurteilung des Wissens beschäftigt. Dies sind nur einige Merkmale, die die Bedeutung des Wissens als komplexer Begriff und Wissensmanagement als komplexes System beschreiben.

Zu den größten Schwierigkeiten des Wissensmanagements gehören die Messung und Bewertung von Wissen. Eine Möglichkeit Wissensmanagementaktivitäten in Organisationen zu messen ist ein Wissensmanagement-Assessment. Die Grundlage dafür ist ein Raster an Maßnahmen und unterschiedlichen Perspektiven. Ziel des Assessments ist, den Einfluss möglicher Gestaltungsfelder in Bezug auf die Erfüllung von Zielkriterien aus Sicht der relevanten Stakeholder zu bewerten. Ein verbessertes KM hilft Organisationen ihre Zielergebnisse zu verwirklichen. Ein verbessertes Wissensmanagement Assessment hilft Organisationen die ''soll'' Ergebnisse mit den ''ist'' Ergebnisse zu vergleichen.

Ziel der Arbeit ist auf Basis der Literatur Wissensmanagement Instrumente und Modelle vorzustellen und Best-Practice Kriterien zu identifizieren, um Organisationen zu ermutigen deren Wissensressourcen effizient und effektiv zu verwalten.

Abstract

Knowledge represents one of the most important, if not the most important commodity for organizations to remain competitive in the long term. Knowledge has various definitions. Researchers and practitioners can interpret the meaning of knowledge differently. Knowledge refers not only to experience, but also to many other skills, abilities and capabilities. The goal is to link and apply the available knowledge within the organization's value adding processes. An appropriate Knowledge Management (KM) is therefore necessary. KM addresses a wide range of issues such as knowledge definition, knowledge application, knowledge retention, as well as knowledge assessment. These are only some of the characteristics that describe the meaning of knowledge as a complex term and of KM as a complex system.

One of the biggest challenges of KM is the measurement and assessment of knowledge related activities. One way to measure KM activities in organizations is through KM Assessment (KMA) tools. The objective of KMA is to measure and evaluate the impact of different indicators in relationship to the fulfilment of goals as defined from all relevant stakeholders. An improved KM helps organizations to realize their strategic goals. An improved KMA helps organizations to compare the ''as-is'' with the ''to-be'' status of KM.

Based on literature, the scope of this work is to present KM instruments and tools, to identify best-practice criteria, and to encourage organizations to manage knowledge assets efficiently and effectively.

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Abbreviations

APQC	American Productivity and Quality Centre
APO	Asian Productivity Organization
BPR	Business Process Reengineering
BSC	Balance Scorecard
CIP	Continuous Improvement Process
CKO	Chief Knowledge Officer
CoPs	Communities of Practice
DMS	Document Management System
EIU	Economist Intelligence Unit
EK	Explicit Knowledge
EKMF	European Knowledge Management Forum
EL	Expertise Locator
EVA	Economic Value Added
HEI	High Educational Institutions
HRA	Human Resource Accounting
IAM	Intangible Asset Monitor
IC	Intellectual Capital
ICA	Intellectual Capital Audit
ICI	Intellectual Capital Index
ICM	Intellectual Capital Management
ICMS	Intellectual Capital Management System
ICS	Intellectual Capital Statement (DE: Wissensbilanz)
ICT	Information and Communication Technology
IT	Information Technology
KCO	Knowledge Centric Organization
KM	Knowledge Management
KMA	Knowledge Management Assessment
KMCAT	Knowledge Management Capability Assessment Tool
KMMM	Knowledge Management Maturity Models
KMS	Knowledge Management System
KPAs	Key Process Areas
KPIs	Key Performance Indicators
KR	Knowledge Risks
LL	Lessons Learned

OKMF   Optimized Knowledge Management Framework

QM   Quality Management

ROI   Return on Investment

SMEs   Small and Medium-sized Enterprises

SNS   Social Network Services

TK   Tacit Knowledge

TQM   Total Quality Management

VOIP   Voice-over-Internet Protocol

WWW   World Wide Web

1 Introduction

The primary role of Knowledge Management discipline (from now on referred to as KM) is to manage explicit and tacit knowledge of organizations[1]. A simple representation of methods and instruments that come with KM is suggested by Skyrme and presented in Figure 1. Human capital (instruments 1), organization and management (instruments 2), as well as infrastructure and technology (instruments 3) are the three instrument groups closely linked together to represent the essential pillars of KM followed by the organizational environment. KM life-cycle processes (Cycle 1, 2, 3 in Figure 1) are crucial for KM pillars. Clear and strategic KM life-cycle such as identifying, acquiring, evaluating, applying, retrieving, improving and distributing[2] knowledge are the keys to successful KM experience.
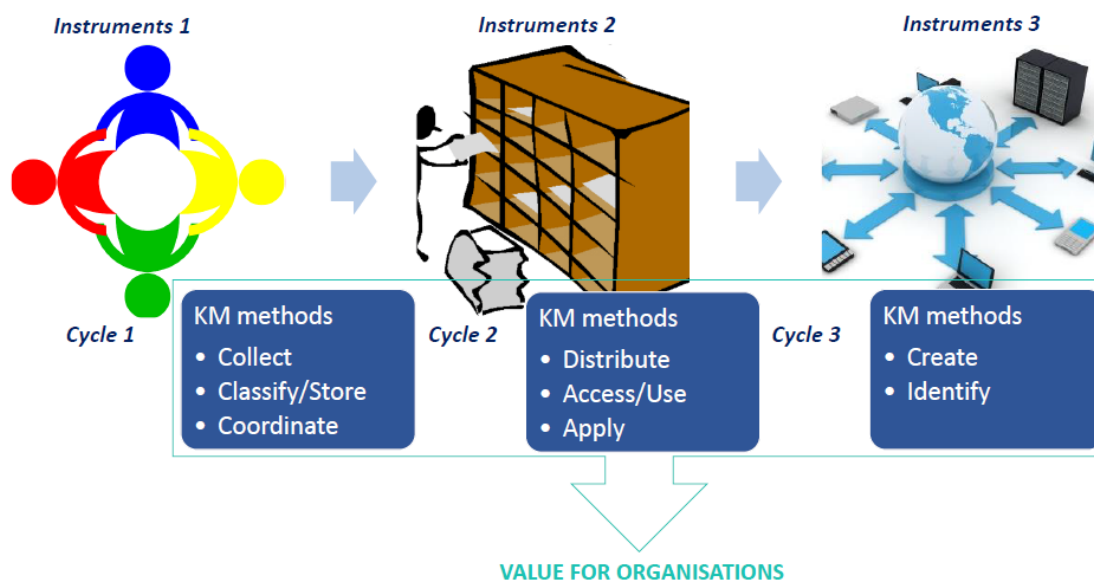
Figure 1: KM Methods and Instruments[3]

When aligned with the organization's strategy, KM adds value to the organization's processes. Appropriate KM pillars and methods used to manage knowledge resources (people, processes, and technology) increase organizational and individual knowledge efficiency and effectiveness. Measuring KM's usefulness and performance is an approach towards the identification of the correlation between two factors: management and performance. Therefore, Knowledge Management Assessment (from now on referred to as KMA) is essential for methodically assessing a company's actual know-how versus its needs. An assessment of KM helps organizations identify their status with

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[1] Koenig, M.E.D. (2012), pp. 1-2.
[2] Nickols, F. (2000); Davenport, T.H. (1994).
[3] Source: based on Skyrme, D.J. (2011).

respect to knowledge assets deficiency, surplus or mismanagement. An assessment of KM helps organizations to make decisions and take actions like for example: hiring new employees, promoting specific knowledge creation, or establishing the intellectual asset database. Such actions protect and exploit at the same time the available knowledge. Research shows that there is a variety of KM and KMA models that have found practical application. The outcome of both KM and KMA models should reflect improved and focused knowledge development efforts according to company's needs. For different reasons as explained along in this work, KM is not necessarily always successful. However, KM remains a potential cross-functional discipline that connects and/or complements other different processes, departments and management disciplines in an organization. The significant impact of KM on the performance and competitiveness of an organization is the motivation for this research.

1.1 Motivation

In times when humanity is overwhelmed by digital data, big organizations are struggling to control and make profitable use of their databases, information centres, and knowledge structures. Our society is overwhelmed by the vast amount of data sources, databases, data management tools, data storage, and even data businesses and industries. These data are all collected, identified, interpreted, managed, and used by people, at a given point in time, for a given company, with a given purpose. This all generates knowledge and experiences which should be managed to the advantage of organizations. Although knowledge has proved to be a significant production factor, organizations have not yet been able to incorporate their knowledge capital into the organization. Organizations have not quite apprehended the importance of identifying, using, improving, and sharing individual and organizational knowledge. This knowledge is not static, this knowledge is dynamic, and its biggest owner is the knowledge worker. Knowledge workers fluctuate and they do not stay forever there, where they once started. They are always on the move. Their knowledge is always expanding, but not always being acquired, applied, stored and shared to the advantage of the organization. Late 2014 and 2015 demonstrated how demographic dynamics, economic and political instability of both developed and emerging countries can lead to permanent loss of once owned, knowledge capital. The so called, ''brain-drain'' phenomenon mostly affects big national and international organizations operating in emerging or non-EU countries of South-Eastern Europe. On the other hand, western developed countries like Germany, Austria or Switzerland claim to lack skilled workforce, academics as well as engineers required for many technical open positions. While well integrated migrants living now in the West could be a good fit for these open positions, other issues like working or visa permits appear to be the hurdle for many organizations searching for skilled people. This is especially the case for non-EU good candidate employees. Due to high administrative and organizational costs of employing a non–EU applicant, national and international organizations operating at national and international levels reject many good applicants. Certain rules have created a ''no way out labyrinth'' where brilliant candidates and a high percentage of knowledge power and Intellectual Capital (IC) are locked out and frozen. KM programmes and initiatives could be the tool to change the situation and to acquire

the knowledge without having to worry about the legislative or administrative limitations, because knowledge knows no borders. Knowledge is power. Political, economic, historical governmental and social background in emerging countries are spilling out their knowledge capital. However, this knowledge that exists mostly in the tacit form, is a powerful treasure that organizations either have it, can and will have it or cannot and will not have it. The question is whether they know how to make use of it and make sure it does not get stolen, lost, drained or frozen when they have this knowledge in their organization.

This does imply the need for acknowledgement of skilled workforce management. This does also imply the necessity of acquiring, organising, evaluating, saving, using, promoting, sharing and developing organizational knowledge assets. According to the KPMG report from 2000[4], even though organizations have KM programmes, there is space for improvements. The implementation of the necessary technology is not the main issue. Running a complete KM programme is what challenges the organizations the most. Among 423 organizations in Europe and the US, only 38% had already implemented a KM programme, 30% were creating one and 13% were examining the need to do so. After nearly 15 years have passed since this report, KM has gained territory in both research and practical field. It is therefore decisive for organizations to know how they are doing and how does a good KM help in defining knowledge-driven performance.

1.2 Scope of Work and Research Questions

With regard to the discourse above, organizations face the necessity to develop KM projects and to make sure that these projects prove to be useful. In order for a KM programme to be fully completed and to measure its usefulness, the implementation of a KMA is necessary because it can:

1. Map out the KM status-quo in an organization.
2. Define the bottlenecks of KM.
3. Help to take measures for KM optimization.

The scope of this research is to review literature about KM frameworks and KMA models. Theoretical knowledge and practical examples will be discussed coherently. Best practice examples are considered to determine the best criteria that lead to successful KM projects. The suggested best criteria catalogue helps to develop an Optimized Knowledge Management Framework (OKMF). The objective of this work is to encourage organizations to efficiently and effectively gather, archive and manage their past and present knowledge assets to ensure a competitive future. In this context, research questions and objectives were defined:

A. What is KM, which are the existing KM and KMA models?
B. Identify best practice criteria for KM overall successful performance.
C. Develop an optimized list of criteria catalogue and an OKMF for successful KM experience.

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[4] KPMG (2000), p. 11.

1.3 Methodology

The theoretical part of this thesis enlists selected KM issues including the most challenging issue, KM assessment. Introduction to the topics of KM and KMA including respective definitions; discussion about different approaches related to KM measurement; as well as the identification of theoretically based relevant practical criteria to create a benchmark in KM are the steps to writing the theoretical contribution of this work. A qualitative literature analysis is provided, followed by a summary of the best practice criteria for successful KM experience. Benefits and challenges of existing KM and KM and KMA models are identified. The practical contribution of the thesis consists of a suggested successful criteria catalogue and a new OKMF.

1.4 Thesis Limitations

The thesis is a theoretical approach with focus on theoretical and practical KM and KMA characteristics. The theoretical part provides relevant theories and concepts with respect to knowledge, its management and assessment. KMA is mostly about whether the strategic and normative goals of knowledge-centred companies are achieved or not. Available literature about KM and KMA successful projects and challenges constitute the fundamental part of the thesis. Best practice successful criteria are discussed. Failure criteria of KM projects are also included in the discussion. Further on, a new list of criteria suggestions for building successful KM models including an OKMF will be provided making no claim of full integrity.

1.5 Thesis Outline

A general theoretical introduction to KM and its aspects in *chapter one* is the first step to understanding the role of KM and its necessary input to the assessment process. *Chapter two* is focused on the definition and explanation of KM including a literature review about terminology, definitions and authors that dedicated their research to KM. *Chapter three* explains the evolution of KM, its purpose and its cross-functional effect in the organizations. A list of KM benefits together with some various selected examples of international companies that used KM and proved to benefit from its use is included in this chapter as well.

Chapter four is dedicated to the assessment of KM and KM Maturity Models used to identify the performance of KM. A description of advantages and disadvantages based mostly on qualitative arguments provided by various literature practical examples is included. Best practice KM and KMA criteria and their potential contribution to KM are presented as well and the results, the observations, and the literature background provide help to develop the best criteria catalogue and the optimized KM framework. The best criteria catalogue and the new framework are suggestions based on deductive reasoning.

Chapter five ends the thesis with conclusions and outlook about the addressed topic.

2 Knowledge Management Basics

"Theory does not have to be true to inspire great works - most great discoveries were based on false hypotheses!"[5]

In the 21st century, when the globalization, world economics, world demographics, and world technology change rapidly, knowledge is the exclusive precious commodity that calls for attention. We live in a world of wide spread multidisciplinary knowledge, which expands every day to an incredibly high speed. The amount of data generated from knowledge, experience, and innovation is soon to become a complex problem of storage management, usage efficiency and effectiveness. Parallel to this data, there are smaller levels of data and information that could be more controllable and manageable in an organization. Knowledge gained through experience over time of gathering various data and interpreting them, represents the intellectual capital of an organization. National and international, small and big organizations, are not specifically aware of the tremendous impact that their most valuable asset ''knowledge worker'' might have in their organizational achievements. Chapter two is structured in a way that the reader can first familiarize with knowledge and management as two separate terms and then grasp the meaning of KM as a broader concept. Additional elements that characterize KM are included in this part of the thesis with the main attempt to comfortably read through the sections.

Nonaka and Takeuchi, Davenport et al., Skyrme, Probst, Auer, Alwert et al., Prusak, and Drucker, APQC (American Productivity and Quality Centre), Ernst & Young, and KPMG, are the pioneers and reference authors or best practice examples in the KM discipline, its theoretical and practical findings and applications. What is remarkable in the existing literature is the amount of discussions and extended arguments about definitions of knowledge. The smartest ''good-fit'' KM framework and the most appropriate KMA model are also fairly discussed. KMA is seemingly the topic where researchers and practitioners seem to have encountered significant challenges. What is important though, is that research points out that organizations have started to understand the importance of knowledge assets and are gradually starting to integrate Knowledge Management concept in their organizations. Knowledge is critical to successful, competitive and long-term survival of organizations[6], thus there is no doubt that knowledge needs to be managed[7] but at the same time also measured in order to improve the efficiency and effectivity of knowledge centred organizations. Initially the most important aspect to remember about knowledge is its categorization into two main forms: tacit and explicit. Knowledge is incorporated in the organization through documents, databases, reports, patents, and different types of archives all representing the explicit knowledge in this case. The knowledge that is possessed by people, i.e. tacit knowledge results from the

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[5] Refer to Balázs, B. (1925) cited in Skyrme, D.J. (2003a), p. 50.
[6] Refer to Wissensmanagement Forum (2007), p. 9.
[7] Refer to Davenport, T.H. et al., (1997), p. 11.

integration of the information acquired into a context of understanding and experience. Tacit knowledge is most difficult to manage and measure.

Practitioners struggle to successfully integrate KM with business strategy, work processes, culture and behaviour. The identification, determination and the implementation of the relevant KM processes in an organization represent a serious challenge. KM processes can derive from appraised organizational KM initiatives or come directly from the work process in line[8]. If KM is needed, a better explanation of ''how'' and ''what'' exactly should be achieved with KM should be provided.

Some of the most encountered issues before or during the KM implementation are related to organizational culture, knowledge sharing cultures, support of top-management, budget, leadership, communication, and rewards and incentives.

One important thing that practitioners should keep in mind is that knowledge is not objective. Organizations, institutions and businesses, including HEIs[9], own experts with different backgrounds who contribute their experience and know-how for creating and sustaining organizational knowledge. This acumen of organizations is dependent on the total sum of every individual's and the overall collected organizational knowledge. Therefore, organizations must acknowledge that knowledge is not objective[10]. In other words knowledge is people driven, people dependent, people intensive. Knowledge is also political and must be incorporated in the organizational and corporate culture with guaranteed full commitment from top-management. Organizations need to define their business purposes, vision, goals and strategy. Organizations need to make structural changes in the policy of the company, and continuously update KM activities along with business goals. This is possible by prioritising and identifying the bottlenecks or the critical information that leads to changes in organizational performance at a certain time and at certain circumstances. Organizations need to have a better business plan about the effective use of resources, they need to think of the follow-up phase after the KM is implemented, they need to forge ahead with liability and adapt the KM initiative to own expectations and targets.

Chief Knowledge Officers Delphi study[11] shows how to use KM to provide strategic advantage, how to gain top-management support, hot to motivate individuals, how to identify organizational knowledge, how to design and develop the best KM, how to assess financial KM costs and benefits, how to verify the efficacy, legitimacy, and relevance of knowledge contributed to KM, how to preserve progress and how to ensure knowledge security.

Since the late nineties when KM and its application took off, projects mostly in the West, developed and improved their KM. However, many barriers or challenges characterize KM discipline to this date.

Leadership remains a critical competence before, during and post KM implementation. If there is no leadership, KM projects perform lower than expected. People are expected

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[8] Refer to Davenport, T.H.; Grover, V. (2001), p. 12.
[9] Refer to Pircher, R.; Pausits, A. (2011), pp. 12-13.
[10] Refer to Pircher, R.; Pausits, A. (2011), p. 11.
[11] Refer to King, W.R. et al. (2002) cited in King, W.R. (2009), p. 10.

to develop a rich skillset where not only technical or engineering backgrounds come to play but also soft skills or the so called Associated Non-Technical Skills.

Capturing existing knowledge in an organization, with the main goal to make it available for access in the future no matter the fluctuations of employees over time, is a delicate mission to accomplish. Capturing knowledge means to mainly create knowledge repositories. The most common options include known technologies like Lotus Notes, World Wide Web, or more recent programmes and tools offered by different services such as Google Docs, Google Drive, Dropbox, Polybox, iCloud, Gmail, Skype, and many more. Such tools allow companies, projects and teams worldwide to promptly share, transfer, use, and edit knowledge online. When such teamwork takes place and the organization is knowledge-oriented, rewards and incentive systems for those sharing valuable knowledge, hence contributing to a successful and measurable KM[12] can significantly increase employees' motivation. Rewards and incentive systems are not yet fully implemented though. This is an issue that asks for more attention and consideration. In a knowledge based and complex societal, environmental and technological economy, the knowledge worker[13] should always be consciously managed as ''an asset'' and not disregarded as ''an expenditure''. As such, the knowledge worker should be the one who decides to work for the organization that makes him feel a valuable asset. Employees can gain company's trust and motivation, and then they learn and teach continuously with high quality. At the end it all counts for the advantage of the organization.

Intercultural management is another issue which must be taken into account during the KM implementation. Change Management is the discipline that can mostly help in this respect and also in the overall KM implementation. Implementing KM in an organization is very difficult. The whole process of structuring, implementing and selling a KM to all the employees involved in the project should be accounted for. Some of the most important concerns a Chief Knowledge Officer should administer before, during and after the KM implementation are change management, LL and best practices, increased efficiency, quality and risk management. Another important concern is to assure stakeholders' warrant for support to create and invest in a solid KM. Furthermore, in most of the cases, communication has proved to be a significant driver in the KM usefulness. To this end, it is proposed that the KM is best implemented when the cultural, social and professional exchange stands on strong pillars of cooperative, friendly and ''we for us'' principles within and beyond the organization.

KM, just like other disciplines and departments such as product development and innovation, Quality Management (QM), Research and Development (R&D), is a rapidly changing and evolving business practice. The core interest of KM is to improve organizational competencies and increase successful competitive performance at all levels through a better handling of the main priceless commodity, knowledge[14]. KM does not differ much from existing concepts like Total Quality Management (TQM) or Business Process Reengineering (BPR) and is considered their complementary discipline.[15] KM

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[12] Refer to Dalkir, K. (2005), pp. 320.
[13] Refer to Drucker, P.F. (1997) cited in North, K. (2009), p. 4.
[14] Translated from Probst, G.J.B.; Romhardt, K. (1997, 2002), p. 1.
[15] Refer to Bhojaraju, G. (2005), p. 38.

adds value to businesses. The report conducted by European Intelligence Unit (EIU)[16] found out that for executives of energy producers and suppliers in order to remain competitive, they plan to deploy Information Technology (IT) resources strategically in KM and customer support. Healthcare and pharmaceutical industry for example see KM (42%) and customer support (36%) as the top two areas with the most productivity gains potential for the future. Many business services such as IT and software development, financial services, life sciences, pharmaceuticals, architecture, engineering, market research, business process outsourcing, and R&D are knowledge intensive. Organizations should therefore develop a consequent KM strategy that replies to four questions: who (people involved), what (knowledge context), why (fulfil business objectives), and how (tools and techniques, technology) is KM going to affect business performance.

2.1 Knowledge Definition

''To have knowledge is to have the power to give a successful performance, not actually to be giving one.''[17]

Knowledge has two main definitions: "tacit" and "explicit". Tacit knowledge is context-specific, subjective, not directly accessible, and hard to formalize and communicate. Meyer and Sugiyama[18] discuss two dimensions of tacit knowledge; technical dimension which is related to informal and hard-to-pin-down skills, and cognitive dimension which consists of ingrained schemata, mental models, beliefs and perceptions that humans take for granted. Explicit knowledge on the other hand is objective, rational, accessible, and can be expressed in a systematic language.[19] Another definition of knowledge is developed by Nonaka[20] who identifies three knowledge types: episteme, techne and phronesis. Episteme type is scientific knowledge, known otherwise as explicit knowledge. This type of knowledge is universal, context-free and objective. Techne knowledge refers to practical and context-specific know-how, known as tacit knowledge. Phronesis type of knowledge refers to experiential practical wisdom. Phronesis is high quality tacit knowledge which people gain through experiences and make context-specific decisions based on own values or ethics. However, knowledge remains mostly defined as a "justified personal true and identifiable belief" and is mostly considered to have two main forms, either tacit or explicit.

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[16] Refer to EIU (2006), p. 47.
[17] Refer to Ayer, A.J. (1958), p.10 cited in Hunt, D. (2003), p. 102.
[18] Refer to Nonaka, I.; Takeuchi, H. (1995) cited in Meyer, B.; Suguyama, K. (2006), p. 11.
[19] Refer to Jeong, D.H. et al. (2008), p. 1;Hoe, S.L. (2006), p. 495.;Blakeley, N. et al. (2005), p. 2; Tress, B. et al. (2005), p. 22;Nonaka, I.; Takeuchi, H. (1995) cited in Noble, B.P. (1996), p. 3.
[20] Nonaka, I. (2006), p. 51.

Table 1: Knowledge Definition[21]

Knowledge Definition	Author, Year
''The Master said, Yu, shall I teach you what knowledge is? When you know a thing, to recognize that you know it, and when you do not know a thing, to recognize that you do not know it. That is knowledge.''	Confucius, 551-479BC[22]
"Justified true belief that increases an entity's capacity for effective action"	Nonaka and Takeuchi, 1995
'' The most valuable asset of a 21st-century institution, whether business or non-business, is its knowledge workers and their productivity."	Drucker and Maciariello, 2008
''Knowledge is a dynamic process of justifying personal belief towards the 'truth'.''	Nonaka and Toyama, 2005 p.422
''Knowledge is a type of instruction or recipe that sets out how a good or service can be produced.''	Blakeley et al., 2005
"Knowledge is a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices and norms''	Davenport and Prusak, 2005
''Knowledge is defined as a set of structural connectivity patterns. Its contents have proven to be viable for the achievement of goals.''	Meyer and Sugiyuma, 2006 p.3
''A dynamic human process of justifying personal belief towards the truth.''	Nonaka, 2006 p.6
1. Explicit: information/knowledge set out in tangible form. 2. Implicit: information/knowledge that is not set out in tangible form but could be made explicit. 3. Tacit: information/knowledge that one would have extreme difficulty to set out in tangible form.	Koenig, 2012
''Information, understanding, or skill that you get from experience or education.'' ''The fact or condition of knowing something with familiarity gained through experience or association. ''	www.merriam-webster.com
''Understanding of or information about a subject that you get by experience or study, either known by one person or by people generally.'' ''The state of knowing about or being familiar with something.''	dictionary.cambridge.org
'' In an organizational context, knowledge is the sum of what is known and resides in the intelligence and the competence of people. ''	www.businessdictionary.com

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[21] Source: Own table
[22] Cited in Hunt, D. (2003), p. 101.

Table 1 gives a summary of various knowledge definitions. Although there are many definitions that attempt to properly define knowledge, research shows that there is a need to determine a standardized definition of knowledge. Such definition would simplify the understanding and application of knowledge as a successful tool for organizational excellence. Knowledge is already widely accepted as a competitive resource[23] which can significantly improve the performance of a business if properly managed. Knowledge is seen as an effective resource used in production, parallel to physical and human capital. Knowledge is the production factor which indicates how productive other inputs are. [24] Aune[25] notes that philosophers have associated knowing with being rationally certain about something. Somewhat different is the idea behind knowledge itself. Knowledge owned by workers is fundamental to production. Knowledge becomes a core competency when companies have to show survival abilities in hard times, particularly when innovation is a must. Innovation requires knowledge and excellence. Knowledge requires people. People with the appropriate knowledge require management. Organizations are aware of workers trading their knowledge, selling it, giving it away, codifying it, and still owning it[26], but management department is the one who can manage workers' knowledge in companies' favour. Management instances can use simple but effective approaches like hoarding, improving, and multiplying the existing knowledge. Knowledge is not the same as data or information though. Confusing knowledge with data and information[27] is a common mistake. Knowledge is a more complex form of information. [28] Knowledge is the result of the ability of an individual to process, to analyse and to interpret information patterns coming from available data. The difference between the three concepts can be easily remembered through the 3A specification given in Figure 2.
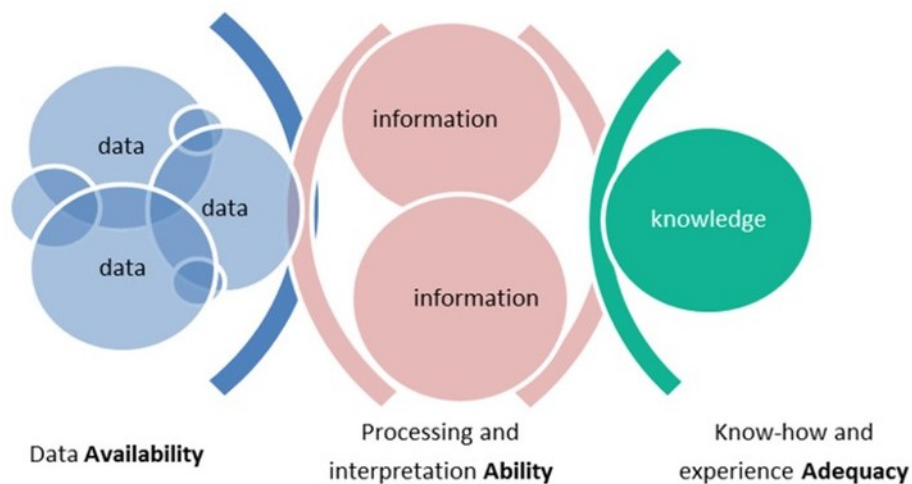

Figure 2: Data, Information and Knowledge – 3A Specification[29]

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[23] Hoe, S.L. (2006), p. 490; Davenport, T.H. et al. (1997).
[24] Blakeley, N. et al. (2005), p. 2.
[25] Refer to Aune, B.A. (2011), p. 19.
[26] Refer to Allee, V. (2001), p. 1.
[27] Refer to Hoe, S.L. (2006), pp. 492-493.
[28] Refer to Ziesak, M. (2011), pp. 5-8.
[29] Source: Own figure

Data is characterized by availability, information by ability to read and to interpret through analytical processing, and knowledge is characterized by the adequacy to know-how and by the overall experience generated from data and information. Wisdom is what then comes in place after knowledge adequacy. Data, information, knowledge, and wisdom are usually listed as the four elements that build the business intelligence hierarchy. Knowledge is power and knowledge processing impacts significantly social and economic sustainability. When shared, knowledge survives, and is stored as an asset that can be accessed for multiple purposes[30] at different times. Due to the fact that knowledge is invisible and intangible[31], managers and leaders often lose track of tacit knowledge.

Knowledge is the most powerful asset that adds tremendous value to any type of organization that owns it and knows how to manage it. [32] The comprehension gained about knowledge, about its characteristics (non-rival[33] and cumulative in nature)[34], its types (explicit and tacit), and its benefits confirm how important it is to recognize, to acknowledge and to effectively manage knowledge.

2.2 Management Definition

When combined with management (dispositive factor), the elementary production factors such as job performance, resources, and materials can accomplish the ultimate goal of enterprises and organizations: goods and services. In an industrial society and knowledge economy, management can get things done through people[35] by using the core management functions of planning, organising, informing, leading and controlling and by making sure that all these functions are interactively performing all simultaneously. Drucker[36] postulates that management is work. He considers management to be the basic institution itself and the dynamic organ of an institution. Drucker and Maciariello[37] define management as polycentric. This perspective makes management a discipline too difficult to master. The reason behind this difficulty is that management requires the integration of all interrelated elements into one single frame of work. Figure 3 shows how complex the management gets and how each and every single element is attached to the whole management system and its singular elements. At the same time, two effects are demonstrated in Figure 3: the creativity and improvement effect, and the destruction of the whole framework effect. Both could happen in management. Elements that are improved in the system may have both

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[30] Refer to Abhary, K. et al. (2009), p. 1755.
[31] Refer to Hunt, D. (2003), p. 100.
[32] Refer to Drucker, P.F. (1999) cited in North, K. (2009), p. 2.
[33] Non-rival means that one person's use of the good does not diminish another's use. Non-rivalry leads to increasing return to scale. If we want to double the amount of output, we only double the standard inputs, capital, labour, etc. but not the knowledge. Knowledge is non-rival, that's why it is not needed to double the knowledge stock, which if it would have happened that the return to scale would not be doubled but it would have increased several times.
[34] Refer to Blakeley, N. et al. (2005), p. i.
[35] Wood, N. (2012), p. 58.
[36] Drucker, P.F. (1986), p. 3.
[37] Drucker, P.F.; Maciariello, J.A. (2008), pp. viii-ix.

effects, good or bad. Elements that are weaker, less precise or less efficient might strengthen the whole system if taken care of.
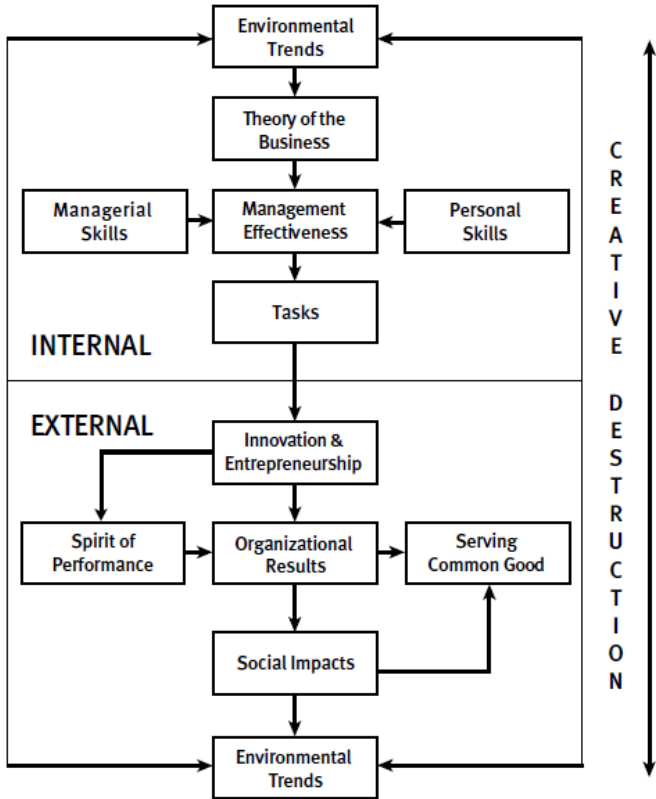
Figure 3: Management System Elements[38]

Even though managers are hired and some organizations are now aware of the extensive field of management and its broad operational areas[39], often do people involved in business not understand whether their management is doing what is supposed to do or not and why. Furthermore, managers often do not understand or not pay enough attention to the current management to identify whether it is satisfactory or not, whether it does a good job or not, whether it displays the expected contributions to the business or not.

Research shows that many authors define management differently. Some of these definitions presented in Table 2 are an attempt to bring the reader closer to management as a term.

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[38] Source: Drucker, P.F.; Maciariello, J.A. (2008), p. ix.
[39] Refer to Vaijayanthi, D. et al. (2010), p. 3.

Table 2: Management Definition[40]

Management Definition	Author, Year
"To manage is to forecast and to plan, to organize, to command, to coordinate and to control."	Fayol, 1930[41]
"Management is a multipurpose organ that manages business and manages managers and manages workers and work."	Drucker, 1997
"Management is the process of designing and maintaining an environment in which individuals, working together in groups, efficiently accomplish selected aims."	Koontz, Weihrich, 2007 (7th reprint)
''The act or skill of controlling and making decisions about a business, department, sports team, etc.''	www.merriam-webster.com (simple definition as of February 2016)
''The act or art of managing: the conducting or supervising of something (as a business).''	www.merriam-webster.com (full definition as of February 2016)
''The organization and coordination of the activities of a business in order to achieve defined objectives. Management is often included as a factor of production along with machines, materials, and money. According to the management guru Peter Drucker (1909-2005), the basic task of management includes both marketing and innovation.''	www.businessdictionary.com (as of February 2016)
''Management is the coordination of activities in an organization with the main objective to achieve the target goals. There are indeed three things that the term ''management'' incorporates: management as an organizational unit of an enterprise, management as a function within an enterprise and management as a method of running business.''	own translation from bwl-wissen.net (as of February 2016)

Management is a discipline, a profession, a science and an art. Management is a system of authority, a group of activity, and dynamic. Management is a process that involves decision making and applies leadership. Management is goal-oriented and has three levels top, middle, and lower management. Management is an integrative universal goal-oriented intangible force[42] which can successfully be applied for knowledge driven objectives. The three tasks of management according to Drucker and Maciariello[43] are: to think through and define the specific purpose and mission of an institution; to make worker and work productive; and to manage social impacts and social responsibilities. This extends the purpose of management towards three dimensions: strategic, economic, social.

An overall picture of management based on the previous discussion and its most important definitions, purposes, activities and roles is summarized in Figure 4.

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[40] Source: Own table
[41] Vaijayanthi, D. et al. (2010), p. 2.
[42] LPU (2011), p. 5; Murugan, M.S. (2008), p. 6.
[43] Drucker, P.F.; Maciariello, J.A. (2008), p. 26.
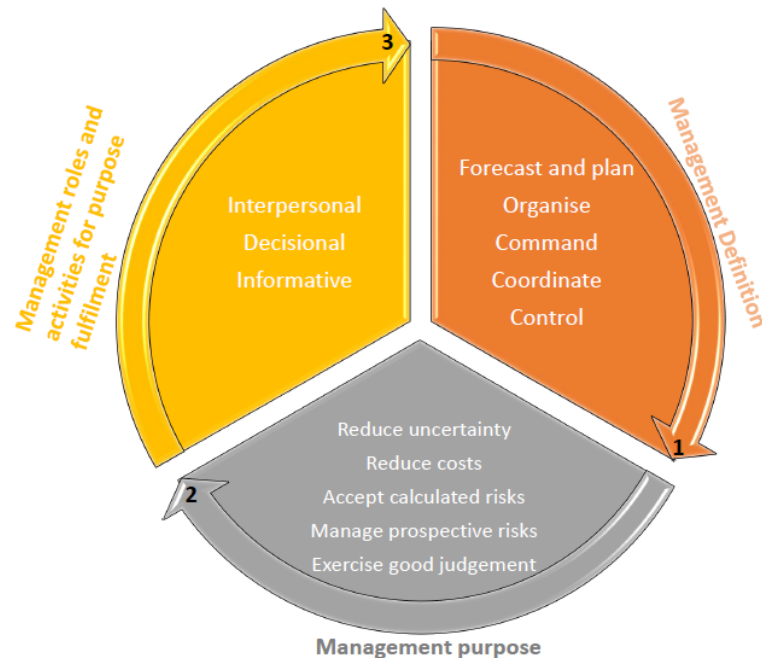
Figure 4: Management Definition, Purpose and Activities, and Roles[44]

Management is seen as the art of forecasting, planning, organising, commanding, coordinating and controlling of people, processes, departments, projects, and businesses. The purpose of management in general is to reduce uncertainty and doubt in working methods, to reduce costs, and to increase revenue[45]. Management accounts for and accepts calculated risks whilst managing and controlling the prospective risks. Another purpose is exercising and stimulating good judgement.[46] The purpose of management can be fulfilled through management activities and roles defined as: interpersonal, decisional and informative. Some of the most relevant thoughts and work dedicated to management as described before contribute as a theoretical support for the KM definition.

2.3 Knowledge Management Definition

''Knowledge work lives through the triad of communicating-learning-applying''[47]

KM concerns forming, processing and ruling all the business acumen and experience that contribute substantially to a functional organization[48]. Effective communication with a skimmed ''fit for purpose'' shared and used knowledge is fundamental for our technologically, environmentally, politically and socially complex society. Development, implementation and continuous improvement of an effective KM embodies the instrument that helps society, organizations, and institutions to achieve effective

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[44] Source: Own figure based on Murugan, M.S. (2008), pp. 3-4.
[45] McLean, L.D. (2004), p. 1.
[46] LPU (2011), p. 7.
[47] Translated from Rehm, S. et al. (2013), p. 13.
[48] Refer to Sarayreh, B. et al. (2012), p. 45.

communication aligned with excellent knowledge performance. KM is the key to accomplishing organizational objectives sustainably, reliably and consistently. According to Ditzel et al., there are five important levels that represent the basic model of KM and describe which aspects of an organization are essential from knowledge perspective[49]:

1. Knowledge (person-related organizational tacit knowledge).
2. Data (organizational data and information, i.e. collective knowledge).
3. Handling (organizational added value through different business processes, i.e. use of knowledge).
4. Objectives (defines goals and specifications for KM and is prior to knowledge, data and handling levels).
5. Culture (provides the context for the four previous levels and has an impact on how the organization deals with knowledge).

Products, processes or strategies make businesses viable[50]. Context-specific knowledge, known otherwise as tacit knowledge is the know-how, the experience and the insight that contributes to improve organization's products and services[51]. Observations[52] show that American CEOs prefer ''explicit knowledge'' by creating the tradition of the rationalism of the West. Japanese colleagues opt for ''tacit knowledge'' and create the intellectual tradition of the East called ''oneness of body and mind''. The difference between two choices is that the former is the type of knowledge that is scientific, and the latter is not. Tacit knowledge is intuitive, interpretive, ambiguous, nonlinear, and difficult or almost impossible to be expressed mathematically. What does it mean to manage these types of knowledge?

Most of the definitions specify KM as very organizational and corporate oriented fine process of organizational activities. The various definitions about the KM converge to the message that KM's ultimate goal is to support in executing organization's objectives. To fulfil this role, CKOs (Chief Knowledge Officer) and/or knowledge managers are in charge and should dedicate the exclusive attention to the organizational activities. By doing so, they can identify the real meaningful value chains of knowledge dependent activities. KM can focus on knowledge and its effective and efficient use. KM can be implemented only through projects and initiatives which can be very expensive. KM is capable of generating better performance and organizational achievements. KM requires follow-up dedication and demands CKO's full engagement and responsibility. In this context, KM is multi-disciplinary, it has people and content as core drivers, and can be both theoretical and practical. IBM consultants for example divide the KM into two main categories: collecting stuff which represents the content of KM, and connecting people, which represents the exchange, share and expansion of knowledge[53]. A list of KM definitions by different authors is provided in Table 3.

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[49] Refer to Ditzel, B. et al. (2007), pp. 15-17.
[50] Refer to Noble, B.P. (1996), p. 2.
[51] Refer to Hoe, S.L. (2006), p. 493.
[52] Refer to Nonaka, I.; Takeuchi, H. (1995) cited in Noble, B.P. (1996), p. 3.
[53] Koenig, M.E.D. (2012), pp. 1-2.

Table 3: Knowledge Management Definition[54]

Knowledge Management Definition	Author, Year
"Knowledge Management is the process of capturing, distributing, and effectively using knowledge."	Davenport, 1994[55]
"Knowledge Management is a discipline that promotes an integrated approach to identifying, capturing, evaluating, retrieving, and sharing all of an enterprise's information assets. These assets may include databases, documents, policies, procedures, and previously un-captured expertise and experience in individual workers."	Duhon, 1998[56]
''Knowledge Management caters to the critical issues of organizational adaption, survival and competence in face of increasingly discontinuous environmental change. Essentially, it embodies organizational processes that seek synergistic combination of data and information-processing capacity of information technologies, and the creative and innovative capacity of human beings.''	Malhotra, 2000 p.50
''Conscious strategy of getting the right knowledge to the right people at the right time helping people share and put information into action in ways that strive to improve organizational performance''	O'Dell et al., 1998, p.6
''The goal of Knowledge Management is to build and exploit intellectual capital effectively and gainfully''	Wiig, 1999, p.4
''A process that helps organizations to find, select, organize, disseminate, and transfer important information and expertise necessary for activities.''	Gupta et al., 2000 (cited in Zaied et al. 2012)
''Explicit and systematic management of vital knowledge and its associated processes of creating, gathering, organising, diffusion, use and exploitation to help achieve organizational objectives.''	Skyrme, 2003
''KM is the practice of selectively applying knowledge from previous experiences of decision making to current and future decision making activities with the express purpose of improving the organization's effectiveness.''	Jennex, 2005, p.iv (cited in Jennex and Olfman, 2008, p.36)
EN: ''The steering and managing of knowledge work, such as knowledge conversion, memorising, exchange or sharing'[57]'	ÖNORM, 2007 (cited in Woitsch et al. 2013)
''Knowledge Management consists of leveraging intellectual assets to enhance organizational performance.''	Stankosky 2008 cited in Owen, 2011 p.5
'' KM is a systematically organized and integrated set of processes, aimed at the optimal usage of knowledge resources, in a broadly defined decision taking''	Kotarba, 2011, p.68
''The summary of all measures designed to address knowledge-related challenges''	UNDP, 2014 p.8
"A business model embracing knowledge as an organizational asset to drive sustainable business advantage. It is a management discipline that promotes an integrated approach to identify, evaluate, capture, create, enhance, share, and apply an enterprise's intellectual capital".	KPMG, 2016, p.1

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[54] Source: own table
[55] Refer to Davenport, T.H. (1994) cited in Koenig, M.E.D. (2012), p. 1.
[56] Refer to Duhon, B. (1998) cited in Koenig, M.E.D. (2012), p. 1.
[57] Own translation from German

To concretize the work of this thesis, a new definition is formulated based on the literature contributions as described previously. The new formulated definition is the result of the combination of different definitions and adapted to this work's perspective:

*''Knowledge Management is the **ability** to recognize who knows what (detect, qualify, quantify); the **wisdom** to determine how and where this knowledge can be best used to powerfully improve organization's production and performance (classify, harmonize, administer); the **capacity** to efficiently, effectively and sustainably evaluate, optimize, secure, transfer, and share knowledge (KM life-cycle) with respect to strategic objectives; the **knowledge** to measure the benefits and reward their enablers; and the **commitment** to follow-up on the Continuous Improvement Process of successfully managed individual and organizational tacit and explicit knowledge of an organization.''*

In this context, KM is in itself a project or initiative that helps organizations to achieve their strategic goals. For these achievements there is always a certain knowledge that comes into play. This knowledge can be identified or not, can be tacit or explicit, can be old or renewed, can be localized and centralized or shared and transferred, updated and applied. These processes represent the life-cycle of knowledge in a KM project. The KM life-cycle is essential. The KM life-cycle is crucial for developing a successful KM overall project. Through a smart KM life-cycle organizations are able to thoroughly manage their knowledge if they take into consideration each and every step of it. Having in mind the new knowledge definition from this work's perspective, the successive section describes the KM life-cycle that knowledge centred companies should be aware of.

2.4 Knowledge Management Life-cycle

Knowledge processes can be structural and informal. Structural knowledge processes have previously planned, organized and systematically collected and shared the knowledge. Informal knowledge processes are the spontaneous and voluntary processes of collecting and sharing knowledge[58]. The most important element in knowledge creation and management is the commitment of human and capital resources. Knowledge creation within an organization is mainly driven by five factors; vision, strategy, structure, system and staff.[59] Human knowledge and its appropriate use should be the leading torch to performance excellence. The main objectives of KM are to create knowledge repositories, to improve knowledge access, to enhance cultural support for knowledge use, and to manage knowledge as an asset. [60] The organizational knowledge created and accumulated at the individual level is expanded at the upper ontological levels through the four knowledge conversion modes and is applied and internalized at the lower levels.[61] Although they relied their research only on qualitative methods, Nonaka and Takeuchi's conclusion that knowledge is initially created by individuals[62] is broadly accepted. Given that knowledge is created by individuals,

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[58] Refer to Hoe, S.L. (2006), p. 10.
[59] Refer to Nonaka, I.; Takeuchi, H. (1995) cited in Sarayreh, B. et al. (2012), p. 46.
[60] Davenport, T.H. et al. (1997), p. 3.
[61] Nonaka, I. et al. (1996), pp. 209-210.
[62] Refer to McLean, L.D. (2004), p. 2.

identification of the processes through which KM's life-cycle develops is necessary. Kanagasabapathy et al.[63] define KM as a managerial activity during which knowledge is created, transferred, shared, memorized and used. Thereafter, it is time to inform the organization members, employees and all stakeholders about KM activities so that they simplify their decision-making processes and accustom it to the organization's goals. Andersen and APQC[64] published seven processes for their KM life-cycle: share, create, identify, collect, adapt, organize, and apply knowledge.

Skyrme's KM life-cycle[65] goes also through seven processes: identify, collect, classify, organize/store, share/disseminate, access, and use/exploit.

European KM Forum[66] suggests five KM life-cycle processes: identify, create, store, share, use.

After almost three decades of evolution, there are still many unresolved issues that characterize KM discipline. One of the most discussed issues in the history of KM is the life-cycle. Understanding life-cycle gives organizations an opportunity to thoroughly consider every possible benefit from both tacit and explicit knowledge sources in the entire organization. A general opinion that knowledge should first be created, recorded and then retrieved and used is obvious. However, if we look thoroughly into each of the proposed versions presented in Table 4, some cycles seem to be vague, incomplete or not up to date.

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[63] Refer to Kanagasabapathy, K.A. et al. (2006), p. 2.
[64] Refer to Holsapple, C.W.; Joshi, K.D. (2003), p. 103.
[65] Refer to Skyrme, D.J. (2003), p. 5.
[66] Refer to European Committee for Standardization (2004), p. 21.

Table 4: KM Life-cycle Models[67]

Allee (1997) Davenport (1998) Alavi and Leidner (2001)*	Andersen and APQC (1996)	Ruggles (1998)	Gupta et al. (2000)*	Karagiannis and Telesco (2000)	EU KM Framework (2000-2002) CEN (2004)	Skyrme (2003)	Kanagas-abapathy, Radhakrishnan and Balasubramanian (2006)	APO (2010)	Kotarba (2011)
Acquire	Share	Generate	Find	Identify	Identify	Identify	Develop	Identify	Identify K-resources
Organize	Create	Access	Select	Generate	Create	Collect	Transfer	Create	Analyse K-usage
Sustain	Identify	Use	Organize	Acquire	Store	Classify	Transmit	Store	Analyse K-needs
Apply	Collect	Embed	Disseminate	Store	Share	Organize/ Store	Store	Share	Address K-resources
Share	Adapt	Store/ Codify	Transfer	Distribute	Use	Share/ Disseminate	Apply	Apply	Acquire K-resources
Renew	Organize	Grow		Use		Access			Process K-resources
	Apply	Transfer				Use/Exploit			Use K-resources
		Measure							

cited in Kanagasabapathy, et al. (2006)

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[67] Source: own table

The observation that different KM life-cycle proposals miss one or another crucial cycle is inevitable. Following on the work of the authors listed in Table 4, a detailed optimized life-cycle of KM is suggested in Table 5.

Table 5: Optimized KM Life-cycle[68]

Detect/Identify
Locate
Classify/Map
Evaluate
Optimize/Transform
Memorize/Store
Apply/Use
Transfer
Share
Assess
Update/Create new

The first process in a KM initiative is to *detect* (knowledge content, flow, sources) the existing knowledge. This knowledge could be embodied in people, databases, software, or patents. In the second process, the *location* of the detected knowledge in order to prevent the reinvention of the wheel[69] must be documented and described. Third step should be able to *classify and/or map* knowledge into tacit/explicit (organizational, educational individual background, i.e. technical, engineering, soft-skills) and asset types (people, processes, content, technology[70]). *Evaluate* (check out and cede information)[71] the existing knowledge and cross-check its status with the organization's objectives is the mission of fourth process. After that, as required by step four, comes knowledge *optimization/transformation* (correct, adapt, eliminate boundaries and transform raw knowledge into usable knowledge)[72]. Step six is to *memorize/store* (electronically, hard copy, data bases, i.e. create an organizational memory[73]) the existing/optimized knowledge. The seventh process is crucial because most of the organizations do not *apply* knowledge efficiently and in synergy with cross-functional teams and processes, therefore quite a significant attention span of the whole KM should be given to this process. *Transferring* knowledge across organizational boundaries and cross-functional departments; *sharing* knowledge within the team and beyond, and *assessing* knowledge by measuring organizational performance are the three next processes that contribute to a thorough KM life-cycle. The last process is the *update/create new*[74] knowledge which concerns the knowledge update and its adaptation to the latest ''state of the art''

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[68] Source: own table
[69] Refer to APO, (2010), p. 29.
[70] Refer to APO, (2010), p. 72; EU KM Forum, (2001).
[71] Refer to Delak, B. et al. (2014), p. 168.
[72] Refer to Davenport, T.H.; Grover, V. (2001), p. 9.
[73] Refer to Karagiannis, D.; Telesco, R. (2000), p. 13-5.
[74] Refer to Nonaka, I.; Konno, N. (1998), pp. 46-47.

technological development. Some of the elements of the new optimized KM life-cycle are not explicitly seen in other models but should not be ignored. Organizations consume time in reinventing the wheel, processing depreciated and no longer relevant knowledge, using wrong resources for wrong processes. This leads to time loss and pressure about the lack of the right skilled employees. It might happen that managers give the wrong tasks to the wrong employees in critical moments or in ''running out of time'' scenarios. These scenarios can lead to unexpected failures when the right knowledge has not been detected, located, classified and evaluated. By all means should the organizations pay the same attention and give the same credit to every single cycle, otherwise the KM life-cycle may prove unsuccessful. One of the most important cycles is the assessment of the knowledge capital. This assessment refers to the knowledge of intangible assets involved in the performance of a task, a project and the overall performance of the knowledge oriented organizations. The assessment of intangible assets is a difficult task in KM projects. Together with each of the KM life-cycle processes and with the new developed definition of KM as described in Section 2.3, organizations must prove their ability to adapt to dynamic markets' circumstances and to technological and environmental changes. What helps to do so is the strategic use of intangible assets. This task can be accomplished with the help of a strategy-oriented KM programme, the function of which that takes into account and cooperates also with other management disciplines in an organization.

3 The Evolution of Knowledge Management

''In the end, the location of the new economy is not in the technology, be it the microchip or the global telecommunications network. It is in the human mind.''[75]

The subject of Knowledge Management is relatively new. The first conference on KM was organized by Ernst & Young in 1992 in Boston. KM started to gain research terrain after 1995 when Nonaka and Takeuchi presented the creation of organizational knowledge with the main challenge to transfer tacit to explicit knowledge.[76] Since then, the interest of many companies, with Skandia, the Scandinavian company being the first to create a specific role for KM[77] increased rapidly and so did the desire to capture knowledge and the imperative to invest and spend more on information systems[78]. The main goal behind such information systems was to achieve valuable knowledge creation, capturing, sharing and knowledge management. KM has been a research topic of many researchers and a strategic management discipline for various large organizations. KM has evolved in terms of importance, knowledge life-cycle definitions, and also in terms of KM performance assessment. It was only after 2003 when the gurus of the field strongly recommended academia to integrate KM as an academic discipline. This evolution is referred to KM as a discipline and all its aspects such as the models of KM, the KM life-cycle or KM pillars, and KM assessment. Some of these aspects are discussed in this work in form of an evolutionary chronological presentation of the topic. Owen updated a summary of the main events that signed the evolution of KM as presented in Figure 5.

Year	Entity	Event
1980	DEC, CMU	XCON Expert System
1986	Dr. K. Wiig	Coined KM concept at UN
1989	Consulting Firms	Start internal KM projects
1991	HBR article	Nonaka and Takeuchi
1993	Dr. K. Wiig	First KM book published
1994	KM Network	First KM conference
Mid 1990s	Consulting Firms	Start offering KM services
Late 1990s	Key vertical industries	Implement KM and start seeing benefits
2000–2003	Academia	KM courses/programs in universities with KM texts
2003 to present	Professional and Academic Certification	KM degrees offered by universities, by professional institutions such as KMCI (Knowledge Management Consortium International; information available at: http://www.kmci.org/) and PhD students completing KM dissertations

Figure 5: KM Evolution[79]

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[75] Webber, A. (n. y.) cited in Davenport, T.H.; Prusak, L. (2005), p. 1.
[76] Sarayreh, B. et al. (2012), p. 45; Woitsch, R.; Karagiannis, D. (2005), p. 572; Davenport, T.H. et al. (1997), p. 5.
[77] Refer to Sarayreh, B. et al. (2012), p. 45.
[78] Refer to McLean, L.D. (2004), p.1.
[79] Source: Owen, J. (2011), p. 19.

The first to start investigating knowledge, its types, its transfer and its creation in a company were Nonaka and Takeuchi. They found out that the American practice of benchmarking (keeping a scorecard on competitors' business practices) is a method to continuous improvement but not to knowledge creation. On the other hand, Japanese practice of knowledge creation goes through three steps: internal generation from basic principles laid out by top management; improvement by internal brainstorming; and feedback from external sources.[80] Nonaka and Takeuchi offer the classic example in the KM literature of true "tacit" knowledge. Kinesthetic knowledge was necessary to design and engineer a home bread maker, knowledge that could only be gained or transferred by having engineers work alongside bread makers and learn the motions and the "feel" necessary to knead bread dough. In this case the knowledge acquired by the individuals in the company is what turns into ''organizational knowledge'' and then is shared among colleagues.

Nonaka and Takeuchi's SECI model focuses on the conversion from tacit to explicit and then back to tacit knowledge through the spiral of four galleries of transformation; socialization, externalization, combination and internalization as illustrated in Figure 6. In the SECI model personal subjective knowledge is validated socially. The social process of knowledge validation ensures objectivity which itself interacts dynamically with the subjectivity of context embedded factors. This dynamic interaction is the mechanism of knowledge creation according to Nonaka and Toyama[81].
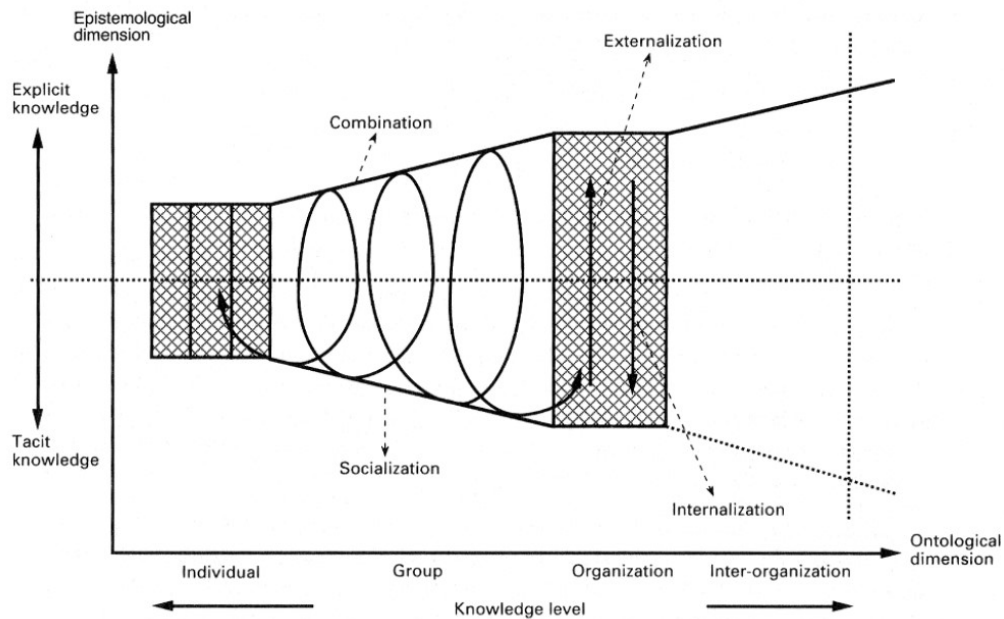

Figure 6: Organizational Knowledge Creation[82]

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[80] Refer to Nonaka, I.; Takeuchi, H. (1995) cited in Noble, B.P. (1996), p. 4.
[81] Refer to Nonaka, I.; Toyama, R. (2005), p. 433.
[82] Source: Liikkanen, L. A. (2010), p. 5.

The authors argue that the intervention of middle management is as important as top management in knowledge creation. Middle management represents the engine that drives innovation. Top management may encourage the ''creative chaos'', which is the trick to keeping companies innovative[83]. Linking explicit knowledge and creating teams require a lot more effort. The two processes represent a major and critical step in the whole process of knowledge transfer as presented more detailed in Figure 7.
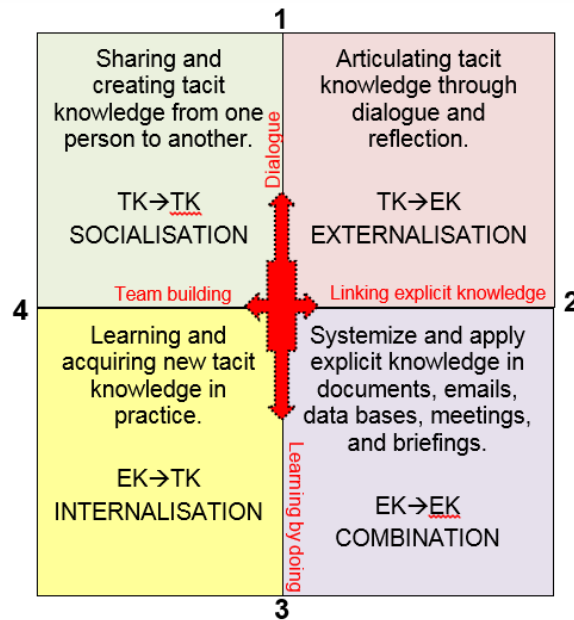
Figure 7: SECI Model of Knowledge Transfer[84]

Hoe[85] describes SECI as the model which highlights organizational learning as a social process for which the need to convert different types of knowledge is inevitable. SECI model displays also some weaknesses such as: too much subjectivism leading to dangerous relativism[86]; overlooked learning theory[87]; lack of explanation about how new ideas or deep understanding develop[88]. The spiral knowledge creation is considered too abstract, almost an impossible task and far from real world organizations' capability to easily and successfully implement it. SECI is metaphorically excellent and it may have proved to work well in the Japanese culture but not in other cultures across the world.[89] Gourlay[90] argues that SECI is not supported by empirical evidence, modes are not coherent, questionnaire measured content is weak, more qualitative data would have been useful, and that *''at best SECI might be regarded as a theory of semantic information creation rather than of knowledge creation''*.

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[83] Refer to Noble, B.P. (1996), p. 5.
[84] Source: adapted from Nonaka, I. (2006), p. 9; Sarayreh, B. et al. (2012), p. 45.
[85] Refer to Hoe, S.L. (2006), pp. 495-497.
[86] Refer to Essers, J.; Schreinemakers, J. (1997) cited in Sarayreh, B. et al., (2012), p. 47.
[87] Refer to Jorna, R. (1998) cited in Sarayreh, B. et al., (2012), p. 47.
[88] Refer to Bereiter, C. (2002) pp.175-179 cited in Sarayreh, B. et al., (2012), p. 47.
[89] Refer to Bratianu, C. (2010), p. 195.
[90] Gourlay, S. (2005), p. 8.

Sometimes the model is criticized for being far too abstract, and over simplistic[91], especially from the practitioner point of view. SECI is inadequate in a time of continuous change of communication technologies, especially after the 2000s. However, SECI model seems to have survived the critics and is still very much in use.[92] As it is also confirmed in the SECI model, knowledge is people intensive, is dynamically generated and augments through sharing.[93] The most basic KM model consists of two subsystems: humans (tacit) and documents (explicit).[94] Managers struggle to bring people together and make them share, support and contribute to organizational knowledge creation with their experiences and owned tacit knowledge. As such, KM is an activity that is most successful when social groups within the company are created. Strengthening organizational learning increases the flexibility of organizations to promptly react to market and technological trends[95]. The social groups call for attention of social processes that facilitate the implementation of KM in an organization. Along with content management (e.g. SIEMENS AG)[96], there are three vital social processes that constitute KM. These processes are known as Lessons Learned (LL) databases, Expertise Locator (EL) and Communities of Practice (CoPs).

LL databases capture knowledge that has been operationally obtained and makes it accessible to others. LL makes knowledge embedded in persons explicit by creating repositories of specific knowledge.[97] This knowledge is accustomed to different business functions and processes such as: Business Process Management (best practice knowledge); Innovation Management (LL knowledge); Strategic Management and planning functions (competitive knowledge); as well as sales purposes implicating products, customers and markets (marketing and business knowledge). Implementing LL is a complex task. Its integration in a new project starts with the old project idea, its assignment and its realization. After the realizations, some LLs are noted and then forwarded to the new project for consideration before realization.[98]

EL identifies and locates the persons with specific expertise within the organization. EL is fed with data from employee resumes, employee self-identification of areas of expertise, or by algorithmic analysis of electronic communications. The latter approach is typically based on email traffic, but can also include other social networking electronic communications.

CoPs are intentionally or spontaneously formed groups of individuals who share same interests, concerns or passions. They learn how to perform better as they interact in regular basis. They come together to tell stories, to share and discuss problems, options and opportunities, and talk over LL[99]. CoPs, mentoring and coaching are instruments

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[91] Refer to Suresh, R. (2002), p. 8.
[92] Refer to Sarayreh, B. et al. (2012), p. 47.
[93] Refer to Ditzel, B. et al. (2007), p. 13.
[94] Refer to Pircher, R.; Pausits, A. (2011), p. 11.
[95] Refer to Ditzel, B. et al. (2007), p. 11.
[96] Refer to Krause, H. (2001), pp. 9-11.
[97] Refer to Davenport, T.H.; Grover, V. (2001), p. 9.
[98] Translated from Probst, G.J.B.; Romhardt, K. (1997, 2002), p. 13.
[99] Refer to Wenger, E.C. (1998); Wenger, E.C.; Snyder, W.M. (1999) cited in Koenig, M.E.D. (2012) p. 5.

that facilitate organizational intelligence suitable to the priorities of the organization[100]. CoPs play an important role in KM when it comes to knowledge sharing beyond formal divisions, departments and processes[101] and the three main roles in CoPs to be taken: manager, moderator, and thought leader.

KM contents are crucial for the development of a KM framework especially in a cross-functional organizational environment. KM's role has increased recently due to its usefulness in profitably and effectively managing intangible assets of organizations. Intangible assets are commonly known as soft factors of production and can have different nature. Some of the factors that can be affected by KM are employees, relationships, organizational development,[102] and leadership.

The evolution of management discipline as whole, together with the existing research and practical examples show that KM is mostly related and must be combined especially with Change Management discipline. KM's evolution is now at the stage of institutionalization, meaning KM is broadly accepted as a useful tool towards business excellence. Systematic knowledge activities and continuous surveillance make KM a key crosscutting dimension in such a cross-functional operating area. Other organizational functions that KM is cross-functionally related to and has a considerable impact are: HR Management, Intellectual Property Management, Learning Organization, Innovation Management, Quality Management, Risk Management, Communication and IT, Strategic Management, Controlling and Business Process Management. Figure 8 presents KM as a cross-functional tool that has an impact on all the other levels, departments and disciplines in an organization.

Figure 8: KM as a Cross-function[103]

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[100] Refer to Pircher, R.; Pausits, A. (2011), p. 12.
[101] Refer to APO (2010), p. 35.
[102] Biedermann, H. et al. (2002), p. 53.
[103] Source: based on CTM (2013), p. 23; Baskerville, R.; Dulipovici, A. (2006), p. 87; DON (2001), p. 29; Skyrme, D.J. (1998a), p. 4; Wissensmanagement Forum (2007), pp. 43-142.

This critical impact is related to knowledge, therefore the involved stakeholders in KM must possess knowledge about these disciplines[104]. People with the right skillset and knowledge are therefore brought together to interact and make KM an easy flowing process. KM is what makes individuals, teams, managers and CEOs talk the same language. They demonstrate the same organizational culture when it comes to knowledge and its appropriate boundary-free application. Successful KM cross-functional systems are created when the KM team management structure is aligned to the hierarchical overall management structure. Knowledge groups coming from different divisions and functional areas of the organization are consciously aligned too[105]. Taking into account that KM activities are part of business activities[106], it is compulsory to mention that successful KM can be achieved only if and when every single phase of the life-cycle is strategically adapted to the objectives of the organization and the KM is designed "fit-for-purpose".

Weichbrodt[107] notes that KM is not about knowledge itself, but about knowledge-based doing and knowledge-oriented enterprise management. Manufacturing companies for example, find it very difficult to capture, access, share, optimize, transfer and apply knowledge generated from external partners in order to improve processes and product innovation[108]. KM itself is a new form of reporting from knowledge centred organizations about their knowledge-driven business processes.[109]

Having started in the mid-nineties with Nonaka and Takeuchi, KM seems to be the discipline of the future which needs more theoretical and practical research. Linking informal knowledge to tacit knowledge to enhance the organization's KM capability is what Hoe[110] suggests for future research.

KM is certainly a trend that will bring massive changes to the global knowledge-based economy. Economist Intelligence Unit[111] reports that together with KM, globalization, demographics, atomization, and personalization too are the major components that will change our global economy, the landscape of giant industries, and the workings of companies. Studies show that KM will be the fundamental core discipline on which companies and organizations will focus now in order to be better prepared for 2020. In the automobile industry for example, KM (32%) is believed to be the third most potential activity for productivity gains, after operations and production processes (60%) and product development (40%). The same trend is believed to characterize the IT investments in the automobile industry where 49% of the respondents selected general IT infrastructure to be the first and KM (45% in 2020 from 11% in 2005) the second focus area of investments. KM is the most important factor in increasing the productivity gain.

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[104] Refer to Ditzel, B. et al. (2007), p. 13.
[105] Refer to Kanagasabapathy, K.A. et al. (2006), p. 7.
[106] Refer to Karagiannis, D.; Telesco, R. (2000), p. 13-6.
[107] Translated from Weichbrodt, R. (2011), p. 17.
[108] Refer to EIU (2007), p. 2.
[109] Refer to Biedermann, H. et al. (2002), p. 53.
[110] Refer to Hoe, S.L. (2006), pp. 498-499.
[111] Refer to EIU (2006), p. 3.

KM is a field that has a remarkable potential for further development that currently faces many challenges and that according to OECD: *"Knowledge Management practices seem to have a far from negligible effect on innovation and other aspects of corporate performance. But there is little systematic evidence of just how great an effect Knowledge Management has. Among the various categories of knowledge-related investments…Knowledge Management is one of the areas about which little is known in terms of quality, quantity, costs and economic returns."*[112]

3.1 Knowledge Management Frameworks

Wiig[113] believes that there are three organizational perspectives on KM: business (why, where and how much to invest in knowledge?); management (focus knowledge-related activities to achieve business targets); and hands-on perspective (apply the expertise to conduct explicit knowledge-related tasks). Different to SECI model, Wiig is more specific and divides KM into six important fields: business, intellectual assets, personal knowledge asset responsibility, creation, transfer, and customer-oriented strategy.

The next KM model presented in Figure 9 is created by Probst[114] and consists of eight interdepending building blocks. This model helps structuring KM process in logical phases, and highlights weak areas for interventions. The model offers a diagnosing framework that according to the author has been tested and can effectively identify the knowledge problems of an organization.
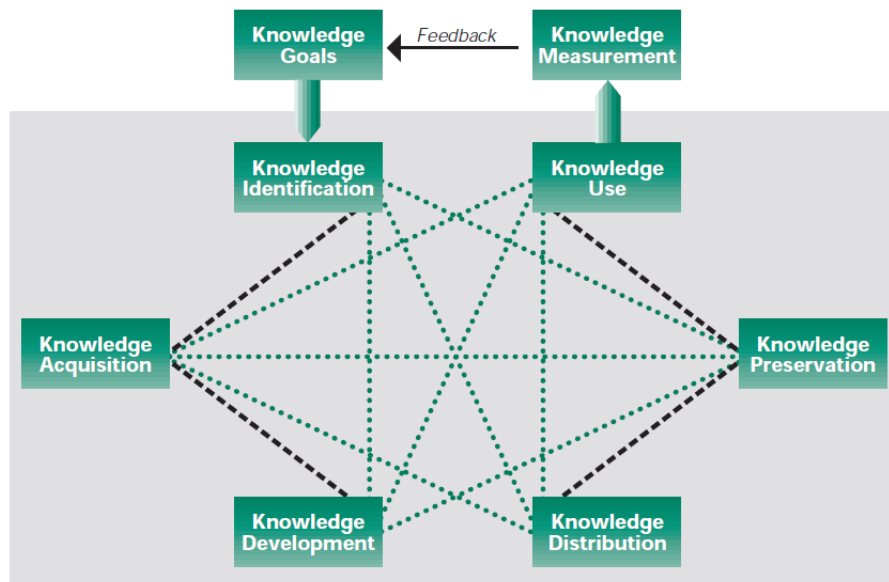
Figure 9: The Building Blocks of KM[115]

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[112] OECD (2004): The Significance of Knowledge Management in the Business Sector, Policy Brief.
[113] Refer to Wiig, K.M. (1993) cited in Owen, J. (2011), pp. 21-22.
[114] Refer to Probst, G.J.B. (1998), pp. 18-20.
[115] Source: Probst, G.J.B. (1998), p. 19.

The inner cycle consists of identification, acquisition, development, distribution, preservation and use of knowledge. The outer cycle consists of all six KM life-cycle activities plus the organizational knowledge goals and KM assessment. Organizations are suggested to first define their knowledge goals in three perspectives: normative, strategic and operational and then proceed with the six knowledge activities. Probst's model may be a good practical reference for many companies. It serves as a functional tool kit for design and best-practice analysis related to KM.

Malhotra[116] created a model which from the information-processing perspective offers four key components of all organizational processes and activities; playfulness in organizational choices; shift from error avoidance to error detection and correction; strategic planning as 'anticipation of surprise'; and creative chaos through organizational vision.

The KM framework created by the American Productivity and Quality Center (APQC) is presented in Figure 10. The APQC KM framework is interactive and accessible online on the official APQC webpage[117]. Different to other frameworks this one is one of the most detailed framework that consists of four main categories: call to action, develop KM strategy, design and implement KM capabilities, evolve and sustain. For each category, there are different cycles of continuous improvement which lead to the achievement of target results. These target results are defined by the organization through strategic goals at the beginning of the KM project.

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[116] Refer to Malhotra, Y. (2000), p. 51.
[117] https://www.apqc.org/km-framework

Figure 10: APQC Interactive KM Framework[118]

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[118] Source: APQC (2016), https://www.apqc.org/km-framework (accessed: 25.03.2016).

Skyrme developed a KM framework for success. The advantages of this model are many but the most important ones in terms of KM levers are related to the excellent developed ICT infrastructure, very good knowledge creating-sharing behaviours, and continuous learning and experimentation. In terms of leadership, Skyrme's KM framework provides opportunities to build strong link to business value, compelling vision and structure, knowledge leadership and champions. The main advantage of his model shown in Figure 11 is related to the broad establishment in organizations of all sectors, functions, countries and sizes.
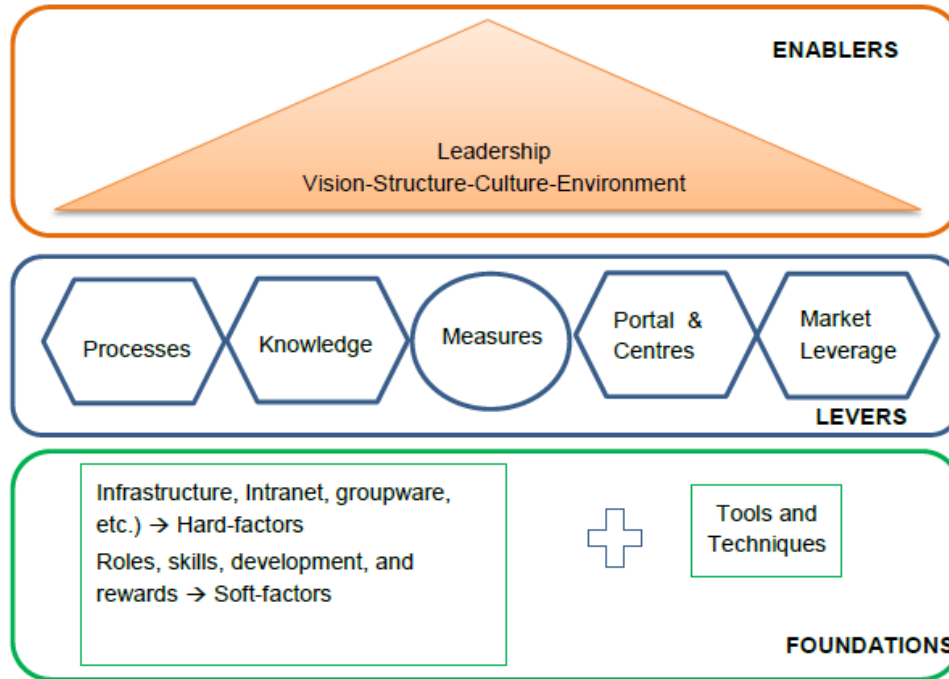
Figure 11: KM Framework for Success[119]

The first draft of the European KM Framework is presented in Figure 12. The framework consists of nine major knowledge containing sections: KM strategies, human and social KM issues, KM organization, KM processes, technologies, leadership, performance measurement, implementation and business cases. Closely interrelated, these sections support not only the innovativeness of the framework but also secure knowledge reuse.[120] Among many other definitions provided in the EKMF's terminology booklet, the KM and KM framework definitions[121] provide the idea behind which the EKMF framework is developed.

KM: ''Planned and ongoing management of activities and processes for leveraging knowledge to enhance competitiveness through better use and creation of individual and collective knowledge resources.''

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[119] Source: Skyrme, D.J. (2000), p. 4 (slightly modified).
[120] Refer to European KM Forum (2001b), p. 10.
[121] Refer to European Committee for Standardization (2004d), p. 11.

KM framework: ''Describes the most essential factors (assets, people, processes, tools) influencing the success or failure of a KM initiative, and their interdependent relationships.''
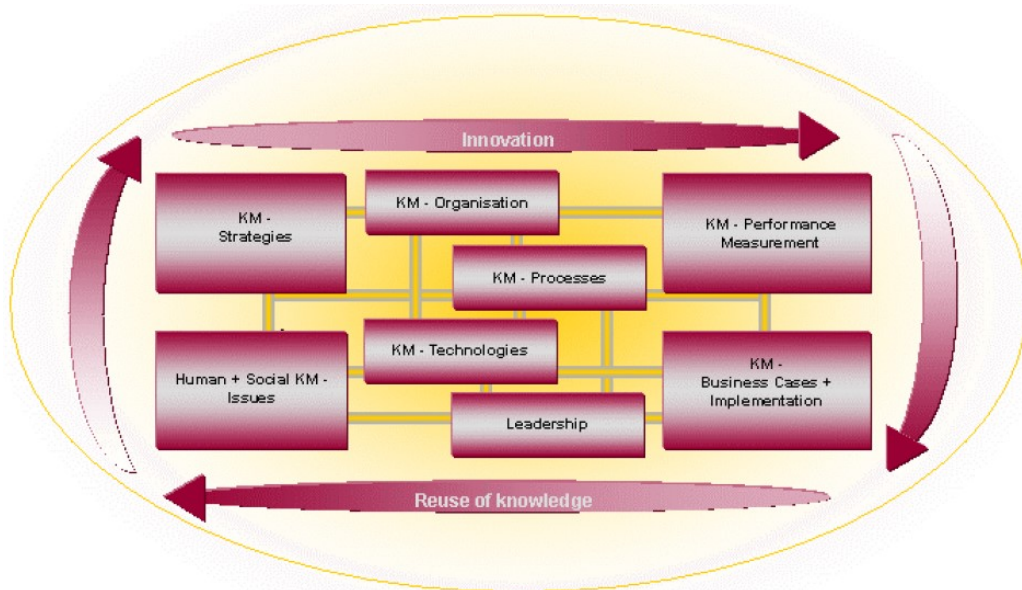
Figure 12: First Draft of European KM Framework[122]

The first draft of the model is built based on the analysis of 140 KM frameworks from all over the world. These frameworks come from researchers, practitioners, consultants and different associations, companies and standards bodies. In the centre of the KMF of any organization should be the business focus with its value-adding processes which has become more inter-organizational due to the fact that business networks with suppliers, partners and clients is a business trend. The processes may include strategy, product/service innovation and development, manufacturing and service delivery, sales and customer support. KM life-cycle is the second layer of EKMF. Identification, creation, storing, sharing and using of knowledge are essential cycles of the KM in order to support the business model of the organization. The third layer consists of the personal (e.g. ambition, skills, behaviour, experience, tools and time management) and organizational (e.g. mission, vision, strategy, measurement, design of processes and organizational structures, knowledge assets) knowledge capabilities which enable KM life-cycle.

Typically, a framework is built up into a pictorial representation which serves as an aide-memoire for implementing KM within an organization, helping users to position individual KM initiatives with within a wider context. The latest version of the EKMF is developed on the basis of empirical and practical research coming from experts and organization from all over Europe and other countries in the world as well is given in Figure 13.

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[122] Source: European KM Forum (2000-2002), p. 17.
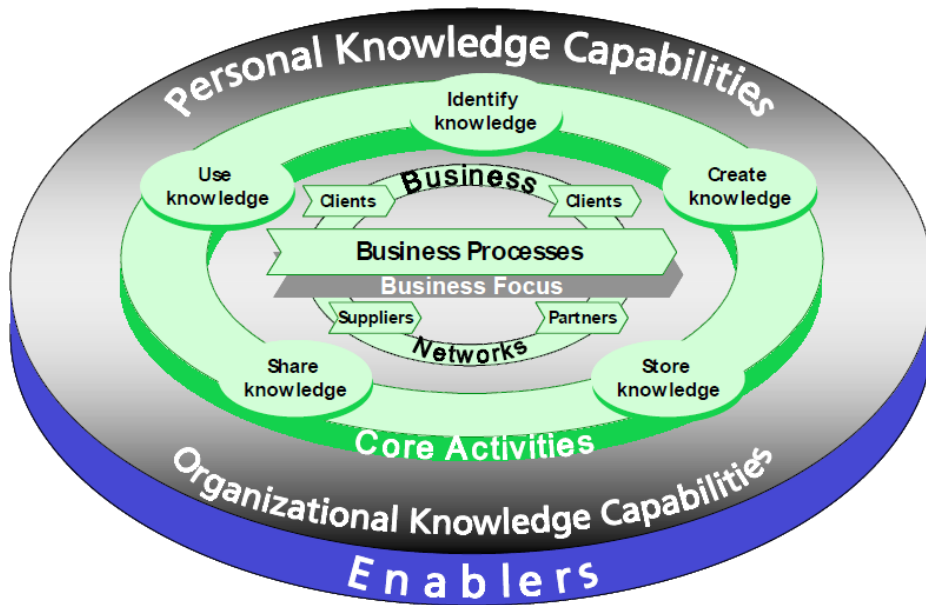
Figure 13: Latest Version of European KM Framework[123]

The next Framework presented in Figure 14 is the Asian Productivity KM Framework. As shown in Figure 14, people, processes, technology and leadership are the accelerators that help to identify and comprehend how important they are for the KM.
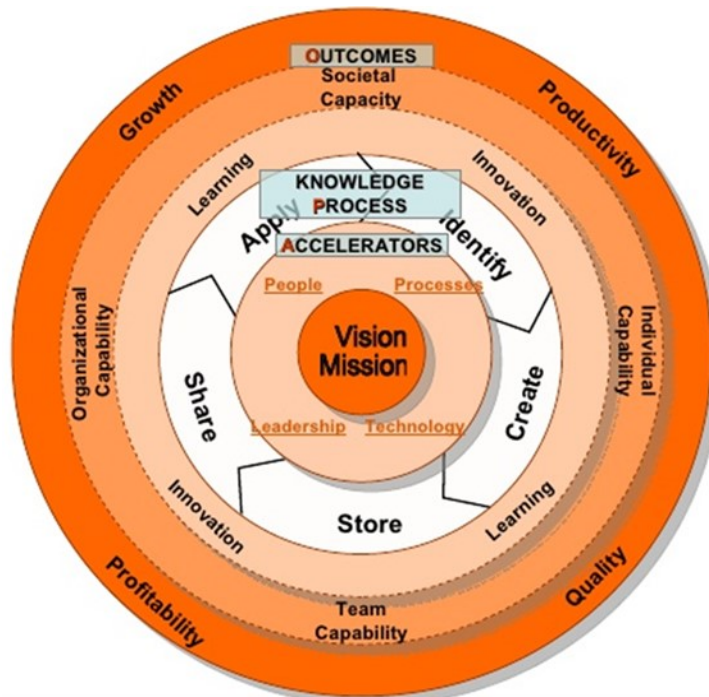
Figure 14: Asian Productivity Organization KM Framework[124]

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[123] Source: European Committee for Standardization (2004), p. 7.
[124] Source: APO (2010), p. 28 slightly modified by Sensuse, D.I.; Rohajawati, S. (2013), p. 26.

The five processes of the KM life-cycle proposed by APO provide an evaluation of existing KM practices which might be improved during KM implementation. Identify, create, store, share and apply are the five processes that the KM life-cycle developed by APO contains. The critical success variables: accelerators, vision and mission support the five knowledge processes. The effectiveness of these five processes can be measured and the results represent the outcomes of the KM efforts. The outcomes of the measurement must indicate enhancement of learning and innovation. Learning and innovation themselves boost individual, group, organizational and societal competencies. This leads to amelioration and higher quality of products, services, and as a result increase of profitability and growth.

To create a proper KM framework requires experience and predefined goals. Organizations must be aware of helpful tools and guidelines that facilitate the establishment of a KM framework. In this context, a list of principles and KM navigational aids is suggested by Allee. Table 6 shows how diverse knowledge and its navigational aids can be. In the last column of this table some examples of KM implementation from the most known companies are included.

Table 6: KM Principles and Navigational Aids[125]

KM principles	KM navigational aids	Description	Example
Knowledge is messy	A north star	Represents the purpose, sense of identity and core principles that guide an organization. Without a north start for knowledge, it's impossible to focus on what is needed.	Buckman Laboratories, Canadian Imperial Bank of Commerce, Chevron, Philip Morris, Monsanto, Dow Chemical, Owens Corning, Motorola and General Motors (additionally implemented the TQM).
Knowledge is self-organising	The crew	Knowledge is embodied in people. It's impossible to talk about knowledge without addressing the way people work and learn together, grow in knowledge individually and collectively. Companies serious about knowledge support continuous learning through Discovery Centres, Leading Journal publishing of results, knowledge-sharing centres, etc.	Owens Corning, Genentech, Federal Express, Ernst & Young, Lotus Development.
Knowledge seeks community	Maps and guides	Knowledge-based organizations seek guides, maps and pathways for building across multiple performance levels. Companies want to know where and how to access knowledge, therefore, they support the creation, acquisition, sharing and renewal of knowledge.	Chevron, Hughes Space & Communication, McKinsey & Company, Lotus Notes,
Knowledge travels via language	Sound vessels	There must be vehicles or vessels to support knowledge exploration, such as: technology support (databases, information systems, communication technologies, web, Email), equipment (groupware, whiteboards, videoconferencing), tools (job aids, knowledge maps), physical structures (learning centres, libraries, meeting rooms).	U.S. West, Silicon Graphic (intranet).
The more your pin-down knowledge, the more it slips away	Feedback and measurement	There must be ways to assess whether you are on course or not. Measurements help gauge and manage knowledge assets, they support continuous improvement.	Dow Chemical (6-step process for managing intellectual assets), Canadian Imperial Bank of Commerce (3-elements of IC: human, customer and structural capital), Pacific Bell and HP (calculate value-added knowledge in products and services), Skandia (knowledge scorecard that measures learning and productivity).

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[125] Source: Allee, V. (2001), pp. 1-5.

Continuation of Table 6: KM Principles and Navigational Aids

Looser is better	
There is no one solution	
Knowledge doesn't grow for ever	
No one is in charge	
You can't impose rules and systems	
There is no silver bullet	
How you define knowledge determines how you manage it	

3.2 Knowledge Management Challenges

On top of the list stands ''employees have no time for KM'' (41%), followed by the ''missing of knowledge sharing culture'' (37%) and the ''lack of understanding KM and its benefits'' (30%). With almost half of the respondents rating employees have no time for KM and 37% saying that there is no knowledge sharing culture, organizations have a lot of work to do for KM. While technology doesn't seem to be a problem, understanding the value of knowledge workers and grasping the meaning of KM benefits is a threatening challenge. In the top five challenges is also the measurement issue of KM. Other difficulties include insufficient resources to structure and update repositories, insufficient validating mechanisms, thus poor quality of the content, lack of context in many documents, as well as no rewarding systems for employees who encourage and support knowledge sharing. The reasons behind these challenges are related first to the ability of senior management in recognising the importance of KM and its power to tackle strategic issues.[126] Suresh's results are supported by other researchers too. Figure 15 shows a graphical presentation of the all the major organizational challenges of KM as suggested by Suresh.

Challenge	Percentage
Employees have no time for KM	41%
No knowledge sharing culture	37%
Lack of understanding KM and its benefits	30%
Inability to measure financial KM benefits	25%
Lack of skill in KM techniques	23%
Organisations' processes not KM-designed	22%
Lack of funding for KM	22%
Lack of incentives/rewards for sharing	20%
Not started KM implementation	19%
Lack of appropriate technology	17%
Lack of top management commitment	14%
No challenges encountered	4%

Figure 15: KM Organizational Challenges[127]

Promoting the knowledge sharing culture, convincing employees of cultural diversity to participate and to apply KM, combining all different employee positions and roles in one KM oriented goal, managing a vast amount of data deriving from multidisciplinary backgrounds, and measuring their effect add to KM and as a result to the assessment challenges.

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[126] Refer to Larsen, M.H.; Pedersen, M.K. (2001), pp. 1-2.
[127] Source: Suresh, R. (2002), p. 16 (slightly modified).

Additional barriers to KM may be related mostly to the existing culture in the organization and its effect on KM and KMA. In the era of globalization, intercultural management must be included in the KM processes in order to prevent mishaps on time during the implementation phase of KM. What is most difficult in this case is to identify and assess indicators and factors affected by the knowledge culture established in the organization. A list of barriers of this kind is provided by European Committee for Standardization.[128] So far, there is little research that focuses on the risks generated by knowledge workers or organizational KM. Taking into account that there is need for risk management, organizations should start implementing in their assessment also the Knowledge Risk (KR) criteria and designate indicators for KR measurement. Knowledge-based risks indicate how successful knowledge oriented organizations are and how strict they should be in considering both benefits and risks of KM. Managing and measuring knowledge-based risks is as beneficial as it is the KM programme itself. Bad personal management, incorrectly qualified employees, and high personnel fluctuations can significantly restrict the know-how flow within the organization[129]. KR can be related to both human and structural knowledge as illustrated through Figure 16.
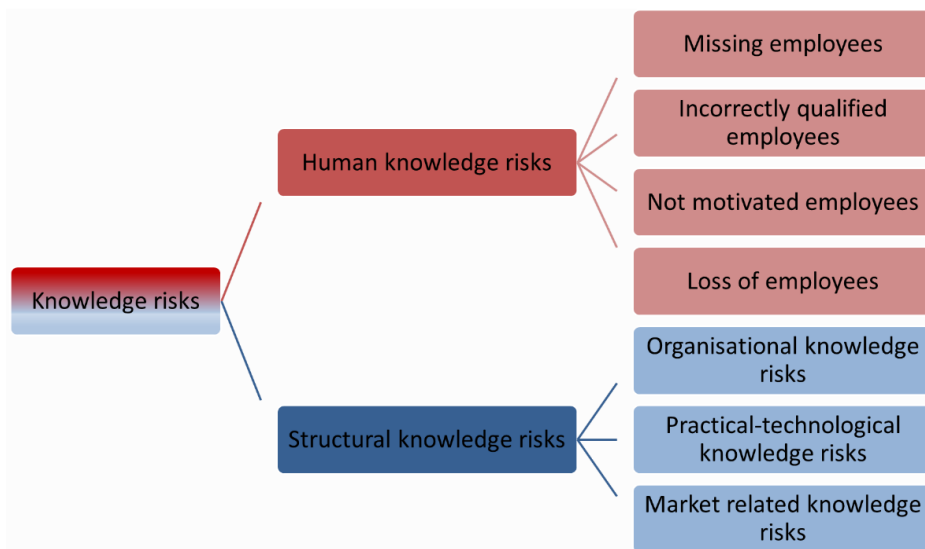
Figure 16: Types of Knowledge Risks[130]

Skyrme[131] pinpoints additional challenges like the KM integration with organization goals and strategy, embedding into knowledge worker's routine, information overload issues where filters and refining are required, harnessing networks via communities and social capital, collaborative technologies that work with humans, as well as openness and trust which must be value-driven. Nevertheless, research shows that despite many challenges, there are many KM benefits identified so far. What is most important, is the fact that the organizations themselves have started to be aware of these KM benefits.

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[128] Refer to European Committee for Standardization (2004a), p. 7.
[129] Refer to Oberschmid, H.; Koller, S. (2007), p. 133.
[130] Source: Oberschmid, H.; Koller, S. (2007), p. 132 (slightly modified).
[131] Refer to Skyrme, D.J. (2003), p. 27.

3.3 Knowledge Management Benefits

'' The most valuable asset of a 21st-century institution, whether business or non-business, is its knowledge workers and their productivity."[132]

The economy, businesses and politics nowadays are strongly dependent and fully operating based on knowledge and KM capabilities. KM is useful because it places a focus on knowledge as an actual asset. Firms can better protect and exploit what they know, with the main aim to improve and focus knowledge development efforts to match their needs. The challenge of the next 5-10 years will be to improve the productivity of knowledge workers through technology, training and organizational change. Knowledge workers in industrialized economies have increased almost by 50% from 1984 until 2014. In the UK for example, knowledge workers have increased in number from 31% in 1984 of the total workforce share to 45% in 2014. Nordic countries, Switzerland and Netherlands have a much higher and faster growth of knowledge workers share in the total global force. [133] Among over 1650 executives who participated in the Economist Intelligence Unit for the Foresight 2020 study, a vast majority accept knowledge workers will be their most valuable asset of competitive advantage in 2020, in both sales and KM. In the survey, 43 % out of 1650 executives consider KM an area of activity that offers the greatest potential for productivity gains in 2020. KM is followed by customer service (35%) as the second most potential activity; operations and production processes and strategy and business development (29% each) third and fourth; and marketing and sales (28%) as the fifth activity with great potential to increase productivity gains until 2020. IT organizations expect KM and customer service to lead the industry towards improved performance. Some of the organizations that early recognized the economic benefit of KM and invested regardless the high costs were Buckman Laboratories who spent 2.5% of its revenues on KM, Ernst & Young with about 6% and McKinsey & Co. with about 10% of its revenues invested in KM[134]. In this context, many companies have already created their knowledge repositories. The most popular companies listed are Anderson's Knowledge Xchange, Booz Allen & Hamilton's Knowledge On-Line, CAP Gemini's Knowledge Galaxy, Ernst & Young's Centre for Business Knowledge, and Monsanto's Knowledge Management Architecture.[135]

Although some of the organizations have already established the role of a Chief Knowledge Officer[136], most organizations do not usually easily invest in KM[137]. The reason behind is the fact that KM's proper implementation can be very expensive and too complex. Another reason as Frost explains is also the difficulty in determining a specific measurable Return on Investment (ROI). Nevertheless, there are many types of knowledge that companies can and should manage, dependent on their performance and expectations. Davenport et al. showed that among 31 American companies that

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[132] Drucker, P.F.; Maciariello, J.A. (2008), p. 191.
[133] Refer to Brinkley, I. (2006), pp. 18-19.
[134] Davenport, T.H. et al. (1997), p. 12.
[135] Malhotra, Y. (2000), p. 39.
[136] Translated from Probst, G.J.B.; Romhardt, K. (1997, 2002), p. 2.
[137] Frost, A. (2011).

participated in their study, the types of knowledge to be managed can cover R&D, sales, and production issues.

KM offers help for the companies in different aspects of knowledge assets. Smooth out the transition times from those retiring to their successors, minimize the loss[138] of organisational memory due to retirement and depreciation, and identify knowledge resources and areas that are potential for success[139] are some of the aspects where KM is beneficial.

Other benefits of KM include improved customer service, better product quality, reduced product development time, minimized overhead costs[140], increased retention rate of employees, and encouraged innovation[141]. Owen describes in Table 7 benefits in three different levels.

Table 7: KM Benefits to People and Organizations[142]

Employees	CoPs	Organizations
Better decision making and problem solving strategy	Professional skills development	Helps drive strategy
Employees are kept up to date	Peer-to-peer mentoring promotion	Quick problem solution
Existence of community bonds within the organization,	More effective networking and collaboration	Best practices principle
More challenges and opportunities to contribute are provided	Development of a professional code of ethics that members can adhere to	Improvement of knowledge embedded in products and services
	Develops a common language	Increased opportunities for innovation
		Better competition strategy
		Enhances organizational memory

KM is obviously related to organizational competitive advantages and successful profit-generating performance. This is possible through timely business decisions thanks to the availability of the right knowledge at the right time with the right employee or team. KM is a clear benefit provider to individual employees, CoPs and to the organization.

Yu et al.[143] prefer to divide the KM benefits into two groups: tangible and intangible. Tangible benefits can give the organization benefits with respect to time and cost

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[138] Refer to Baskerville, R.; Dulipovici, A. (2006), p. 88.
[139] Refer to Owen, J. (2011), p. 4.
[140] Refer to Bhojaraju, G. (2005), p. 39.
[141] Refer to CTM (2013), p. 23.
[142] Source: own table based on Owen, J. (2011), p. 25.
[143] Refer to Yu, W. et al. (2006), pp. 124-126.

reduction as well as man-hour saving. This is possible through CoPs in the case of problem solving process. Intangible benefits can offer better reputation of the organization, functional and updated knowledge repository, improved knowledge sharing culture, and growth of organizational knowledge. Yu et al. found out that the implementation of KM in an engineering consulting firm can save traditional problem solving (meaning no KM available) more than 60% of the three tangible benefits: cost (ca. 87%), time (63%), and man-hour (ca. 74%). To summarize, a list overview of the KM benefits is provided as follows.

1. Effective/efficient use of knowledge.
2. Minimized production time.
3. Minimized production and maintenance costs.
4. Better new and faster access to the market.
5. Lower labour costs.
6. Lower training costs.
7. Reduced time loss and efforts by decreasing number of meetings.
8. Reduced transportation and face-to-face meetings costs.
9. Higher revenues.
10. Higher profit.
11. Influenced balance sheet (profit and loss statements).
12. Decreased bank debts.
13. Improved market share.
14. Identified new markets.
15. Increased productivity.
16. Increased quality.
17. Increased innovation.
18. Coherent responses.
19. Minimized re-invention.
20. Strengthened role of individual staff as knowledge workers.
21. Increased intellectual capital, hence higher future competitiveness.
22. Better know-how, who's doing what.
23. Better relationships.
24. Authoritative advice.

Top-management, Chief Knowledge Officers and employees should bear in mind though that all these benefits cannot be achieved instantly, never in less than 12 months.[144] It takes 18 to 36 months[145] or occasionally even longer for an implemented KM program at the enterprise level, to show increased ROI. There are also many cases when the benefits are not realized[146]. This may happen due to technical problems, lack of time, complexity, little support from senior management, lack of training, or users do not see any personal benefit from KM.

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[144] Refer to Caldwell, F. (2000) cited in DON (2001), p. 7.
[145] Refer to DON (2001), p. 7.
[146] Refer to Skyrme, D.J. (2001), p. 16.

According to the KPMG survey conducted in 1999, the main reason why benefits are not achieved is the poor communication. Internal communication seems to be a big problem for 55% out of 315 European executives[147]. This verifies again how strong and barrier-rich the lack of communication between functions in the company is. About 91% of European manufacturing executives who participated in the Economist Intelligence Unit survey, admit that face-to-face meetings remain the most desirable and efficient tool for sharing experience and knowledge. Other results from the survey show that 47% of the respondents do not know the real extent of the intellectual property residing in their company. Knowledge development, KM and KM performance assessment can cumulatively result in qualitative benefits like:

- Learn from the past mistakes and successes.
- Better exploit existing knowledge assets by re-deploying them (e.g. multipurpose use and transfer of knowledge from one department to another, modify knowledge from a past process to create a new solution).
- Promote a long-term focus on developing the most relevant competencies and skills.
- Remove obsolete knowledge.
- Advanced innovation.
- Enhance protection ability of key knowledge and competencies from being lost or copied.
- Help make a business case for implementation.
- Provide feedback to improve the implementation steps.
- Provide a target/goal.
- Develop LL and help learning from the effort.
- Measure the value of investment decision and the LL.
- Develop benchmark for future comparisons.

KM systems supposed to collect and store knowledge can be devaluated over time. The reasons behind are drawbacks like high maintenance costs, not enough stuff, high amount of unorganized knowledge data, low employee interest to search for relevant information, and outdated knowledge. In this context, KM projects need continuous update and a structure that is well aligned to the most recent business development goals and technological development. Mainly supported in the new KM era is the network and connections between employees of vertical and horizontal positions. Such connections make knowledge flow more dynamically. As a result more tacit knowledge is captured, evaluated, applied, optimized and shared. Some of the international organizations that have already implemented and continuously invested in KM and KMA including a brief KM story when available are shortly introduced.

1. BP – Virtual team working (e.g. videoconferences), prompt solutions of operational problems. *''The KM talked with every BP business unit worldwide carrying out ''engagements'' to create awareness and develop expectations*

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[147] Refer to EIU (2007), pp. 4-9.

across the company" – Chris Collison, formerly in BP's knowledge team. [148] BP has a team of coaches to facilitate the effective use of sophisticated telecommunications infrastructure worldwide consisting of real time video via satellite.

2. Chevron – Introduced LL for its drilling processes which lead to fewer errors, less ''reinventing the wheel'' time, and waste savings in its drilling operations. KM reduced the operating costs by more than $2 billion per year during 2004-2010[149].

3. HP – Faster product development and new products to the market. Hewlett-Packard pre-empted many potential support calls by alerting its customers to most frequently asked questions and providing solutions through a Lotus Notes database. HP reduced the cost of answering customer calls by 50% in two years and hired less technically-experienced support analysts.

4. Texas Instruments - Focused on increasing revenues through licensing of patents and intellectual property. In 1995 TI reported $200 million earnings, more than half its total profit from patent licensing.

5. World Bank – Uses learning and sharing of knowledge as the main criteria for the annual job performance review.[150]

6. Hoffman La Roche – Reduced costs and time to achieve regulatory approvals for new drugs.

7. ICL Finland – Saved time in terms of finding docs and files which made teaching of new project members a lot easier.

8. P&G – Connect + Develop strategy aiming to acquire at least 50% of its innovations from outside the company via a website for customers to submit ideas. The intelligence search engine consists of a group of people around the world who act as corporate match-makers. The IT platform serves as a sharing platform of technology briefs with its main suppliers.

9. Red Bull Technology – Team Center Engineering, a life-cycle management system which captures the mass of product data generated by the company. The system allows data relating to materials, components and designs for each car to be broken down and viewed on screen. This efficient exchange of knowledge and information facilitates the rapid design and development of thousands of new components that the company should introduce each season.[151]

10. Mercedes-Benz - Customer Assistance Center in Maastricht, Netherlands handles all customer needs in 17 EU countries, 12 languages, 24 hours a day, 365 days a year via the KM-based IT solution called BRAiN (Backbone Repository for Archiving Information). BRAiN allows employees to share and retrieve knowledge related to a specific vehicle, country or market. This tool lead to a quick roll-out within the organization and to minimized maintenance.

11. SIEMENS AG – Corporate Knowledge Management to ensure all of Siemens people access to company's pool of knowledge, to be more efficient and to generate greater benefits for customers, to improve EVA, to learn faster and to

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[148] Refer to Skyrme, D.J. (2003), p.16.
[149] Refer to Armacost, R. L. (2011), p. 6.
[150] Refer to Liebowitz, J.; Chen, Y. (2003), p. 409.
[151] Refer to EIU (2007), p. 9.

better focus on developing new products and services through the innovative competence of Siemens employees[152].

12. Monsanto Company – Knowledge Management Architecture aiming at leveraging collective intellect and at creating value. After many decentralization steps that lead to knowledge diffusion, Monsanto realized that short decision cycles are advantageous to global competition. Thus, company's knowledge happening in the strategic CoPs, lead to more educated decisions. CoPs create insight knowledge which then becomes the intellectual capital ready to increase the company's value via updating/refreshing through learning. Innovations were brought more quickly to the market, operational efficiency and customer service improved, profits higher, value better and more new product offerings.

13. Price Waterhouse – *''My three most important priorities? Communication, communication, communication.''* – Paul Pederson, KM leader at Price Waterhouse[153].

14. Ernst & Young – In the need of capturing-codification and storing-sharing knowledge, Lotus Notes was selected as a primary technological platform and was successfully implemented. The company has 22 different knowledge networks facilitators, managers of several new knowledge-oriented organizations that create and distribute knowledge, a Chief Knowledge Officer, and many new committees to prioritize knowledge projects and set knowledge strategy.

15. KPMG International – Uses the advanced global KMS called KWORLD which is an online messaging, collaboration and knowledge-sharing platform. It is KPMG's digital nervous system for which 100 million dollars were invested over one year. It allows professional workers to conduct conferences, public exchanges, access global and country specific firm information, as well as locate customized and filtered external and internal news.

An extended list of successfully KM implemented[154] can be found at www.kmworld.com/Articles/Editorial/Features/KMWorld-100-COMPANIES-That-Matter-in-Knowledge-Management-109344.aspx[155].

Another list can be found in the D3.1 Report of European KM Forum at www.providersedge.com/docs/km_articles/Standardised_KM_Implementation.pdf[156].

The outcomes of the KM implementation in these companies show that all of them have to do with the knowledge sharing culture. KM relies upon information technologies but is not an IT itself. KM is a human-driven knowledge tool that supports strategic objectives and decision-making towards long term survival. KM benefits are usually related to intangible assets and need to be measured. Benefits generated by knowledge workers and a KM project implementation cannot always be identified with figures shown in balance sheets. Different to tangible assets, measuring intangible assets can be a tricky task for organizations. The challenge is related to the difficulties in measuring indicators of performance. Tangible assets such as land, buildings, factory equipment, cash,

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[152] Refer to Krause, H. (2001), p. 5.
[153] Refer to Skyrme, D.J. (2003), p. 15.
[154] Haimila, S. (2016).
[155] accessed: 15.03.2016
[156] accessed: 19.03.2016

investments, etc. can be easily measured through the information registered in balance sheets or accounting assessments. Measuring intangible assets such as goodwill, trademark value, patents, copyrights, and knowledge that generates them is not always based on financial metrics.

3.4 Measuring Intangible Assets in Organizations

Sveiby[157] explains that to measure intangible assets means that organizations are motivated: to monitor and control their performance (Key Performance Indicators (KPIs)); to evaluate their business through acquiring or selling (industry rules-of-thumb like $ per click, $ per client, etc.); to justify, PR through reports to stakeholders (IC, EVA); to make decisions through guiding investments; and to learn through uncovering hidden values (SC and Direct IC methods). According to Sveiby's Figure 17, the four main approaches that can be used to measure intangibles are: DIC (Direct Intellectual Capital methods), MCM (Market Capitalization methods), ROA (Return on Assets methods) and SC (Scorecard methods). Slightly different to Sveiby, Yu et al.[158] speak about three main generations of intellectual asset classes as developed by Chang and Wang:

1. First generation inductive measures (Skandia Navigator, BSC, and IAM).
2. Second generation deductive measures (ICI, ICA).
3. Financial deductive measures (Market-to-book ratio, Tobin's q, EVA).

Among all the no-$ and $ valuation models, the most preferred ones to measure intangible assets are the no-$ scorecard models. It is very important to mention that fact that organization must be careful in choosing the method that corresponds to their objectives. In this context, there are usually two main criteria to take into account[159]: does the model deliver $-valuations or are there indicators to describe the valuation of intellectual capital, and does the model provide a holistic approach of IC or are specific components analysed individually. The $-valuations are suitable for merger and acquisitions, for stock market valuations, and can be used for comparison between companies within the same industry. The disadvantage is that they can be superficial due to the expression of every indicator in monetary terms.

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[157] Sveiby, K.E. (2001).
[158] Refer to Referring Chang, C.Y.; Wang, M.T. (2005) cited in Yu, W. et al. (2006), p. 124.
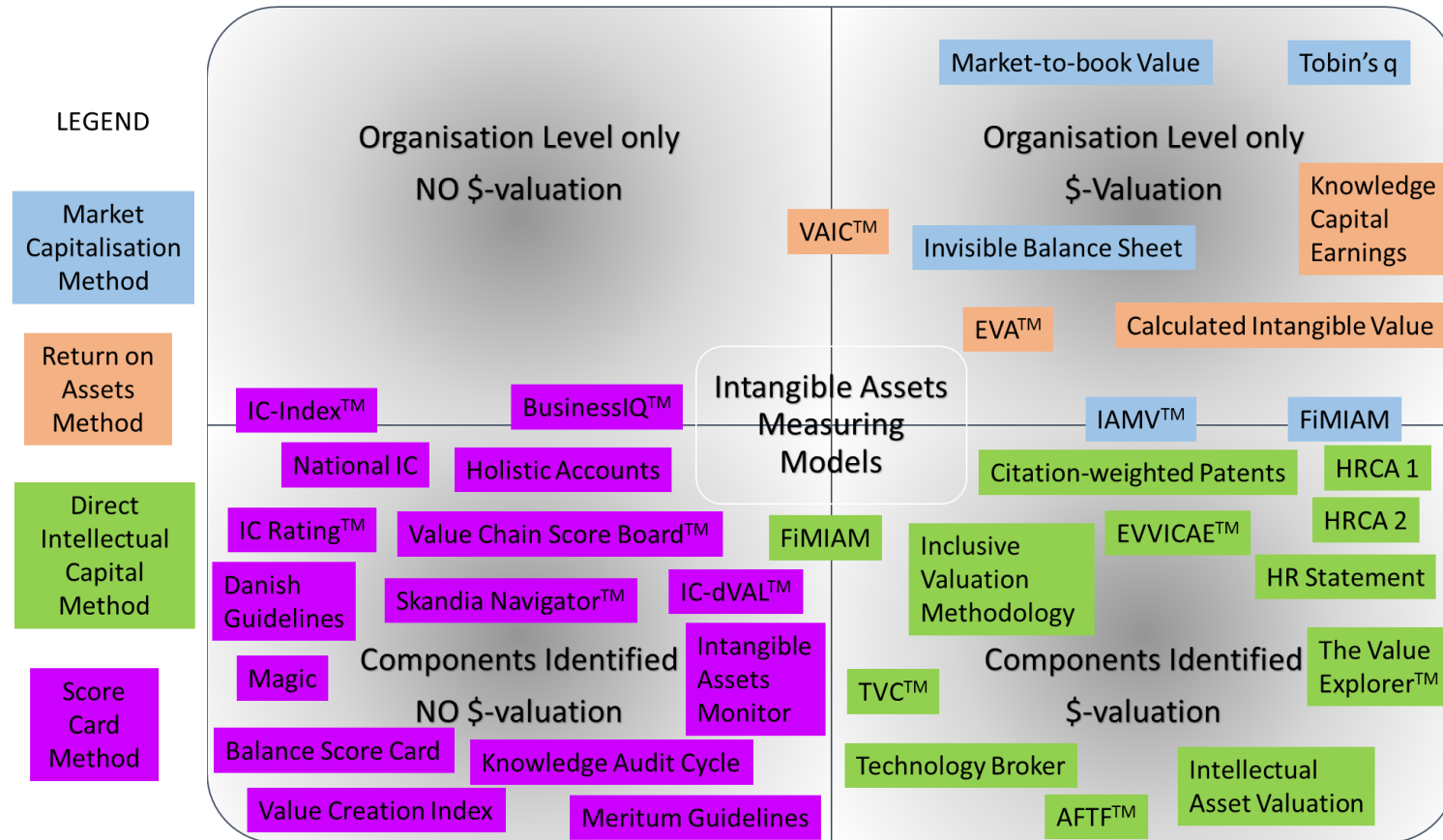[159] Refer to Winkler, R. et al. (2007), p. 121.

Figure 17: Intangible Assets Measuring Models[160]

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[160] Source: Based on Sveiby, K.E. (2001), slightly modified.

The no $-valuations offer a broader and much more comprehensive picture of the health of an organization and are applicable at any level of the organization. These models are adapt for non-profit organizations, internal departments and public sector. The disadvantage is the context of the indicators which has to be customized according to the organization and purposes that they are being applied for. Unfortunately, this leads to comparisons being difficult to make, because data generated are hard to analyse and communicate. A typical no-$ IC model used very often as a reference example comes from the Swedish insurance company Skandia, who uses Skandia Navigator to quantify its IC. This approach consists of five perspectives: finances, customers, processes, employees and renewal and development focus. The five indicators classes published biannually help to understand the organization and the process of value creation in each area. Skandia Navigator became familiar and frequently used to describe intangible assets of different organizations.

Germany and Austria are a good example of countries implementing Skandia Navigator approach in SMEs and especially HEIs (High Educational Institutions). Since 2007, HEIs in Austria submit an Intellectual Capital Statement (ICS) to the Federal Ministry of Education, Science and Culture in order to communicate knowledge and competency-oriented indicators and to help the ministry to strategically supervise public funds. ICS helps to visualize intangible factors that create value and can provide a platform for more efficient decision-making. Prior to implementing the ICS, it is very important to define whether the measurements will focus on the overall organization, or on some parts, departments, and processes only. One of the best HEI example of ICS application including measurement indicators (see Annex) in Austria is the Chair of Economics- and Business Management from Montanuniversität in Leoben that publishes regularly an ICS annual report since 2001.[161][162] ICS offers additional information about intangible assets for the balance sheet.

The additional goal of ICS is to evaluate the achieved performance and present quantitatively and qualitatively knowledge driven business processes and outcome.[163] Business core processes in the case of a University for example are divided into two groups: teaching and further qualification and R&D.[164][165] The results collected serve for the evaluation step which is possible through different evaluation methods but the most preferred one seem to be the potential-portfolio. This approach can display which impact factors should be further analysed, developed or stabilized and at the same time which impact factors do not need further action.[166]

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[161] Refer to Biedermann, H. (2003), p. 490.
[162] Refer to Lind-Braucher, S.; Kohla, H. (2013), p. 305.
[163] Refer to Biedermann, H. (2003), p. 486.
[164] Refer to Lind-Braucher, S. (2015), p. 4.
[165] Refer to Bundeskanzleramt RIS (2016).
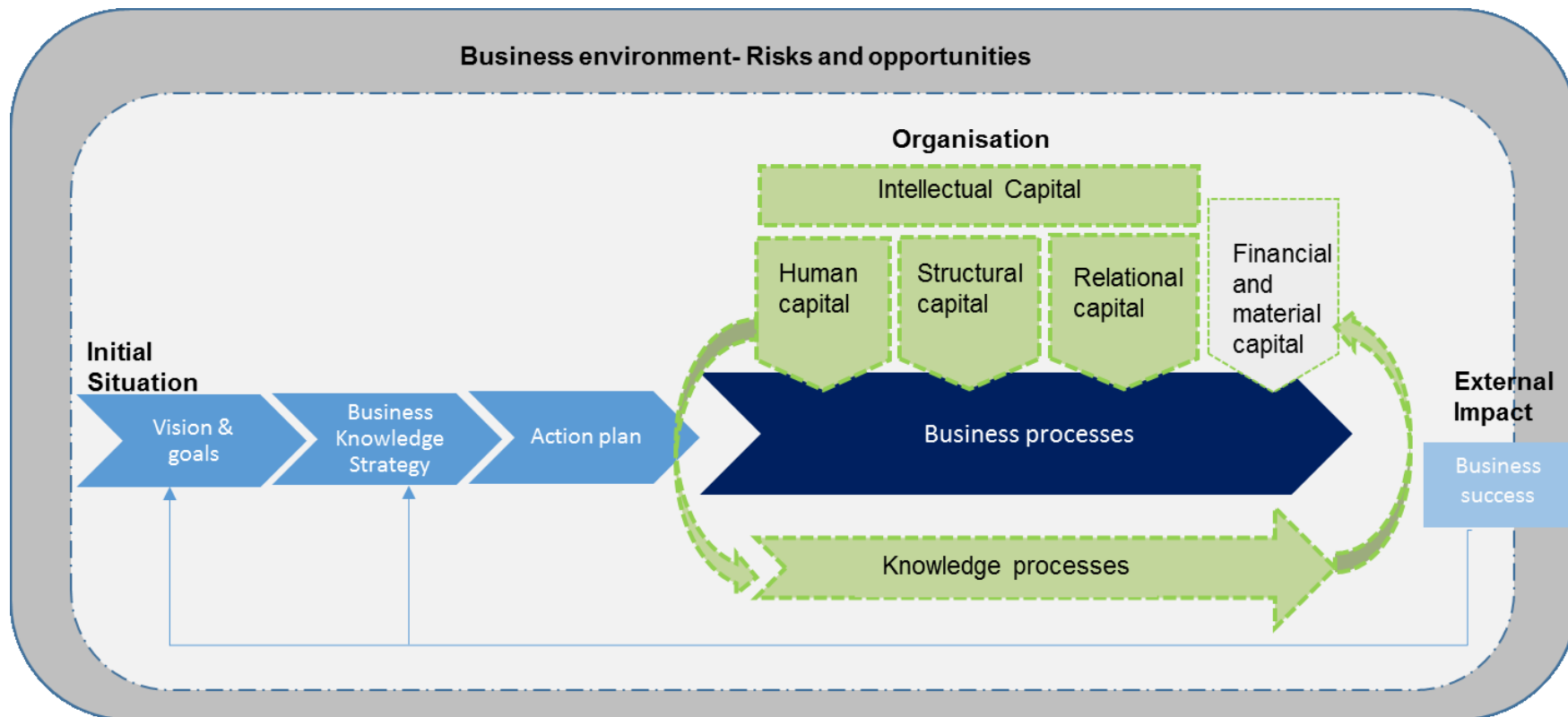[166] Refer to Munjau, G. (2016).

Figure 18: Intellectual Capital Statement (AT, DE)[167]

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[167] Source: Alwert, K. et al. (2008), p. 10 (translated and slightly modified).

ICS presented in Figure 18 focuses on three groups of intellectual capital: human, structural and relational. The initial situation includes vision and goals, business knowledge strategy and actions. With the help of business core processes generated by the intellectual capital the outcome defined as the business success with its respective impact can be achieved. All these aspects are described through pre-determined appropriate indicators[168]. The eight steps[169] of the ICS model of measuring intellectual capital include:

1. Business model: business environment, vision, strategy, business successes, business processes.
2. IC: which human/structural and relationship capital is needed for success now and later?
3. Assessment: how do we assess our impact factors with respect to our business operational/strategic perspectives?
4. Measurement: indicators.
5. Impact: intensity and duration of impact.
6. Analysis/Evaluation: strengths and weaknesses.
7. Action-plan: how are knowledge goals reached, how actions will affect the organization, which investments and timeline should be followed, etc.
8. ICS: frame of work and additional contextual information; goal and stakeholder-oriented report that serves as an input extern and as controlling intern; changes are visible in period t+1. A stakeholder-oriented report is related to the level of completion of the overall report. A complete report is only then possible when it is for internal use. A filtered, adapted, and a refined report is in most of the cases only for external use. Filtered reports may increase the bias of the assessment in front of the external reader, which in this case might be any of the stakeholders willing to cooperate, invest or benchmark themselves toward the company that is publishing such a report.

ICS can serve as an internal and external informative communication, but also as a knowledge steering measurement tool towards the defined strategy of an organization.[170] Lind-Braucher and Kohla[171] add that ICS's main focus is to use it as a strategic and regulation instrument of knowledge capital in organizations.

Biedermann[172] suggests helpful steps to follow toward the processes of strategy adaptation and the implementation of ICS. Steps like the definition of the overall strategy and measures, activities and data collection as presented in Figure 18 should help to identify value adding processes that are able to generate competitiveness and that can be regulated by the ICS. Operationalization short-term and monitoring long-term are two action steps that contribute to a dynamic learning perspective.

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[168] Refer to Biedermann, H. (2003), p. 491.
[169] Refer to Alwert, K. et al. (2008), pp. 12-50.
[170] Refer to Biedermann, H. et al. (2002), p. 54.
[171] Refer to Lind-Braucher, S.; Kohla, H. (2013), p. 307 (translated and adapted).
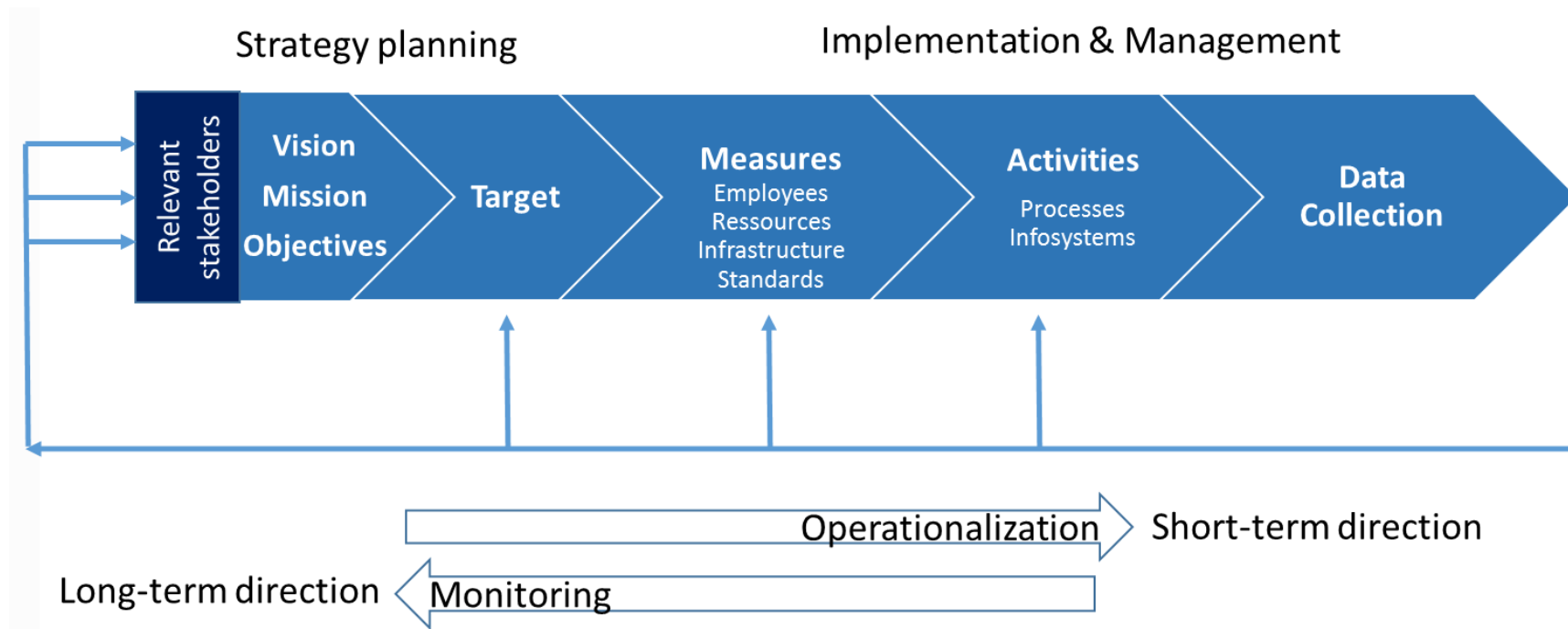[172] Refer to Biedermann, H. (2003), p. 491.

Figure 19: Strategic-operative Control Loop of ICS[173]

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[173] Source: Biedermann, H. (2003), p. 491 (translated and slightly modified).

ICS is a non-normative controlling (development, description and quantification) instrument of knowledge strategy [174] and a promising measurement tool that generates returns and cost savings[175]. Internally, such a report helps to optimize the use of knowledge, and externally it helps to monetize knowledge in order to increase the value of the organization. Nevertheless, some critics are addressed to the model. Manthey[176] for example argues that it is not always possible to verify ICS's efficiency and profitability and is not audited from an independent certified accountant, hence its plausibility is questionable.

According to Yu et al., none of the models discussed earlier give a good picture of benefits generated only by a knowledge management system. All the methods measure intellectual capital only from the corporate level perspective.

Turner and Minonne[177] state that the goal of IC models is to identify, measure and present intangible factors that do not appear in a usual balance sheets. Auer[178] argues that such IC reports have many barriers with which an accurate external benchmarking fails due to the different organizational structures, with corresponding variety of knowledge work and also due to the rejection to publish data that are sensitive for the company. Additionally, according to Auer[179], IC models allow no benchmarking, which can serve almost as a calibration tool for the internal viewpoint[180] of organizations. Mouritsen[181] concluded that although EVA delivers results, they are not interesting in terms of KM and have no strategic value for the organization.

Bontis et al.[182] had a closer look at four knowledge measurement tools: HRA, BSC, EVA, and IC. The authors found out that neither of the models is the best one to recommend. Each model has advantages and disadvantages. Based on the objectives and expectations of the organization, any of the models can be accepted and adapted or denied.

Winkler et al.[183] comment on scorecard models as the most appropriate ones with respect to KM. BSC models give results of measurements deriving from the combination of financial and operational measures. BSC aligns measures with the organization's strategies and is flexible. The main advantage of BSC is the flexibility to adapt according to the organization's needs and the opportunity to extend its content. This means extending from four perspectives: financial, customer, internal processes and innovation, to as much as desired by the applicant and his subject on focus. Auer thinks that BSC is a widely accepted great tool because it is a steering and controlling system functioning good through the combination of strategic and operative planning. This is not the case for IC reports though. IC models contain barriers mostly related to biased assessments

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[174] Refer to Biedermann, H. (2003), p. 496.
[175] Refer to Edvinsson, L.; Kivikas, M. (2007) cited in Ragab, M.A.F.; Arisha, A. (2013), p. 17.
[176] Refer to Manthey, (2015), p. 8.
[177] Refer to Turner, G.; Minonne, C. (2010), p. 162.
[178] Refer to Auer, T. (2010), p. 11.
[179] Refer to Auer, T. (2010), pp. 11-20.
[180] Refer to Biedermann, H. (2003), p. 491.
[181] Refer to Mouritsen, J. (1998), p. 480.
[182] Refer to Bontis, N. et al. (1999), pp. 392–393.
[183] Winkler, R. et al. (2007), p. 121.

due to own interests and overestimation, time and cost efforts, secrecy and reservations, operational priorities.

However, some successful measurement stories from international organizations are available at htttp://www.bestpracticedatabase.com in the Knowledge Management of Internal Best Practices Report[184]. One of the companies mostly cited as a reference model for evaluating intellectual assets is Coca Cola.[185]

Skandia Navigator and the Intangible Asset Monitor[186] measure intellectual capital quantitatively and qualitatively and communicate the results via the ICS. Both models identify and evaluate intellectual capital and provide a holistic view of performance and achievements thanks to the collection of critical measurements. Figure 20 shows a comparison of the relevant scorecard models. In order to evaluate intellectual capital, a structural model is predefined and based on that structure different measurement indicators can be determined. The development of indicators reflects the organization's goal and strategy.

In terms of knowledge assets, there is a critical need for analysing the organization's KM capabilities. The assessment is an essential process of the KM life-cycle which enables companies to monitor progress and successful achievement of the KM objectives and goals. KMA is the tool that challenges organizations to assess current KM practices and benchmark treatments for KM improvement. The quantification method of KM must be affected only by factors deriving from KM activities. KMA helps in systematically assessing and evaluating KM activities with the main aim to improve KM, to identify action options and to derive necessary measures[187]. The next chapter is dedicated to an introduction of KMA discipline with the main objective to build a roadmap for understanding the procedure, contents and criteria based on which knowledge assessment is done.

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[184] Refer to Dalkir, K. (2005), p. 315.
[185] Refer to Dalkir, K. (2005), p. 266.
[186] Refer to Sveiby, E.K. (2001).
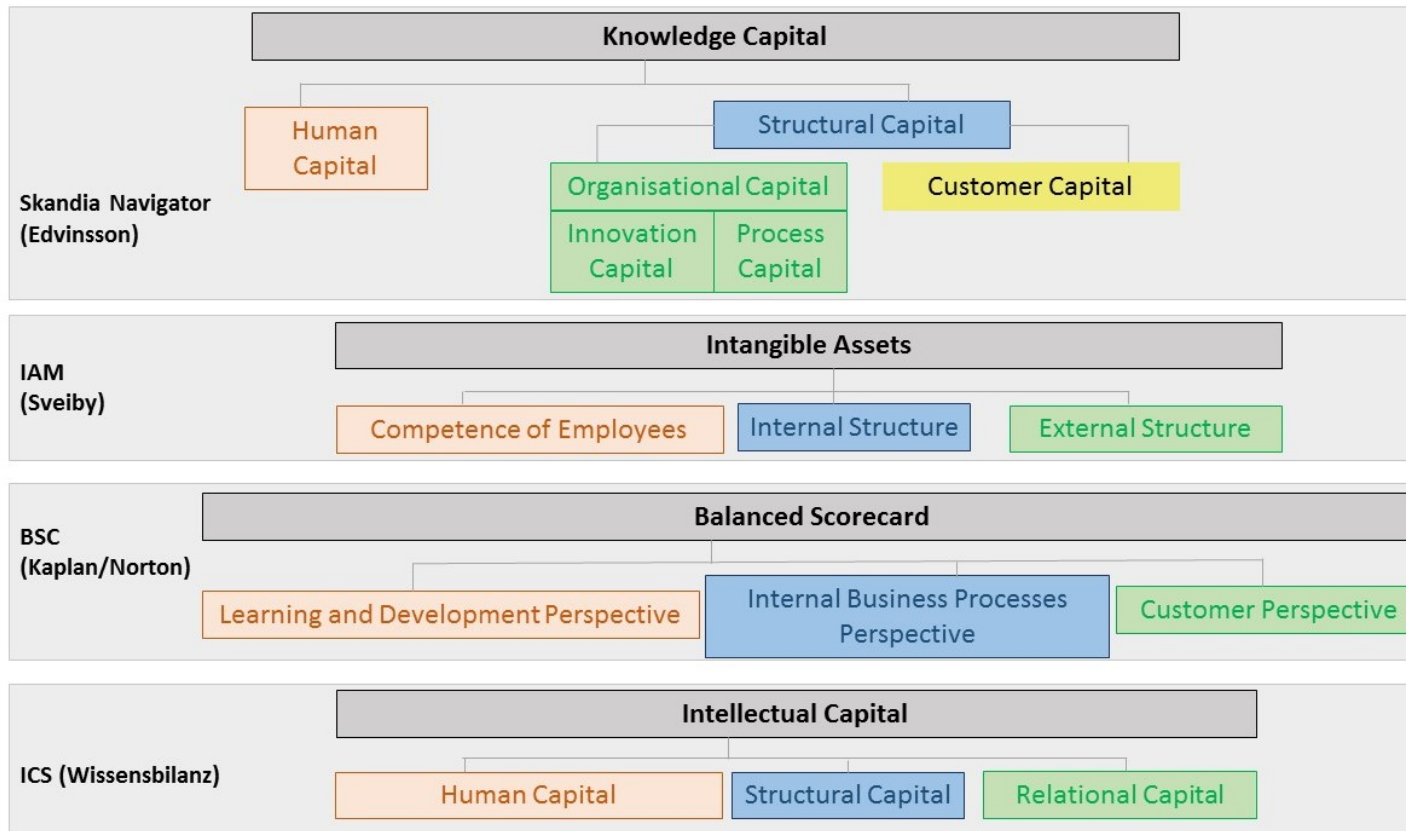[187] Refer to Ditzel, B. et al. (2007a), p. 83.

Figure 20: Comparison of Relevant Scorecard Models[188]

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4 Knowledge Management Assessment

''I shall reconsider human knowledge by starting from the fact that we can know more than we can tell.''[189]

This chapter starts with a brief introduction to the definition of assessment as a single term. Assessment is a form of evaluation that anyone can make based on qualitative or quantitative-based judgement. Assessments can take place at every stage of a learning process and they must remain frequent. Assessments are able to provide feedback which leads to measures of performance.[190] Table 8 presents some of the most common definitions about assessment, among which the assessment in education is commonly referred to.

Table 8: Assessment Definition[191]

Assessment Definition	Author, Year
"Assessment is the collection of relevant information that may be relied on for making decisions. Evaluation is the application of a standard and a decision-making system to assessment data to produce judgments about the amount and adequacy of the learning that has taken place."	Fenton, 1996
''The act of making a judgment about something: the act of assessing something''	http://www.merriam-webster.com (as of 21.05.2016)
''In education, the term assessment refers to the wide variety of methods or tools that educators use to evaluate, measure, and document the academic readiness, learning progress, skill acquisition, or educational needs of students.''	http://edglossary.org, 2015 (as of 21.05.2016)

The definition of assessment together with the previous definition of KM help to quickly grasp the meaning of KMA. However, different researchers define KMA in various ways. Knowledge Management assessment is a systematic analysis of KM capabilities in organizations. KMA assesses the KM performance against world-class practice and identifies the most demanding areas for KM application.[192] Dalkir states: ''Assessment refers to the evaluation of intellectual capital and requires that the organizations define mission-critical knowledge and map current intellectual capital against future knowledge needs.''[193] Additionally Dalkir opines that good metrics can demonstrate whether organizations are growing their knowledge base and profiting from investments in IC or not. Biedermann describes KM assessment as a topic that provides information about

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[189] Polanyi, M. (1983), p. 4.
[190] Race et al. (2005).
[191] Source: own table.
[192] Refer to Dalkir, K. (2005), p. 337.
[193] Dalkir, K. (2005), p. 34.

the profitability, the use and the applicability of knowledge. In order to assess the knowledge in terms of its use for the organizations, the determination of evaluation criteria is necessary.[194] In order to evaluate and compare the performance of KM against organizational goals and best-practice assessment is necessary. KM assessment models are useful because they evaluate where a knowledge-centred organization lies with its KM model with respect to the overall organizational knowledge culture and assists the organizations to develop strategies of moving from ''as-is'' to the ''to-be'' state of their vision[195]. There are two main possible performance assessment methods: qualitative and quantitative. Literature suggests that both qualitative and quantitative data provide the necessary information in assessing the performance of KM application. Quantitative and qualitative data collection that help to assess the maturity level of organizations' KM is done through surveys and/or thorough interviews about knowledge workers, applied technology and knowledge based processes. Such data could come from the innovative capability for example or client satisfaction and productivity measures. Alwert et al. suggest other helpful questions that might help in collecting data for the assessment: which operating figures are currently used; can they possibly be used as indicators for the intellectual capital too; which indicators must be selected because they have strong meaning for important factors of intellectual capital; and which ''current'' values have the indicators and are there time series data.[196] Quantitative methods use numbers and provide hard data to evaluate performance or identify trends, and qualitative methods use the context of a situation such as stories, anecdotes or future scenarios to provide a sense of value. DON[197] explains that qualitative models can measure intangible, while quantitative models can measure tangible benefits of a KM project. Due to more context and meaning, qualitative measures can significantly improve the quality of measures coming from quantitative tools. Quantifying and assessing knowledge is a challenge[198]. Evaluating intellectual capital is a challenge to overcome in KM discipline due to the subtle nature of knowledge as a subject. [199]

Table 9 is an attempt in presenting few statements about KM Assessment as an approach that develops hand in hand with the KM Framework. For meaningful assessments, ideally, before initiating a KM strategy, assessment frameworks that monitor the progress of KM objectives must be elaborated. The lack of knowledge formulated goals, false measurements, and wrong criteria or scale can lead to discontent KM assessment. Most of the statements provide the core message about KMA being a tool that assists organizations in identifying where they are and they could and should be with organizational Knowledge Management.

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[194] Refer to Biedermann, H. (2003), p. 484.
[195] Refer to Dixon, N. (2009).
[196] Alwert, K. et al., (2008).
[197] Refer to DON (2001), p. 20.
[198] Refer to Kanagasabapathy, K.A. et al. (2006), p. 2; Yu, W. et al. (2006), pp. 124-125.
[199] Refer to Baskerville, R.; Dulipovici, A. (2006), p. 97; Probst, G.J.B.; Romhardt, K. (1997, 2002), p. 19.

Table 9: Statements about Knowledge Management Assessment[200]

Statements about Knowledge Management Assessment	Author, Year
''A systematic analysis of your organization's current knowledge management capabilities. It assesses your current performance against world-class practice and identifies critical areas for applying knowledge management.''	Dalkir, 2005, p.337
''A topic that provides information about the profitability, the use and the applicability of knowledge. In order to assess the knowledge in terms of its use for the organizations, the determination of evaluation criteria is necessary.''	Biedermann, 2003, p.484
''The Knowledge Management Assessment and Benchmarking service provides you with an understanding of your current strengths, gaps, and opportunities for intervention in order to introduce a fully operative Knowledge management Framework.''	Knoco Ltd., (2016) (as of 21.05.2016)
''The goal of a Knowledge Management Assessment is to: 1. Assess where the organization is in terms of leveraging explicit and tacit knowledge, collaboration, and the development of new knowledge for innovation. 2. Assist the organization in developing a vision of where they need to be, taking into account 1) the strategy of the organization, and 2) the best practice within their industry. 3. Work with the organization to develop a road map of strategies to get from where they are to their vision.''	Dixon, 2009 (as of 21.05.2016)

Dalkir[201] states that an assessment evaluates intellectual capital under the conditions that mission-critical knowledge is defined and current intellectual capital is mapped against future knowledge needs. According to Mohanta[202], KMA provides organizational benefits that can be related to the identification of weak spots; better understanding of the KM initiative's scope; insights into the world-class KM practices; independent evaluation of KM; exploitation of organizational knowledge; and a clear outcome which emphasizes the areas requiring management attention.

The most important criteria for KM performance assessment is whether indicators measured show that knowledge goes through its core life-cycle processes of sharing and using[203] and whether KM is effective or not. While knowledge goes through its life-cycle processes such as for example creating, sharing and applying, it is very relevant for the assessment to determine selection criteria[204] that reflect organizational goals. The criteria can be related do any of the KM life-cycle issues and indicators. For example, in the case of knowledge sharing the criteria against which the assessment is presented can be linked to how is knowledge shared, how many projects, processes have benefited from it, is shared knowledge old or new, did shared knowledge prevent any risks, etc. Assessing performance indicators or impact factors means to previously define comprehensible measurement principles able to reflect the weak or strong areas of organizational knowledge. For example, if the customer relationship is to be measured

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[200] Source: own table.
[201] Refer to Dalkir, K. (2005), p. 34.
[202] Refer to Mohanta, G.C. (2013), p. 1.
[203] Refer to DON (2001), p. 13.
[204] Refer to Dalkir, K. (2005), p. 43.

as an important driving factor of successful KM, a measurable quantitative indicator that measures this factor[205] must be defined. Probst and Romhardt developed knowledge assessment methods based on high quality normative, strategic and operative knowledge goals. If knowledge goals defined by the organization are vague or abstract, the evaluation results cannot be successful. Figure 21 shows the concept of defining normative, strategic and operative knowledge goals and assessing them respectively. The authors defined three main thesis that derived from this method[206]:

1. ''KM is highly political and needs support from top-management.''
2. ''KM must be attached to the organizational structure and culture.''
3. ''KM is mainly driven through communication technology development.''

		Knowledge goals	Assessment methods
Normative		Create requirements for knowledge based goals in the strategic and operative divisions	Culture analysis
		Aim towards knowledge based company culture	Top-management behaviour observation (e.g. agenda analysis)
		Require support from top-management	Credibility analysis (gap between ''as-is'' and ''to-be'')
Strategic		Content determination of organizational knowledge	Establish an IC statement incl. competence gain + loss and knowledge flow calculation in the areas of core knowledge
		Define the target competence portfolio	Analysis of competence portfolio
		Determine the main lever of the competence structure	Controlling of the most significant knowledge projects
Operative		Translation of normative and strategic knowledge goals into practical	Education controlling with clear learning transfer goals
		Insurance of the adequacy of the interventions related to the respective intervention level	Measuring of system use (e.g. intranet)
			Creation of individual competencies profiles

Figure 21: The Concept of KM Assessment Methods[207]

Companies that implement a KM in stages and pre-define assessment methods of the results like Probst and Romhardt suggest, have a greater chance to succeed in managing and in assessing knowledge. As such, KM projects add value to a business in five potential dimensions: process-customer-human-financial-innovation. In order to perform process-customer-human-financial-innovation-related tasks efficiently and effectively, employees and organizations must implement processes of acquiring,

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[205] Own translation based on Alwert, K. et al., (2008), p. 29.
[206] Translated to English from the original source
[207] Source: Probst, G.J.B.; Romhardt, K. (1997, 2002), p. 20 (translated and slightly modified).

memorizing, and managing knowledge. Knowledge used to perform these tasks must be assessed and one of the primary unwritten KM rules is the ability of individuals to self-assess personal knowledge. SACAT[208] model is for instance a self-assessment computer analysed testing that measures knowledge and produces measurements related to the later performance of an individual. This model provides exclusive benefits due to its ability to detect and identify misinformation and the capability to provide a measure about retaining acquired knowledge. This model does strongly support the certainty of the knowledge that the respondents have. The accuracy of self-assessment tests is of practical importance. The more accurate the self-assessment, the higher and more reliable the quality of performance later. SACAT model is favoured compared to multiple-choice assessment tools because it provides a broader understanding with respect to individual knowledge, misinformed topics, and learning encouragement. The assessment of KM performance is done to check the KM impact on the organization's performance without the need to directly translate the results to business value. [209] Referring to the discourse earlier in this section, the assessment of KM in organizations is related to people, culture, leadership and technology; can be done at normative, strategic and operative level; and is mostly performed through assessment benchmarking questionnaires. The results collected from the questionnaires are then plotted against the KM Maturity Models (KMMM) which provide objective assessment and help in determining at which stage is an organization with its KM project. KMMM are an imperative tool for KM assessment. Some of the KMMMs are described in the next section with an attempt to provide the essential understanding about the way they work and help in managing and measuring knowledge projects.

4.1 Knowledge Management Maturity Models of Assessment

''Assessing knowledge prior to testing performance of a complex task has the advantage of detecting and identifying knowledge deficiencies before they are revealed by errors in performance or other near-accident incidents.''[210]

KM Maturity Models provide a detailed assessment of the relative progress in KM implementation over time. KMMMs are supposed to be applied for different objects of analysis such as for example the organization, business units, and KM systems[211]. To measure something means to assign a number to a characteristic (in our case knowledge) of an object (in our case a person) or event according to a set of rules. The set of rules defines the meaning of the number assigned. For example the multiple-choice test method may be considered as a ''set of rules'' by which the numbers (scores)

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[208] Refer to Hunt, D. (2003), pp. 109-110.
[209] Refer to European Committee for Standardization (2004c), pp. 7-8.
[210] Refer to Hunt, D. (2003), p. 102.
[211] Refer to Ehms, K.; Langen, M. (2002) cited in Pee, L.G.; Kankanhalli, A. (2009), p. 6.

or measurements are produced. As a consequence, knowledge may be operationally defined[212]. There have been several KMMMs developed[213] among which:

1. KMMM™ - APQC, 1996.
2. Siemens' KMMM – Siemens AG, 2000.[214]
3. KM Self-Assessment/Performance Improvement Benchmarking from Learning to Fly - Collison & Parcell, 2011.
4. 5iKM3 KM Maturity Model – TATA Consultancy Services, 2005.
5. Capability Maturity Model Integration (CMMI) – Software Engineering Institute (SEI) at Carnegie Mellon University.
6. K3M – Wisdom Source, 2004.
7. G-KMMM (General KMMM) - Pee and Kankanhalli, 2009.
8. European KM Forum, 2002.
9. KMMM – Asian Productivity Organization (APO), 2010.

Hubert and Lemons published an optimized version of KMMM from APQC as given in Figure 22. They offer a detailed explanation[215] for each of the levels. The five levels are possible through four main processes of KM development known as ad hoc knowledge (strategy), applied knowledge (people), enabling knowledge (processes) and scalable knowledge (content and IT)[216].
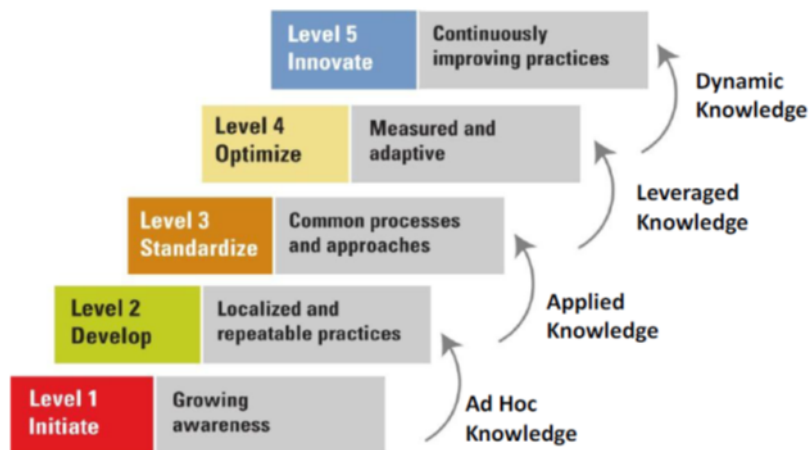
Figure 22: KMMM APQC[217]

In level one, organizations are not familiar with consistent processes or practices for successful KM life-cycle activities. Organizations cross-check their KM performance with the initiating phase of the Maturity Model where the following objectives must be achieved: explain the importance of KM to organization's people so that it relates to them,

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[212] Refer to Hunt, D. (2003), p. 6.
[213] Refer to APO (2010), p. 74; Pee, L.G.; Kankanhalli, A. (2009), pp. 5-12.
[214] Refer to Ehms, K. (2001), p. 1.
[215] Refer to Hubert, C.; Lemons, D. (2010), pp. 1-5.
[216] O'Dell, C. (2015), p. 27.
[217] Source: Based on APQC (2011), p. 2 (slightly modified).

explain the possible benefits of KM, convince key stakeholders and senior management, and look for weak areas where KM could generate benefits.

Level two addresses the definition of KM strategy and its establishment. Organizations must identify business opportunities for knowledge share and transfer. Leadership is important for this phase because it helps with generating buy-in, builds up the support structure for the integrated KM strategy, selects and secures buy-in for business opportunities, tests KM approaches and tools, and finds resources to support KM. Governance and sponsorship are crucial for this phase.

In level three, KM officers deal with KM strategy management. The four assignments are: managing KM approaches and processes, make them standardized and replicable together with pilot opportunities design and implementations, capture LLs to facilitate CIP, and communicating and marketing the KM methodologies. The tools that help in KM strategy management are: integrating external best practices, develop proof of concept by embedding standard KM approaches into the daily workflow, developing competencies and capture/sharing LL.

Level four concerns the expansion of KM initiatives at the organizational level. The expansion strategy, providing standard KM methodologies, expanding new divisions of functional areas, managing growth, controlling chaos and confusion, continuing to communicate and market the KM methodologies are essential at this stage of KMMM.

In level five, KM officers optimize KM approaches and processes in order to improve core business processes, to achieve target outcomes and breakthrough innovation. Proactive and institutionalized (individual, departmental/functional, and organizational) CIP activities to close gaps between ''as-is'' and ''to-be'' KM performance are necessary. On this level organizations start to count on KM capabilities. Embed, monitor standard KM methodologies in the business model, align performance evaluation and recognition with KM strategy, and balance the organizational KM framework with local control are the five core activities of level five in the APQC KM Maturity Model.

Hubert and Lemons found out that the organizations that invest in KM and measure most rigorously achieve a financial ROI of two dollars for every dollar spent per participating employee. On the official homepage of APQC organizations may find the quick assessment questionnaire that can determine the status-quo of KM. APQC tool helps to identify deficiencies within the organizational teams and strengths from potential partners and competitors through benchmarking.[218]

Figure 23 shows a systematic maturity level assessment with a questionnaire that has only yes/no answers and that the part of the questionnaire that gets more positive answers reflects the level at which a company is in the KM maturity journey.

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[218] Refer to Fathian, M. et al. (2008), p. 15.

	Yes	No
Is your organization doing anything it calls knowledge management?	○	○
Is there a general consensus in your organization about what knowledge management means?	○	○
Is your organization doing something that, although not called knowledge management, falls under the definition of knowledge management?	○	○
Has a business need for knowledge management been identified?	○	○
Does senior management understand and support knowledge management as a key to your organization's business strategy?	○	○
Are people specifically assigned to knowledge management activities?	○	○
Does your organization as a whole know what knowledge it already has?	○	○
Do the people who need information know who has it and how to find it?	○	○
Is knowledge systematically transferred from one part of your organization to another?	○	○
Is knowledge consistently gathered from outside your organization for internal use?	○	○
Is technology used effectively to share knowledge within your organization?	○	○
Are people networks accustomed to effectively sharing knowledge within your organization?	○	○
Does the culture of your organization encourage people to share their knowledge and reward them for doing so?	○	○
Is your organization taking full advantage of its knowledge to improve its products and services?	○	○
Does your organization measure the impact or success of its knowledge management efforts?	○	○

Figure 23: Quick KM Assessment APQC[219]

KMMM Skyrme's model[220] consists of five phases: ad-hoc, formal, expanding, integrated, and embedded level of KM. In the ad-hoc and formal phase organizations focus on developing awareness/understanding, discovering what's happening, sharing lessons, best practices, learning resources, identifying peers, and auditing. In the expanding phase change management happens, good practice is announced, standards are developed and methods are customized. The phase between integration and embedding means that KM has reached the highest maturity level through codification and communities. In order to not abandon the embedding phase and success, Total Quality Management (TQM) can be implemented[221]. Similar to this model, KPMG[222] developed the Knowledge Journey which consists of five KM stages:

1. Chaotic: no realization of the KM importance in goal achievement.

2. Aware: awareness and implementation not quite uniform, pilot projects in place.

3. Focused: KM procedures/tools in use, recognition that KM generates benefits.

4. Managed: organization has an integrated framework of KM procedures and tools, but some cultural and technical issues still exist.

5. Centric: KM integral part of organizational and individual processes, stakeholders informed about the value of knowledge.

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[219] Source: APQC (2015), URL:https://surveys2.apqc.org/ViewsFlash/servlet/viewsflash?cmd=page&pollid=Advisory%21K MMiniAssess (accessed: 20.04.2016).
[220] Refer to Skyrme, D.J. (2003), p. 8; (2003a), p. 9.
[221] Refer to Skyrme, D.J. (1998), p. 3.
[222] Refer to KPMG (2000), pp. 22-23.

The Capability Maturity Model Integration (CMMI) is another model which has proved to be a reference point for all the other KMMM mentioned before. The CMMI model which consists also of five levels of maturity is presented in Figure 24.
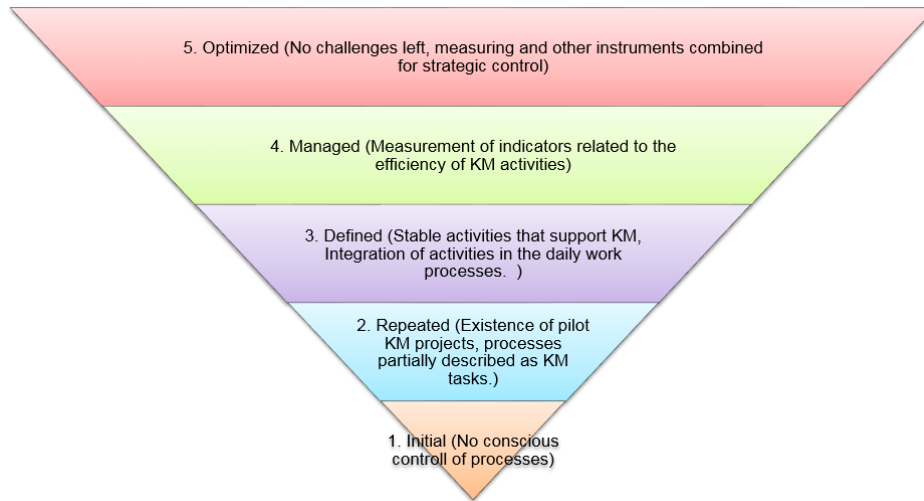
Figure 24: KMMM CMMI[223]

However, all different KMMMs have the same purpose of providing valuable information on how to reach to a higher level with respect to KM development. For instance, in the case of Asian Productivity Organization (APO) maturity model as demonstrated in Figure 25, strengths and improvement opportunities in KM practices and the results of the assessment provide adequate information to understand the KM maturity level relative to the model. The five KM readiness levels of: reaction, initiation, expansion, refinement and maturity can be obtained and identified through the assessment questionnaire.
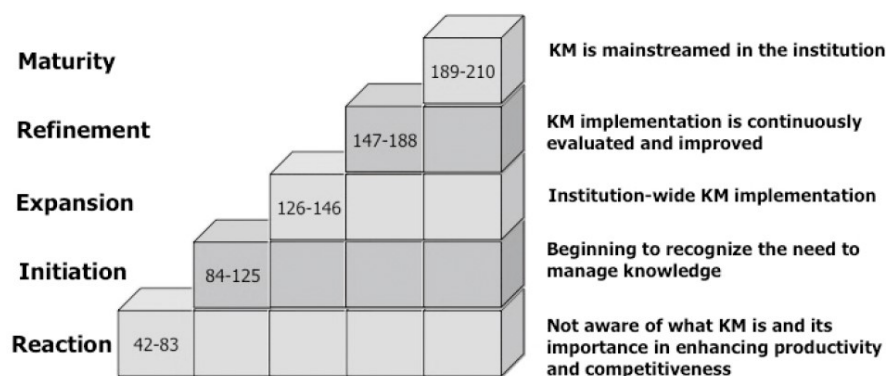
Figure 25: KMMM APO[224]

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[223] Source: APO (2010), p. 74 (modified).
[224] Source: APO (2010), p. 31.

APO model contains 42 questions that cover seven audit categories and the maximal score possible to achieve is 210 points. The seven categories are: KM leadership, process, people, technology, knowledge processes, learning and innovation, and KM outcomes (see Table 12). The maximum score for each of these categories is 30 points, and the number of questions for each category is six. Finding the average score of each category, and then the total mean score of the overall assessment auditing parties can name the stage at which organizations are positioned with respect to KM readiness. For example, if the total mean score is 96.63[225] this means that the organisations finds itself in the Initiation level (ranging between 84 and 125) of the APO KM Maturity Model. For organizations to be at the Maturity level of the APO Maturity Model a total mean score higher than 189 points should be achieved.

Some additional KM Maturity Models are 5iKM3 Maturity Model, General-Knowledge Management Maturity Model, and K3M.

5iKM3 Maturity Model has five levels of maturity as well: initial, intent, initiative, intelligent, and innovative.

General-Knowledge Management Maturity Model has slightly different maturity level names but they are also five: initial, aware, defined, managed, and optimized. Pee and Kankanhalli opine that an ideal successful KMMM consists of systematic and structured procedure, comprehensible and comparable underlying structure, both qualitative and quantitative results, empirically testable characteristics of each maturity level, transparency and liability of assessment, and high level of flexibility.

K3M, in contrast to other models, has eight maturity levels considered as finer defined with respect to KM vocabulary: standardized infrastructure for knowledge sharing; top-down quality-assured information flow; top-down retention measurement; organisational learning; organizational knowledge base/intellectual property maintenance; process-driven knowledge sharing; Continuous Improvement Process, and self-actualized organization. To summarize, the majority of KMMM models have three organizational Key Process Areas (KPAs) pillars: people, processes, and technology. They all consider KM as a process that goes through five stages, from the base stage of awareness to the top stage of optimization.

Reaching the highest level of KMMM does not imply that KM Continuous Improvement Process should stop. In the contrary, it should be always on focus due to the subtle and continuous changes from the operating environment settings. The KMMM are the essential part of an overall KMA model. But what do complete KMA models look like and how do they work? The next sections of this chapter help in finding the answer to this question and helps this research in further extending the knowledge about KMA in order to determine the criteria that can lead to successful KM experiences.

The models selected for discussion come from different academic and private research centers, institutions and practitioners.

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[225] Refer to Sensuse, D. I.; Rohajawati, S. (2013), p. 29.

sIn an attempt to identify the best practice model and criteria that lead to a successful overall KM project and satisfying assessment results, as shown in Figure 26, the following four assessment models are described:

1. KMCAT (Knowledge Management Capability Assessment Tool),
2. EKMF (European Knowledge Management Framework),
3. Know-All 10/50, and
4. APO (Asian Productivity Organization).

The four models that are presented in the next Sections (4.2; 4.3; 4.4; and 4.5) are strongly related to Sections 3.1 and 4.1 where KM frameworks and KM Maturity Models are introduced.
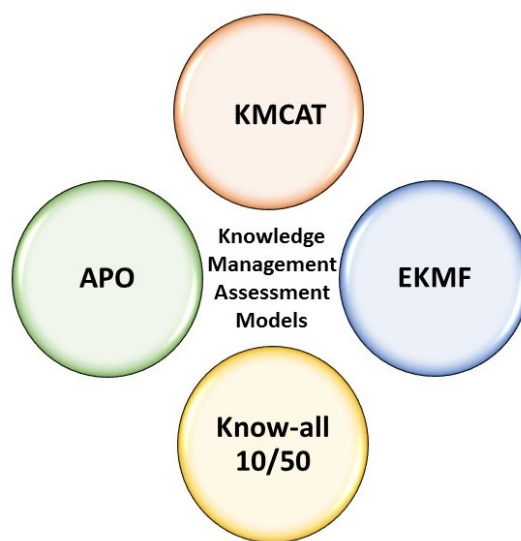
Figure 26: Four Models Overview[226]

4.2 KMCAT Model (1995-2015)

The technique of benchmarking the effectiveness of KM through sophisticated questionnaires is initiated by APQC. Benchmarking models help avoiding time in reinventing the wheel by offering the opportunity to look at what has worked and what not for companies operating in the same environments and sectors. Strategic benchmarking is an assessment tool that exposes KM best practices within benchmarking partners. [227] As a result benchmarking creates an opportunity for each partner to revise and optimize their own KM. Swaak et al. support the questionnaire approach too.[228] The questionnaire approach reveals information about the organization's profile related to concepts like extent of knowledge sharing and LL. For

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[226] Source: own figure
[227] Refer to Baskerville, R.; Dulipovici, A. (2006), p. 97.
[228] Refer to Swaak, J. et al. (2000) cited in Yu, W. et al. (2006), p. 125.

the questionnaire a large number of objective and quantitative indicators is created in order to measure the KM performance. What helps to conduct a successful KM assessment is the publication of the organizations' success together with the determining impact factors and the transfer of relevant indicators to a meaningful and regularly updated organization report.[229]

In the late nineties called KMAT (Knowledge Management Assessment Tool), but recently changed to KMCAT (Knowledge Management Capability Assessment Tool) this is the first KM benchmarking effort conducted by APQC. KMCAT has been developed with the main purpose to help organizations self-assess where their strengths and opportunities lie in managing knowledge. Before using the KMCAT to assess the KM status, a KM framework was developed by APQC. O'Dell et al.[230] conducted the first benchmarking APQC questionnaire-based study on best practices of KM. The authors found out that customer intimacy, product-to-market excellence and operational excellence are in the centre of KM. KMCAT cannot be understood without the KMMM model of APQC as presented earlier in Section 4.1. In order to be able to measure and understand where the company lies at the KMMM levels, APQC uses the results collected from the KMCAT questionnaire. This questionnaire is accessible at https://www.apqc.org/km-capability-assessment-tool., the official APQC homepage where applicants can download the excel file and fill in the questionnaire according to the provided explanatory sections.

For each of the four main KM categories (call to action, develop KM strategy, design and implement KM capabilities, evolve and sustain) and their respective subcategories as presented earlier in the APQC KM Framework results can be obtained. These results can then be translated into interpretation and the definition of the organization's KM status-quo through a final report prepared by APQC.

The tool that has a simple scoring system consists of four capability sections and twelve sub capabilities[231]: strategy (objectives, business case, budgets); people (resources, governance structure and roles, change management, communication); process (knowledge flow process, KM approaches, measurement); and content management and IT processes and tools. KMCAT collects information about specific indicators related to every KM element demonstrated in the interactive KM framework. This information is translated into interpretation and final results of the KM status-quo. The next step is then to compare the status-quo against industry standards. The identification of best practices which can be ''imitated'' or followed to improve own organizational effectiveness is the main objective of KMCAT. After the assessment questionnaires are completed, organizations get feedback from APQC about the organization's KM maturity rating in the KMMM model and about scores for 12 different KM capabilities. A review of the KM performance and a comparison with the ''best practice'' case leads to a determination of the weak sections of the KM and as the result the development of a new KM strategy to reach the next KMMM level. Different to the life-cycle from 1996 presented earlier in this work, the APQC KM processes are updated and contain now only five main cycles:

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[229] Translated from Refer to Picot, A.; Scheuble, S. (2000), p. 8.
[230] Refer to O'Dell, C. et al. (2003) cited in Jih, W-J. et al. (2008), p. 295.
[231] O'Dell, C. (2015), p. 27.

identifying, capturing, sharing, transferring, and applying knowledge.[232] Figure 27 shows the official template for the excel data collection tool that APQC has developed through a work in progress. The latest version of the questionnaire is from 30th of June 2015 which implies that compared to all other models, KMCAT is up to date and continuously improved by APQC. In order for the benchmark to be of great value and meaningful, a company should first identify its strategic objectives and go thoroughly through the following steps[233]:

1. What is the focus of the benchmark, why and with what scope?
2. Create a team for the benchmarking study.
3. List the companies against which the company wants to benchmark.
4. Collect and analyse data from the questionnaire.
5. Define changes to be made as suggested by the obtained metrics' results.

APQC identified six primary strategies that best-practice companies use to steer their KM needs[234]:

1. KM is central to the ability to grow and compete.
2. The transfer of knowledge and best practices is systematic, to improve operations or include them in products, services, and processes.
3. Capture knowledge about customers, understand their needs, preferences, and business.
4. People are personally responsible for knowledge.
5. Measure IC, attach financial measures to organizational knowledge assets and link them to the ''as-is'' and ''to-be'' performance.
6. Innovate and create new knowledge through basic/applied research, development.

APQC experts with almost three decades of experience and continuous improvements in the KM field, based their theoretical and practical research on this KM definition: ''The application of a structured process to help information and knowledge flow to the right people at the right time so they can act more efficiently and effectively to find, understand, share, and use knowledge to create value.''[235]

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[232] Refer to Hubert, C.; Lemons, D. (2010), p. 2.
[233] Refer to Dalkir, K. (2005), p. 289.
[234] Refer to Okunoye, A. et al. (2002), pp. 5-6.
[235] Refer to APQC, (2014), p. 7.

II PEOPLE: (PP1) RESOURCES

Begin at the bottom (Level 1) and work up to Level 5.
Select 'X' to the left of a statement to indicate your organization HAS ACHIEVED that capability.

Level	Achieved	Capability	Example
5	X	KM competencies are expanded and embedded across the enterprise.	
4		The KM group provides direction and resources to promote the development of knowledge assets that support organizational core competencies.	
	x	KM skills and capabilities are aligned with employee development.	
		Business units allocate resources for KM capability and knowledge asset development in business areas and domains.	
		Change agents and knowledge experts are embedded in processes and business units to support knowledge flow.	
		KM resource requirements are determined collaboratively between KM staff and operating units.	
3		There are active champions and sponsors of KM from business units or disciplines.	
		Business unit facilitators, moderators, and content managers coordinate and manage knowledge flow process and approaches.	
		KM capabilities are enhanced across business units or disciplines.	
		There is a group and process to coordinate and facilitate KM approaches.	
		KM group's focus expands from initial areas, such as lines of business, functions, business units, and disciplines in other areas in the organization.	
2		Representatives from business units or disciplines support initial design efforts for KM approaches to enable knowledge flow.	
		A KM group is appointed to design and implement initial KM strategies and approaches.	
1		KM advocates promote the value of KM to business leaders and functional and process stakeholders.	

Cover | Instructions | Terms | Demographics | Objectives | Business Case | Budget | **Resources** | Governance | Change Mgt. | Co

Figure 27: KMCAT Excel Data Collection Tool[236]

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[236] Source: APQC (2015), p. 1.

4.3 EKMF Model (2000-2002)

KM standards have been attempted to be developed by the European Committee for Standardization since the European Guide to good Practice in Knowledge Management is published.[237] The European KM Forum started the initiative of KM standardization with the main objectives[238] to reach a European-wide common terminology, standardized KM aspects, and to achieve more transparency at a common language and understanding level. There are many groups of stakeholders who are supposed to benefit from such a standardized KM initiative among which the policy makers, consulting companies, software providers, research and development, large companies, Small and Medium Enterprises, as well as stakeholders from training and education. Issues like who is involved in the standardization process, what kind of standard should it be, is it an open standardization process or is it done by experts made the road to the KM standardization a challenging task for the authors. In this context, the EU KM Forum developed and presented the roadmap to the standardization of the EU KM initiative as presented in Figure 28. In this self-explanatory roadmap, the activities, methods, processes, and tasks including a milestone window are included. This gives a better overall picture of how complex a standardization process can be. Based on this roadmap five booklets are published in the form of one European good practice guide to KM. The five booklets contain five different KM issues[239] in the consecutive order:

1. KM Framework (CWA 14924-1)
2. Culture and KM (CWA 14924-2)
3. Implementing KM in SMEs (CWA 14924-3)
4. Measuring KM (CWA 14924-4)
5. KM Terminology (CWA 14924-5)

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[237] Refer to Heisig, P. (2002) cited in Ragab, M.A.F.; Arisha, A. (2013), p. 9.
[238] Refer to EU KM Forum (2001a), p. 12.
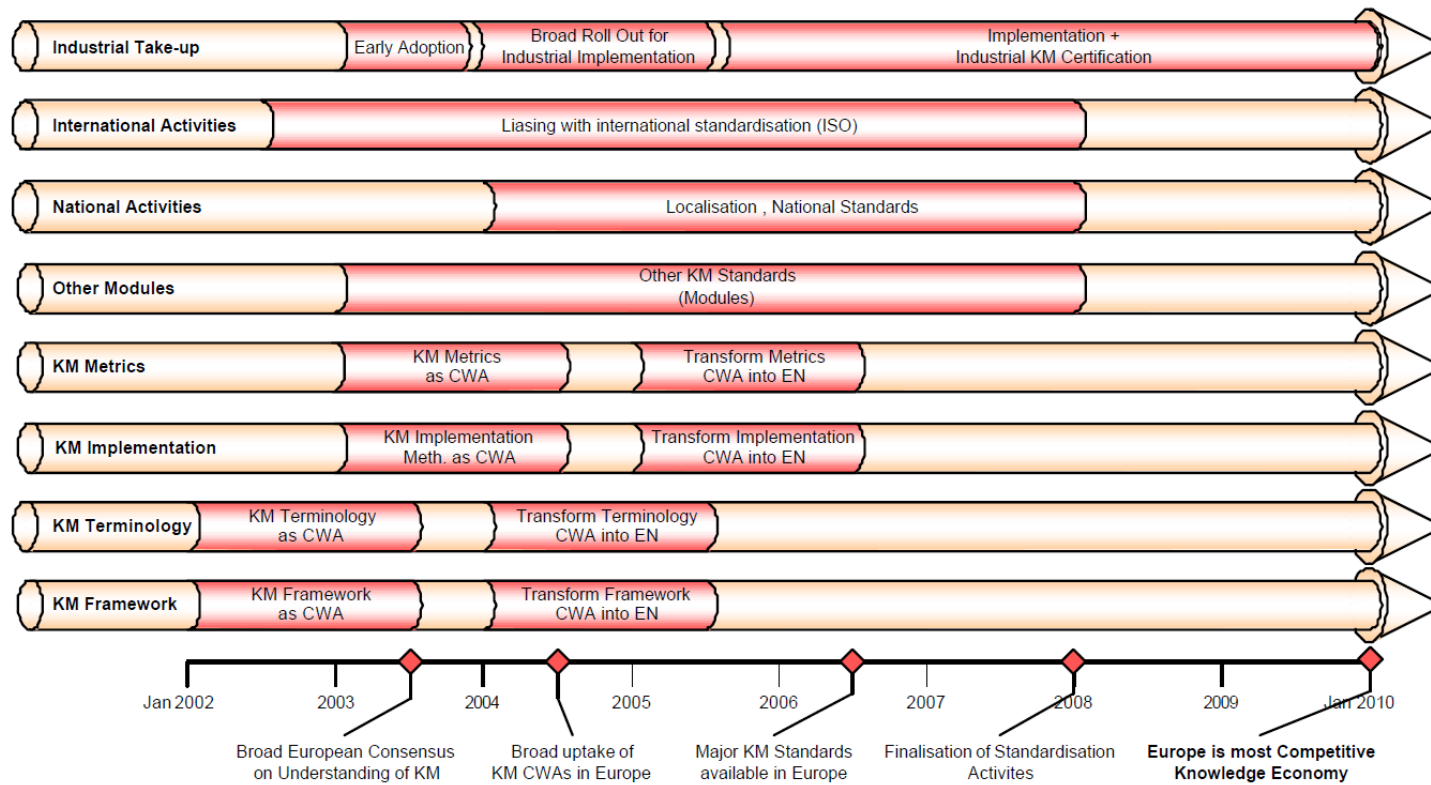[239] Refer to European Committee for Standardization (2004), p. 3.

Figure 28: Potential Roadmap for KM Standardization in Europe[240]

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[240] Source: European KM Forum (2001a), p. 22.

Research shows[241] that usually organizations tend to start their KM initiative with areas that they consider as crucial for their business such as for example, marketing, sales, R&D, and production. In order to collect information about the status of the KM in the organization through EKMF, surveys are conducted in two ways: through online questionnaires or through different companies and research institutes which than publish the results online without including the questionnaires or interviews. Mostly through the online questionnaires, the European KM Forum conducted analysis of different existing KM implementation projects in Europe with the main goal to achieve a standard approach based on best practices for Europe. The assessment tool consists of about 50 pages A4 of questions of standard questionnaires. As presented in Figure 29, there are four different types of assessments: open questions, closed questions, indicators/metrics and rating scales.

	Open Questions	Closed Questions	Indicators	Rating scales
General Section	A, B, C, …	1, 2, 3, …	I, II, III, …	α, β, γ, …
KM Strategies	…	…	…	…
Human + Social KM Issues	…	…		
KM organisation	…			
KM processes				
Technologies				
Leadership				
Performance Measurement				
Implementation + Business Cases				

Figure 29: Structure of the EKMF Assessment[242]

Having different assessment approaches makes the questionnaire and its different sections more reliable. This is due to the fact that for the sections where no indicators whether financial or not are possible, then the respondents can still reply with one of the other three assessment approaches. This makes the whole assessment and evaluation process easier and certainly more understandable. Moreover, a list of KPIs that could be measured during the KM assessment was provided to facilitate KM assessment procedure for applicants. Some of the KPIs are[243]: time to create new knowledge, contribution to knowledge bases, sharing and use of best practices, number of repeated complaints, number of people active in the CoPs, number of patents, number of employees, number of publications, number of contacts with knowledge institutes, reduction in cost of quality, employee satisfaction, knowledge user complaints,

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[241] Mertins, K. et al. (2001) cited in European Committee for Standardization (2004b), p. 11.
[242] Source: European KM Forum (2000-2002), p. 11.
[243] Refer to European Committee for Standardization (2004c), p. 18.

knowledge user satisfaction, KM budget availability, time to develop new ideas, percentage of sales earned with new knowledge, etc. The European KM framework is supposed to provide the necessary common understanding of KM and the need to connect Change Management with it. The team engaged for the KM standardization[244] examined a couple of EU organizations and found out the following problems, tools and success factors that characterize a KM project:

1. The ability of the company to identify its problems.
2. Company's attempt to solve problems by using a system that respects traditional work approach of the users.
3. Adoption of an incentive system.
4. The ability to recognize the need for KM approach as a useful tool to solve problems.
5. Clear diagnosis of the business condition and a defined KM strategy.
6. Existence of a knowledge activist.
7. Creation of new models to assess and describe competencies, and combination of competencies at team level.
8. Prevent hoarding of knowledge to gain power.
9. Promote sharing knowledge culture to get a reward with an increase in power.
10. Trust-wide surveys, in-depth questionnaires focus groups.

To achieve a successful implementation of KM in SMEs, organizations must make sure that they build their KM team with the following five roles: project manager, technological coordinator, knowledge manager, moderator and knowledge broker.[245] Criticism has been addressed to the model which although in use, does (among other limitations) not incorporate aspects studied or models validated.[246]

4.4 Know-All 10/50 Model (2007)

Skyrme developed two templates - *The Know-All 10/50*, a quick ten diagnostic question assessment, and the full 50 questions assessment. The shorter questionnaire template gives a good quick indicator and can be used widely throughout the organization.

The set of ten questions presented in Figure 30 provides a quick check of where an organization is along ten critical success dimensions. The organizations can rate themselves on a score system from 0 to 10, where 0 is doing nothing at all, and 10 is world-class. Skyrme suggests that several people from different groups answer the questionnaire, and then sit together to discuss and compare results. The Know all 10 questionnaire developed by Skyrme helps to gain more insight into the type and character of the questions listed in the assessment. What makes this questionnaire remarkable are the ten fields on focus which are much broader than in the case of the KMCAT questionnaire but almost the same as in the EKMF model. Skyrme's

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[244] Refer to European KM Forum (2001), pp. 12-60.
[245] Refer to European Committee for Standardization (2004b), p. 29.
[246] Refer to Pawlowski, J.; Bick, M. (2012), p. 95.

questionnaire is built according to his previously developed KM framework presented earlier in Chapter 3 of this work. Skyrme lists ten key impact factors for KM assessment: leadership, measures, processes, knowledge (explicit, tacit), culture/structure, role/skills, technology, services, and image.[247]

KNOW-ALL 10: THE QUICK KM ASSESSMENT

Rate your organization (or part of it) on a score 0 to 10, where 0 is doing nothing at all, and 10 is world-class. We suggest that several people from different groups do this, then come together to discuss and compare.

1. Leadership   Score

Does your organization have a compelling knowledge vision and strategy, actively promoted by your Chief Executive, that clearly articulates how knowledge management contributes to achieving organizational objectives.   ....

2. Culture/Structure

Is knowledge sharing across departmental boundaries actively encouraged and rewarded? Do workplace settings and format of meetings encourage informal knowledge exchange?   ....

3. Processes

Does your organization have systematic processes for gathering, organizing, exploiting and protecting key knowledge assets, including those from external sources?   ....

4. Explicit Knowledge

Is there a rigorously maintained knowledge inventory, with a structured thesaurus or knowledge tree, and clear ownership of knowledge entities, that is readily accessible across the organization?   ....

5. Tacit Knowledge

Do you know who your best experts are for different domains of key knowledge, and do you have in place mechanisms to codify their tacit knowledge into an explicit format?   ....

6. Knowledge Hubs and Centres

Are there librarians or information management staff that coordinate knowledge repositories and act as focal points for provision of information to support key decision making?   ....

7. Market Leverage

Are your knowledge and knowledge management capabilities packaged into products and services and promoted in your organization's external marketing?   ....

8. Measures

Does your organization measure and manage its intellectual capital in a systematic way, and publish regular IC reports to its external stakeholders?   ....

9. People/Skills

Have specific knowledge roles been identified and assigned, and are all senior managers and professionals trained in knowledge management techniques?   ....

10. Technological Infrastructure

Can all important information be quickly found by new users on your intranet (or similar network) within three mouse clicks?   ....

Figure 30: Know-All 10 KM Assessment[248]

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[247] Refer to Skyrme, D.J. (2001), p. 13.
[248] Source: Skyrme, D.J. (2000), p. 6.

The scores collected from the questionnaire are then to be plotted on a radar chart in order to understand the strengths and weaknesses of the KM which is under assessment. In a real sample results, the rating for KM measurement was very low. Skyrme found out that this is a very common pattern because very few organizations have really made progress in the measurement of KM.[249]
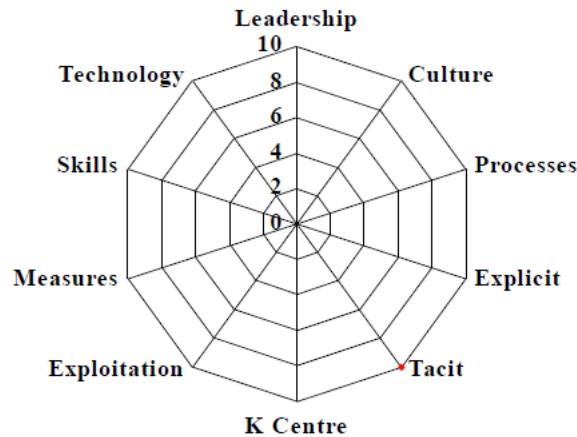

Figure 31: Radar Chart of the Assessment Score Results[250]

Although Know-All 10 is not very time consuming and can be widely used throughout the whole organization, Skyrme suggests Know-All 50 (see Annex) version of the assessment to be used by those on the knowledge initiative team, and the key individuals and stakeholders with whom they have most contact. This model is easy, and offers simple analysis, coupled with ongoing dialogue and interpretation. This model is according to the author very flexible because the template, the language, the questions, and the scoring system, are flexible and can be easily customized to the organization's need. Nevertheless, identifying the target audience for the assessment and preparing the respondents with explanations about what is expected from them and how much time commitment is needed are important. Preparing the respondents means also to provide the right information about the answers, meaning the respondents should make clear if they are responding for the whole organization or for their department only. Additionally, in order to best sell the assessment and assure the commitment from the respondents, the support from senior management must be presented. This way of measuring KM performance, simple analysis of the results, dialogues and interpretations are more productive. There is no need for sophisticated software to interpret or analyse the results of this assessment model. Given that organizations usually lack the staff, the time and the budget to invest in a software, Know-All KM assessment model is certainly an advantage for organizations.

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[249] Refer to Skyrme, D.J. (2000), p. 17.
[250] Source: Skyrme, D.J. (2000), p. 10.

4.5 APO Model (2010)

The Asian Productivity Organization developed the APO KMA model which is considered an easy tool to learn and implement, even by those companies which are new to KM[251]. KMA mainly created for SMEs in Asia, starts with the necessity to understand the vision, mission, strategic goals and directions of the organization. As presented earlier in Chapter 3, APO KM Framework contains five processes of the KM life-cycle: identify, create, store, share and apply. Each of these five knowledge processes can be optimized and accomplished by many specific methods and tools. Tables 10 and 11 are a better presentation of the idea behind the APO KM methods and tools categorization and allocation in each of the five KM processes.

Table 10: APO KM Methods and Tools[252]

Before KM initiative starts		After KM initiative has started	
Non-IT methods and tools	IT-methods and tools	Non-IT methods and tools	IT-methods and tools
1. Brainstorming	12. Document libraries leading to a DMS[253]	21.Knowledge worker competency plan	25. Knowledge portal
2. Learning and idea capture	13. Knowledge basis (e.g. Wiki, etc.)	22. Knowledge mapping	26. Video sharing
3. Peer assist (BP)	14. Blogs	23. KM Maturity level	-
4. Learning reviews	15. SNS[254]	24. Mentor/Mentee scheme	-
5. After action review	16. Voice and VOIP[255]	-	-
6. Storytelling (World Bank)	17. Advanced search tools	-	-
7. Collaborative physical Workspace	18. Building knowledge clusters	-	-
8. APO KMA	19. Expert locator	-	-
9. Knowledge Café	20. Collaborative virtual workspaces	-	-
10. Community of Practice	-	-	-
11. Taxonomy	-	-	-

Note: the numbered list does not mean order of importance or hierarchy.

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[251] Refer to Sensuse, D.I.; Rohajawati, S. (2013), p. 25.
[252] Source: based on APO (2010), p. 9.
[253] Document Management System
[254] Social Network Services
[255] Voice-over-Internet Protocol

Table 11: APO Methods and Tools for each KM Cycle[256]

Identifying knowledge	Creating knowledge	Storing knowledge	Sharing knowledge	Applying knowledge
8. APO KMA	1. Brainstorming	4. Learning reviews	3. Peer assist	3. Peer assist
9. Knowledge Café	2. Learning and idea capture	5. After action review	4. Learning reviews	7. Collaborative physical workspace
10. CoPs	4. Learning reviews	9. Knowledge Café	5. After action review	9. Knowledge Café
17. Advanced search tools	5. After action review	10. CoPs	6. Storytelling	10. CoPs
18. Building knowledge clusters	7. Collaborative physical workspace	11. Taxonomy	7. Collaborative physical workspace	11. Taxonomy
19. EL	9. Knowledge Café	12. Document libraries leading to a DMS	9. Knowledge Café	12. Document libraries leading to a DMS
20. Collaborative virtual workspaces	10. CoPs	13. Knowledge basis (e.g. Wiki, etc.)	10.CoPs	13. Knowledge basis (e.g. Wiki, etc.)
22. Knowledge mapping	13. Knowledge basis (e.g. Wiki, etc.)	14. Blogs	11.Taxonomy	14. Blogs
23. KMMM	14. Blogs	15. SNS	12. Document libraries leading to a DMS	17. Advanced search tools
24. Mentor/Mentee scheme	16. Voice and VOIP	16. Voice and VOIP	13. Knowledge basis (e.g. Wiki, etc.)	18. Building knowledge clusters
	17. Advanced search tools	17. Advanced search tools	14. Blogs	19. EL
	18. Building knowledge clusters	18. Building knowledge clusters	15. SNS	20. Collaborative virtual workspaces
	19. EL	19. EL	16. Voice and VOIP	21.Knowledge worker competency plan
	20. Collaborative virtual workspaces	20. Collaborative virtual workspaces	18. Building knowledge clusters	24. Mentor/Mentee scheme
	24. Mentor/Mentee scheme	25. Knowledge portal	19. EL	25. Knowledge portal
	25. Knowledge portal	26. Video sharing	20. Collaborative virtual workspaces	
	26. Video sharing		24. Mentor/Mentee scheme	

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[256] Source: based on APO (2010), pp. 3-5.

There are twenty plus six additional methods and tools developed by APO explained thoroughly in their KM Tools and Techniques Manual. The tools are grouped into before and after KM initiative. Each of the initiative contains then two subgroups of methods and tools: non-IT and IT. As presented in Table 11, some of the methods and tools are useful for more than one of the KM processes. This emphasizes the fact that for example, the CoPs can generally give a major contribution to KM projects. Table 12 shows the summary of APO KM methods and tools.

Table 12: APO KM Strengths and Opportunities for Improvement[257]

Audit categories	APO Tool assesses… (KMA questionnaire, 42 questions, scoring system 1-5)	Strengths KMA results Score Total 1	Opportunity for improvement KMA results Score Total 2
KM leadership	The leadership capability in terms of KM policies, strategies and efforts to initiate, guide and sustain KM practices.	…	…
Process	Knowledge use in managing, implementing and improving the organization's key processes.	…	…
People	The ability to create and sustain organizational knowledge-driven and learning culture. The effort to encourage knowledge sharing and collaboration. The development of knowledge workers.	…	…
Technology	The ability to develop and deliver knowledge-based solutions (e.g. collaborative tools and content management systems). The reliability and accessibility of these tools.	…	…
Knowledge processes	The ability to identify, create, store, share and apply knowledge systematically. The ability to share best practices and LL to prevent the wheel reinvention and duplicate works.	…	…
Learning and innovation	The ability to encourage, support and strengthen learning and innovation through systematic knowledge processes. The efforts of management to embed values of learning and innovation and provide incentives for knowledge sharing.	…	…
KM outcomes	The ability to enhance value to customers through new improved products and services. The ability to increase productivity, quality, and profitability. The ability to sustain growth through effective use of resources.	…	…

Total score 1+2

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[257] Source: based on APO (2010), pp. 29-30.

The objective of this model is the determination if and to what degree KM is applied in an organization. APO model determines also if organizations are feasible enough for building and sustaining systematic KM processes, as well as it identifies strengths and opportunities for improving KM. APO assessment model is structured in the form of a questionnaire just like in the other previous models described in this chapter. The assessment questionnaire is mostly reliable if it is answered by 70-80% of all employees from all levels and departments under the main condition that they have been working in the organization for 6 months at least. There are seven audit categories in the APO KMA questionnaire. The assessment consists of 42 questions that cover all seven categories. Each category can have a maximum score of 30 points and the whole assessment has a maximum score of 210 points. Questions are rated with a 1 (poor) to 5 (very well) scale scoring system. The assessment sheds light on the strengths and opportunities for improvement. The average score collected for each of the categories presented in Table 12 is presented with a radar chart, just like in the Know-All 10/50 model. This chart helps organizations to see the difference between the maximum score possible for each category and the real achieved score. The scores provide useful information about the categories that are healthy and those that have space for improvements. The total score of the assessment is compared against the APO KMMM as presented in Section 4.1. These levels are related to the presence, absence or weakness of the four elements or group of elements in the model: KM accelerators, learning, innovation and the KM outcomes. APO model is practical, helps organizations quickly gain more insight into KM implementation. Organizations can be better prepared to support key business projects and processes after the implementation first and assessment of the KM project afterwards.

4.6 Observations of KM Assessment Models

Assessing KM performance brings benefits and adds value to the organization in many aspects including all involved stakeholders, all knowledge driven financial figures of performance, all business processes and innovation, R&D, and sustainability.

Different KMAs have been identified with KMCAT and Know-All 10/50 being the most preferred ones, although they do have limitations too. All four models discussed in this work have quite a good KM focus that considers the core KM pillars: people, technology, processes, leadership, and culture. Some of the areas where assessment models are lagging behind are related to the quantification methods of KM benefits[258], knowledge risks, assessment biases, and follow-up programmes. The assessment of organizational knowledge is a challenging initiative that raises challenging needs[259]. These needs may be related to better tools to manage investment in knowledge assets, the need to measure ROI over the long-term, and the need for an indicator that can differentiate organizations with appreciating and those with depreciating knowledge base. KM

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[258] Refer to Yu, W. et al. (2006), p. 124.
[259] Refer to Turner, G.; Minonne, C. (2010), p. 164.

assessment can be done in three perspectives: normative, strategic and operative.[260][261] Defining metrics for KM is strongly related to organization's strategy and objectives and highly dependent on the focus areas where KM is being applied. Organizations willing to implement KM must make sure that their project is aligned with their vision, mission, and knowledge goals strategy. Business objectives can be divided into three central groups[262]: programme and process management; programme execution and operation; and personnel and training. The alignment of KM with business objectives require the development of appropriate metrics in order to generate useful information through indicators that represent different aspects of KM and its performance. DON suggests for example three KM metrics perspectives[263]: outcome perspective which informs about the organization's overall value; output perspective that is strongly referred to a given project or task; and system perspective which covers metrics about the technology or tools.

Knowledge Risks such as knowledge loss, brain-drain, or knowledge freeze are neglected in the research field and in the assessment models. Knowledge is lost when there is no knowledge sharing, no knowledge improving, and no knowledge updating culture. Organizations might suffer from the brain-drain risk which happens when no recognition or rewards, bonuses and incentives packages are provided. Knowledge is frozen when employees are not motivated.

Bias-free criteria seems to be an area where more opportunities are available to minimize assessment biases coming from employees and interviewees who might sugar-coat the real KM situation in the organization. Although this is not the case for all the assessment models, it is an issue that exists and might occur mostly in the Eastern countries.

KM follow-up programme is a criteria important for successful KM. More emphasis should be put on the follow-up phase of KM. Researchers and practitioners should seek further improvement and/or adjusting processes to external or internal socio-environmental, technological and economic changes. This makes KM always up to date, based on which continuous benchmarking and improvement processes take place afterwards.

Depending on the type of the KM project, area of application, size of the organization as well as strategic objectives, the list of criteria that guarantee organizational success might change and become more specific in addressing knowledge related-issues. Organizations implementing a KM should consider the opportunities of combining different assessment tools to create their own model which meets their needs, until a standard certified KM framework is provided. After having gained more insight into the selected four models and based on the overall understanding about knowledge presented earlier in this work, this section tries to identify the most relevant criteria that make KM creation, implementation and assessment successful.

Observations from four models show that APQC and Skyrme are the most successful KM approaches that companies at international level can apply to enable competitiveness and better performance. KMCAT is very adapt for any organization

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[260] Source: Del-Rey-Chamorro, F.M. et al. (2003) cited in Yu, W. et al. (2006), p. 125.
[261] Translated from Probst, G.J.B.; Romhardt, K. (1997, 2002), pp. 7-8.
[262] Refer to DON, (2001), pp. 24 -27.
[263] Refer to DON (2001), pp. 24 -27.

throughout the world. KMCAT remains one of the best models discussed in this work. KMCAT is well thought, detailed, has its developed appropriate metrics, is applicable in many organizations of any industry or sector and is continuously updated. The questionnaire is very quick to respond, and not too complex to understand. This model has also its own KM Maturity Model and is far more advanced than any other assessment model presented here. KMCAT seems to also pay more attention to issues like knowledge risks and the sustainability deriving from the follow-up phase of a KM programme and its continuous improvement.

Know-All 10/50 assesses the KM of organizations through the questionnaire and then plots the results on a radar chart to see the gaps between the ''as-is'' and ''to-be'' scores. The higher the gap between the results the more improvement is needed in the KM project. Skyrme has also developed a KMMM for measuring the performance of the assessed KM. This model is possible to use for any company of any country of origin and of any sector. Nevertheless, Know-All 10/50 KM model has opportunities for improvement, particularly in the follow-up phase of KM.

EKMF appears to be the weakest model among the chosen four, for which many areas of opportunities are still to be worked upon. Although this model is supposed to find application and to have been embraced by many SMEs particularly in Europe, researchers[264] criticize it for being not well constructed and not covering the main aspects of globally distributed KM. Along with a confusing existing literature about the EKMF and its issues, consistent sources of research publication are missing. However, EKMF has a well-developed assessment approach by giving the respondents the opportunity to answer questions not only through yes or no answers but also through open extended answers, through indicators and rating scales.

APO shows that is very strong with its KMMM domain but at the same time weak in terms of biases during KM assessment. This might be due to the fact that respondents come from the Asian countries where people and employees are driven by an implicit way of doing and saying things, rather than explicit. This is strongly related to the differences in culture compared to the western companies. APO shows to be a combination of both KMCAT and Know-All 10/50 but that requires more refining and a more clear assessment procedure.

In an attempt to answer the question whether the chosen KMA models are useful or not and whether they address most of the issues related to KM initiatives, two models prove to be quite useful and mostly aware of different KM related issues. Based on the preceding observations, KMCAT and Know-All 10/50 seem to be more reliable and have implementation advantages compared to other models. They are especially strong when it comes to their applicability, pillars of assessment, and KM Maturity Models. Their metrics are also well developed and they address a diverse and rich measurement of the knowledge-related processes. Due to their very well constructed KMMM, both models have a complete and clear presentation of KMMM.

Both Know-All 10/50 and KMCAT appear to be the best practice within the context of this work, but KMCAT is the ''state of the art''. After years of practice and continuous

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[264] Refer to Pawlowski, J.; Bick, M. (2012), pp. 95-97.

improvement KMCAT seems to have reached the status of the best practice in the field of the KM assessment and KM discipline overall.

Table 13 is a summary of the observations described earlier. The criteria that play the most important role in a successful KM experience from this work's perspective are: type of assessment, number of questions, assessment approach, flexibility and complexity, KM auditing pillars, KM life-cycle, metrics, bias risk, knowledge risk consideration, and applicability.

Table 13: Observations KMA Models[265]

Model Criteria [unit]	KMCAT	EKMF	Know-All 10/50	APO
Assessment [type]	Questionnaire	Questionnaire	Questionnaire	Questionnaire
Questions [no.]	15-150	50 pages (A4)	10-50	72
Approach [OQ, CQ, I, RS]	OQ, CQ, RS	OQ, CQ, I, RS	RS	RS
Flexible [yes, no, partial]	Yes	Yes	Yes	Yes
Complex [yes, no, partial]	No	Partial	No	Partial
Audit KM pillars [nr.]	5	9	10	7
KM life-cycle [no. of processes]	5	5	7	5
Bias risk [yes, no, partial]	No	No	No	Partial
Metrics, KPIs [weak, strong]	Strong	Weak	Weak	Weak
KR consideration [yes, no, partial]	Yes	No	Partial	No
Applied [organisations/area]	All-Worldwide	All-EU	All-Worldwide	Mostly SMEs in Asia

Where OQ – open questions; CQ – closed questions; I – indicators, figures; RS – rating scale;

Depending on the type of the KM project, area of application, size of the organization as well as strategic objectives, the list of criteria that guarantee success might change and become more specific in addressing knowledge related-issues. It is worth emphasising though, that organizations implementing a KM should consider also the opportunities of combining all four models or parts of them to create a new own model which meets their needs, until a standard certified KM framework is provided. Whether this will be possible, is yet to be discovered.

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[265] Source: own table

4.7 Best Practice Criteria for Successful KM Performance

"Brainwork beats muscle work"[266]

KM success factors can be economic, strategic, behavioural and learning. KM models should be created so that they prove to be practical and they assure internal and external transparency. Compatibility (KM should be a good fit with management disciplines in the organization); comprehensibility (organizations must choose KM terms and ideas that are relevant and understood across the company); problem and action orientation (should not remain theoretical); and appropriate instruments (tools are less important than their skilful use) are standards to be met by any KM model.[267]

Questionnaires developed to measure the KM performance should be carefully constructed and possibly not too long. Different sections, split questions into logical groups, coherent and suitable questions with respect to the organization type (private, commercial, governmental or non-profit organizations) must be considered. As a result, the assessment process and procedure is easier, effective and reliable.[268]

Hard-facts assessment can be an outcome of financial analysis factors, and soft-facts an outcome for analysis of indicators related to innovation power, process quality, and management quality. This type of soft-facts cannot be delivered by financial analysis.[269] Therefore, KMA models must assure that tools like BSC for example are used. Productivity, quality, continuous learning or teaching measures are very important figures for KM assessment. Questions related to mistakes and LL, effectivity and efficiency fluctuations, time spent searching for information and what type of information, tasks accomplishment rate add remarkable quality to the KM assessment for all these questions have a strong relationship to knowledge. Most of the performance factors are dynamic, hence not appropriate for every scenario. Organizations should therefore consider critical and meaningful success factors, a combination of financial and non-financial data, and a balance between different perspectives.[270] Taking into account that there are different categories of performance indicators as adapted to particular objectives of organizations, the determinants of competitive success are different for each organization. That said, the design of a generic system for measuring the KM performance is practically impossible. A custom solution is required for almost every organization. Following this logic[271] there are five important principles to take into account when developing a measurement system related to human knowledge assets of organizations:

- Effectiveness and efficiency measured by a combination of hard- and soft-facts.
- Productivity promotion by focusing on important issues, tasks and objectives.
- Performance measurement at individual and team levels.

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[266] Translated from Weichbrodt, R. (2011), p. 18.
[267] Refer to Probst, G.J.B. (1998), p. 18.
[268] Refer to Kruger, C.J.; Snyman, M.M.M. (2007), pp. 3-5.
[269] Refer to Winkler, R. et al. (2007), p. 125.
[270] Refer to Turner, G.; Minonne, C. (2010), p. 164.
[271] Refer to Fitz-Enz, J. (1995) cited in Turner, G.; Minonne, C. (2010), p. 166.

- Manager measurement by effectiveness and efficiency of the units they manage.
- Effectiveness ultimate KM measurement and not efficiency measurement.

There are different approaches to implementing a KM approach, as there are different methods and tools to measure the performance of KM approaches. Moreover, there are as many criteria that guarantee success as there are KM and KMA models and tools together. What makes the difference is whether these criteria are rightly chosen, thoroughly thought through and certainly taken into account in accordance with organization's overall business strategy. Davenport et al.[272] assessed the KM projects of 31 companies, and identified four effectiveness indicators:

1. Growth of resources (people, money, materials...).
2. Growth knowledge content volume of and application (documents, accesses for repositories, participants for discussion-oriented projects).
3. Likelihood that the KM project would survive without the support of a particular individual or two (i.e. projects are organizational initiatives and not individual).
4. Some evidence of financial return, either for the KM activity itself or for the organization.

Due to the difficulty in quantifying the economic returns on knowledge, eight common factors that lead to successful KM projects are listed in Figure 32.
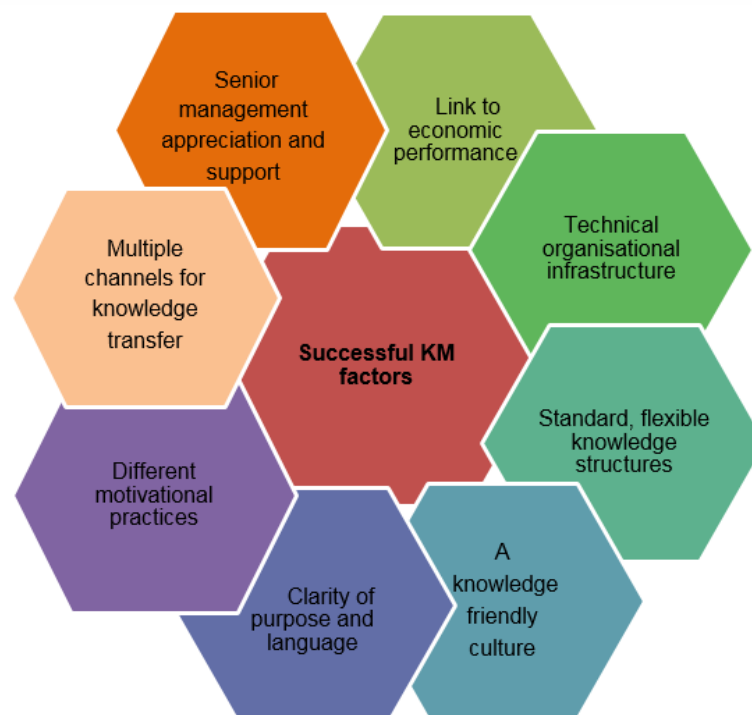

Figure 32: 8 Common Success Factors for KM[273]

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[272] Refer to Davenport, T.H. et al. (1997), pp. 2-12.
[273] Source: based on Davenport, T.H. et al. (1997), pp. 11-14.

Facts and figures related to the eight successful factors of KM shown are briefly described as follows.

Link to Economic or Industry Value

- Dow Chemical lowered patent taxes paid on patents that were no longer useful. This KM initiative lead to $40 million saved in the first year.

Technical and organizational infrastructure

- Take advantage of both technology and organizational infrastructure.
- Establish roles and groups with the appropriate skills to be one step closer to organizational infrastructure. Best examples: Ernst & Young, and BP.

Standard, flexible knowledge structure

- Minimize efforts to extract knowledge from a non-structured and not up to date repository.

Knowledge-oriented culture

- Learn on and off the job, make your culture positively knowledge-oriented with less hierarchy.
- Cultivate trust! Employees who feel that their knowledge is critical to maintaining their value in the company, do not share knowledge. Employees don't share any information about mistakes or failures either, because they fear layoffs.

Clarity of purpose and language

- KM deals with complexity, uncertainty and organic growth. Effective use of knowledge means changing the way people think about it. Change the language, hence less insecurity and uncertainty.
- Knowledge managers must know how to communicate. Avoid on purpose the use of the term ''knowledge'' and prefer to communicate differently: ''we are going to reduce cycle time by finding new ways to reuse our engineering designs''.

Different motivational practices

- KM projects must display motivational habits.
- The consultants at Ernst & Young and McKinsey and Co. are evaluated partially on the knowledge they contribute to repositories and human networks.
- Buckman Laboratories introduced a knowledge sharing network and shortly after that the best 150 ''knowledge sharers'' won a reward of a company trip to a resort.

Multiple channels for knowledge transfer

- Tim Allen (MIT researcher) found out that scientists/engineers exchange knowledge in direct proportion to their level of face-to-face contact.
- Sematech CKOs value more human channels and consider them as most effective. They organize face-to-face researchers-sponsors meetings.
- The use of a variety of knowledge transfer channels adds value in different dimensions, and their synergy enhances the knowledge use.

Senior management support

- Senior management can be helpful and send messages that KM and OL are critical for success; provide funding and other resources for infrastructure; clarify what types of knowledge are mostly important.
- If there is a lack of proactive support, start KM on a small scale. Focus on small functions or processes only.

Other successful criteria from different research reports and studies are provided next. The most successful KM initiatives identified by Skyrme[274] have:

Strong link to a business imperative

- KM enhances business performance e.g. in customer service, time-to-market for new products, improved productivity.

A compelling vision and architecture

- KM is portrayed in terms that are meaningful to all employees.

Knowledge leadership

- Good understanding of the role of knowledge, strong support for the knowledge initiative e.g. by the appointment of a Chief Knowledge Officer.

Knowledge creating and sharing culture

- Encourage free flow of knowledge through behaviours, organization rewards, sanctions, and time allocation.

Continuous learning

- Promote individual and organizational learning. Encourage experimenting and learning.

Well-developed information and communications infrastructure

- Explicit knowledge (information) is readily accessible through the corporate network (e.g. an intranet); person-to-person communication is straightforward (e.g. email); the infrastructure is widely available, reliable and responsive.

Systematic knowledge processes

- Assure a systematic process of your KM life-cycle.

Ragab and Arisha collected from different authors these KM success factors:[275]

- Understand, define KM, and communicate its benefits
- Link KM to business strategy.
- Define organizational knowledge criteria.
- Manage both explicit and tacit knowledge.
- Integrate KM with other initiatives.
- Support and participation of top-management.
- Reward knowledge sharers.
- Create communication culture and promote team work.

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[274] Refer to Skyrme, D.J. (2000), pp. 2-3.
[275] Refer to Ragab, M. A. F.; Arisha, A. (2013), pp. 12-13.

- Install an appropriate IT infrastructure to support KM processes.
- Adopt a holistic approach to KM that is not entirely dependent on IT.
- Appoint dedicated staff and provide training.
- Provide standardized and documented KM policies and procedures to ensure clarity of roles and processes.

European KM Forum identified a list of KM routes to success for SMEs:[276]

- Adapt to the business environment.
- Have a special group of customers; learn from leading customers and from companies with a good innovation record.
- Stick a small niche that others do not want to contest.
- Benefit from local monopolistic circumstances.
- Address inertia/lack of information among the customer base.
- Create a stable long term technology infrastructure.
- Maximize the profitability of the activity.
- Loyal and capable workforce.
- Be responsive to customers' needs and requirements.

Other successful criteria for a good KM or KMA highlighted by other authors are:

- Extended enterprise spirit, i.e. moving beyond the boundaries of the company[277]
- Knowledge-based strategy for a dynamic portfolio of relationships to cooperatively collect and co-ordinate relevant assets towards a value for the customers[278].
- Define company based on both internal capabilities and network in which you operate with the main goal to generate knowledge and complementary benefits.[279]

The criteria that lead to successful KM projects are diverse but mostly related to five main KM pillars: people, technology, processes, culture, leadership and products. These pillars are later grouped into one domain which is named KM pillars. Each of the pillars is so designed as to represent its knowledge related elements. These elements attached to each pillar are derived from the best-practice criteria described previously, and from the knowledge gained up to this point about KM and KMA. For example under the KM pillar people fall human capital management, human knowledge communication, human knowledge culture, human knowledge-sharing reward, human knowledge acknowledgement, and human knowledge reliability. Under the pillar of leadership it is meant communication, top-management support, on and off *job relationships to create new knowledge and share knowledge, and rewards initiatives.

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[276] Refer to European Committee of Standardization (2004c), p. 4.
[277] Refer to Konsynski, B.R. (1993) cited in Larsen, M.H.; Pedersen, M.K. (2001), p. 14.
[278] Refer to Venkatraman, N.; Henderson, J.C. (1998:3) cited in Larsen, M.H.; Pedersen, M.K. (2001), p. 15.
[279] Refer to Larsen, M.H.; Pedersen, M.K. (2001), p. 17.

Under the pillar of culture it is meant the sharing culture promotion, team work, trust cultivation, hierarchy barriers minimization, intercultural barriers acknowledgement, and recognition of knowledge worker's needs. This means that for each main pillar of core criteria there is a subset of criteria that should be fulfilled for a KM project to be successful. A list of main criteria domains is presented Table 14 with the main objective to create a criteria catalogue that leads to successful KM experience.

Table 14: Criteria Domains for Successful KM[280]

KM Types
KM Life-cycle
KM Pillars
KM Applicability
KM Level
KM Assessment
KM Maturity Model
KM Follow-up

These domains represent the initial awareness of the most important aspects that organizations should take into account before starting a KM. Based in these domains the next section is an attempt to list and describe the most relevant criteria for both KM and KMA models.

4.8 Criteria Catalogue Suggestion for Successful KM Performance

The work presented until now together with the best practice criteria presented in Section 4.7 help in determining a list of criteria that lead to successful KM experience. Table 15 shows the criteria together with a short comment on the side and the model which most fulfils the criteria. Criteria 13 and 14 are criteria statements mostly dedicated to Chief Knowledge Officers or managers of all levels involved in a KM initiative. The criteria presented in Table 15 have a significant impact in the overall KM initiative, hence they must be considered before entering the planning phase of a KM project and adapted or regularly updated based on the KM experiences and lessons learned. It is also of interest to highlight the fact that an essential contribution to the creation of the criteria catalogue comes from Chapters two and three, but mainly Chapter four of the thesis and especially the discussion about the four selected assessment models: KMCAT, EKMF, Know-All 10/50 and APO lead to the clarification of the criteria presented in Table 15.

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[280] Source: own table

Table 15: Criteria Catalogue for Successful KM[281]

Criteria	Comment	Fulfils the criteria
Both tacit and explicit knowledge should be managed and measured.	People or databases, they all contain organizational knowledge.	Know-All 10/50, KMCAT
Every element of the KM initiative should be strategy oriented.	If no strategy is defined, wrong or not very desirable results might occur.	KMCAT, Know-All 10/50, APO, EKMF
KM and KMA models should be easy, practical, compatible and flexible.	Every stakeholder must understand, like and grasp the meaning of the models.	KMCAT, Know-All 10/50
KM life-cycle should consider all the crucial processes the KM has to go through.	KM life-cycle is the most important domain.	Know-All 10/50
KM officers should consider people, technology, processes, leadership, and product as stability enabling pillars.	Based on the strategy and objectives of the organization, one or more pillars may require KM.	KMCAT
KM should be possible for organizations of private, commercial, public, administrative, and NGO nature.	Models should be developed so that they are appropriate for the geographical area and market/industrial sector of operation.	KMCAT, Know-All 10/50
Models should be able to match organizational, departmental, process, product/unit levels and focus accordingly.	Managing individual or organizational knowledge of weak performing levels requires a ''fit for purpose'' KM model.	KMCAT
Assessment approach should provide both financial quantitative and qualitative knowledge driven results.	BSC and especially questionnaires are very effective.	KMCAT, Know-All 10/50, EKMF, APO
KM Maturity Models are a must.	KMMM provides information about the KM status-quo.	KMCAT, APO
KM and KMA models should take into account possible KRs.	Prevent knowledge loss, ''brain-drain'', and knowledge freeze.	KMCAT
Models should be aware of the follow-up commitment through CIP to reach Business Excellence.	Ensure ''state of the art'' and sustainability.	KMCAT
People talk, listen, understand, empathize and follow. Communicate, communicate, and communicate!	Communication is the key to success, no matter the circumstances or the difficulties, no matter the topic.	Know-All 10/50
Manage and measure with the help of Change Management and Intercultural Management.	Read and understand your people's culture, needs and behaviors.	-
Cultivate trust, enable motivation, establish hierarchy-free knowledge driven relationships.	Drive your business!	-
Managing and measuring people's knowledge is a challenge that requires experienced managers who pay people to work for them.	Be a KM manager!	-
Supporting people towards the desired knowledge-driven performance requires born leaders that can communicate with and invite people to work with them.	Be a KM leader!	KMCAT, Know-All 10/50

Finally, to build a complete Optimized Knowledge Management Framework, three fundamental reference subjects are taken into account:

1- The new KM definition:

> *''Knowledge Management is the **ability** to recognize who knows what (detect, qualify, quantify); the **wisdom** to determine how and where this knowledge can be best used to powerfully improve organization's production and performance (classify, harmonize, administer); the **capacity** to efficiently, effectively and sustainably evaluate, optimize, secure, transfer, and share knowledge (KM life-cycle) with respect to strategic objectives; the **knowledge** to measure the benefits and reward their enablers; and the **commitment** to follow-up on the Continuous Improvement Process of successfully managed individual and organizational tacit and explicit knowledge of an organization.''*

2- The new optimized KM life-cycle presented in Figure 33:
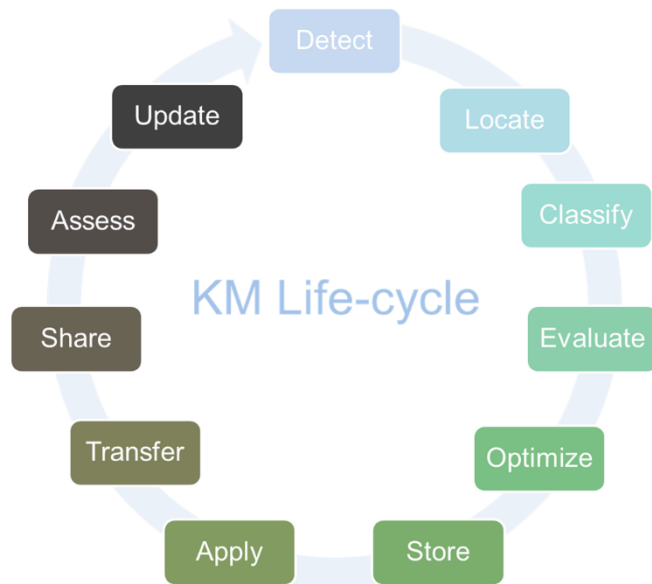
Figure 33: Optimized KM Life-cycle[282]

3- The newly created criteria catalogue suggested for successful KM experience as presented in Table 15.

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[282] Source: own figure.

4.9 Optimized Knowledge Management Framework Criteria Domains

'""Style" is packaging. The only substance is performance."[283]

Table 15 presents the list and the description of the main criteria that KM projects require to be implemented successfully. Figure 34 presents criteria clusters or domains that represent a complete KM framework. Each criteria domain is so constructed that it contains the most relevant criteria that guarantee success. The Optimized Knowledge Management Framework consists of eight domains; three hot spots in the strategy-driven KM domains marked with red background; two sustainability assurance domains marked with green background; and the most important and central criteria domain, the KM life-cycle marked with brown background. The additional light blue background stands for the whole KM framework during the implementation of which, Chief Knowledge Officers and KM managers should be constantly communicating, establishing hierarchy-free relationships, offering rewards for KM success enablers as well as applying Change Management and Intercultural Management along the way. An introduction to each of the domains is provided in the following paragraphs.

1. KM concerns managing the tacit and explicit knowledge that an organization has and sometimes forgets it needs management. Managing both tacit and explicit knowledge effectively to ensure organizational long term successful competitiveness is what KM tries to achieve. KM can be implemented in any department or division that benefits from knowledge transfer[284].

2. KM life-cycle is the content of domain two. What knowledge is there, how can it be effectively and efficiently managed, why and who has process/product related tacit knowledge which could be better used, smartly transformed, broadly shared, innovatively optimized, technologically stored and coherently updated? Each process of the life-cycle is possible when using different tools like CoPs, LL, informal meetings, online databases, reward and incentive systems, WWW, online conferences, workshops, knowledge sharing platforms, etc. make the KM life-cycle possible. For example in the KM pillar of people and culture the most important task in terms of knowledge is the ability of the employees to share the knowledge, to build trust and to foster motivation among each other. Many times workers fear the loss of position, power and sometimes they fear even the layoff. In order to prevent them from having these fears and as such prevent them from locking their valuable knowledge, organizations must apply rewards and incentives for those who share knowledge. Communication, teamwork, know-how sharing experiences and knowledge, situation awareness, leadership and management are essential ANTS that add value to the knowledge culture of organizations. Finding employees that are competent in both technical and ANTS backgrounds is a HR challenge for Oil and Gas companies, pharmaceutical and aviation industry, automobile and military industry, infrastructure and manufacturing. For example, Xerox, the American global corporation rates

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[283] Refer to Drucker, P.F.; Maciariello, J.A. (2008), p. 244.
[284] Refer to Lind-Braucher, S.; Kohla, H. (2013), p. 307.

employees based on two criteria: technical and leadership skills.[285] It is these skills that add value to organizations because they drive the knowledge flow and this is why they are subject to management and assessment. Not knowing how to communicate or share knowledge, not knowing how or not wanting to work in teams, means that the much desired soft-skills are not present when they must be. Especially in terms of knowledge sharing and transferring, a considerable amount of success of industrial giants is strongly dependent on the ANTS of engineers, technicians, Chief Executive Officers, and managers of any discipline. Organizations must therefore keep employees' motivation high so that they feel secure on their way to reaching their self-actualization level of Maslow's hierarchy of needs. By doing so, organizations transform their knowledge culture from ''keep-it tight'' to ''share-it-all''.

3. Domain three is dedicated to KM stability pillars: people, technology, processes, culture, leadership, and product. They are the core pillars of a stable KM initiative. The strength of these pillars in terms of content and contextual KM shows how solid is KM towards the desired business performance. The tools in managing knowledge in and for every pillar are determined by the KM life-cycle processes. Managers should not forget that the company is human-driven. For humans to do what leaders and managers strive for, is very important to understand their needs, their culture and individual perspectives towards change. Highly educated employees, especially engineers are those who most lack associated non-technical skills (ANTS). The lack of ANTS can limit the KM life-cycle's success or even make it fail.

Leadership is crucial in KM and KM assessment. Leadership is responsible for starting change management and communicating that to all relevant stakeholders. Leadership is responsible for cultivating the knowledge culture into the heart of the management, known otherwise as the annual plan.[286]

Stakeholders should meanwhile generate openness, foster trust and manage their expectations at the start of the KM initiative.

Technology and processes are also of high importance in a KM project. With, for and from them various potential knowledge sources, strengths and weaknesses can be identified. For example if a process is failing to reach the target results, a knowledge trigger related to the technology of the process or the process itself might be somewhere in explicit or tacit form. Exactly this knowledge needs to be identified, located, and managed so that the process is completed successfully.

The product is also an essential pillar for KM. Many organizations depend on a single or small variety of products. Knowledge related to those products is often hidden in the tacit form and rarely transferred to new coming employees or to databases for future generation's employees. Products make organizations increase their competiveness and performance if knowledge products and about products is well managed. Customer-related knowledge plays a very important role in this pillar too. Innovation is the best example in this case.

4. Depending on the application field, KM should be strictly adjusted to the characteristics, size, geographical area as well as the operating sector. KM must

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[285] Refer to Allee, V. (2001), p. 6.
[286] Refer to Skyrme, D.J. (2000), p. 17.

fulfil the criteria of being applicable for private, commercial, large national and international enterprises or SMEs, governmental, NGOs, from different regions, nations, continents, and/or market/industry sector. Cross-border and cross-country intercultural issues must not be neglected when KM initiatives are implemented.

5. Domain five is strongly dependent on the overall strategy of the organization. KM team decides whether to run the project at organizational, department, project, and process or unit/product level. It is very important to know before the KM implementation, what is that the company wants to improve in terms of performance and at which level. This is where a status quo check of the weakest or low performing areas in the organization should take place in order to identify where opportunities for a knowledge driven improvement are.

6. KM Assessment is another very strategy-dependent domain in the KM framework. What should be measured, how, and why? Research shows that KM assessment is as complex as it is important. In many attempts to standardize a KMA model for all organizations, assessment remains a vague spot of research topics dedicated to KM. The assessment of KM projects is highly dependent on the measurement approach (quantitative, qualitative, combination of both), defined KPIs (which key performance indicators), metrics specifications (#, years, persons, customers, %, $, tons, patents, knowledge centres, etc.), comparison between ''as-is'' and ''to-be'' KM results, KM risks (human or structural risks), LL (Lessons Learned database), CoPs (Communities of Practice achievements), and EL (Expertise Locator). KM assessment can be done at three different levels: normative, strategic, and operational. The performance of knowledge-driven business processes can be measured through a KMA model. KMA models should be short, easy, flexible, clear, and bias-free. Most importantly KMA must offer meaningful measures.

7. After the KM assessment is done the results are then compared against the maturity model of KM. KMMM has in most of the cases five levels of maturity: initiation, development, standardization, optimization and innovation. Initiation phase is where everything and everyone in the organization gets introduced to KM. Development phase is the phase where the strategy, KM details and goals are defined. Standardization is the phase of pilot projects and implementation of KM at organizational level. Optimization and innovations are the highest phases in a KMMM. Organizations have to achieve excellent KM performance results after having implemented the full KM in order to reach level five of the KMMM. The KMMM presented in Figure 34 is based on the best practice KMA model from APQC.

8. The eighth domain is the follow-up domain dedicated to KM post-implementation periods where Continuous Improvement Process, maintenance, continuous periodical internal and external benchmarking, KM alignment with social, environmental, technological, and economic changes, are the keys to competitiveness and long-term survival of any organization. These steps of KM follow-up lead to business excellence.

Claiming no full integrity of this framework, Figure 34 is a summary of all the work in this thesis and it highlights the core criteria that falls under each criteria domain for any KM initiative of any origin, country, or industry sector.

The work collected in Figure 34 is a modest contribution to the theoretical research discipline of Knowledge Management.

Additionally, Table 16 presents the optimized version of the criteria catalogue presented in Table 15 with the added column about the domains of Figure 34 on which each criteria plays a significant role towards successful organizational KM experience.
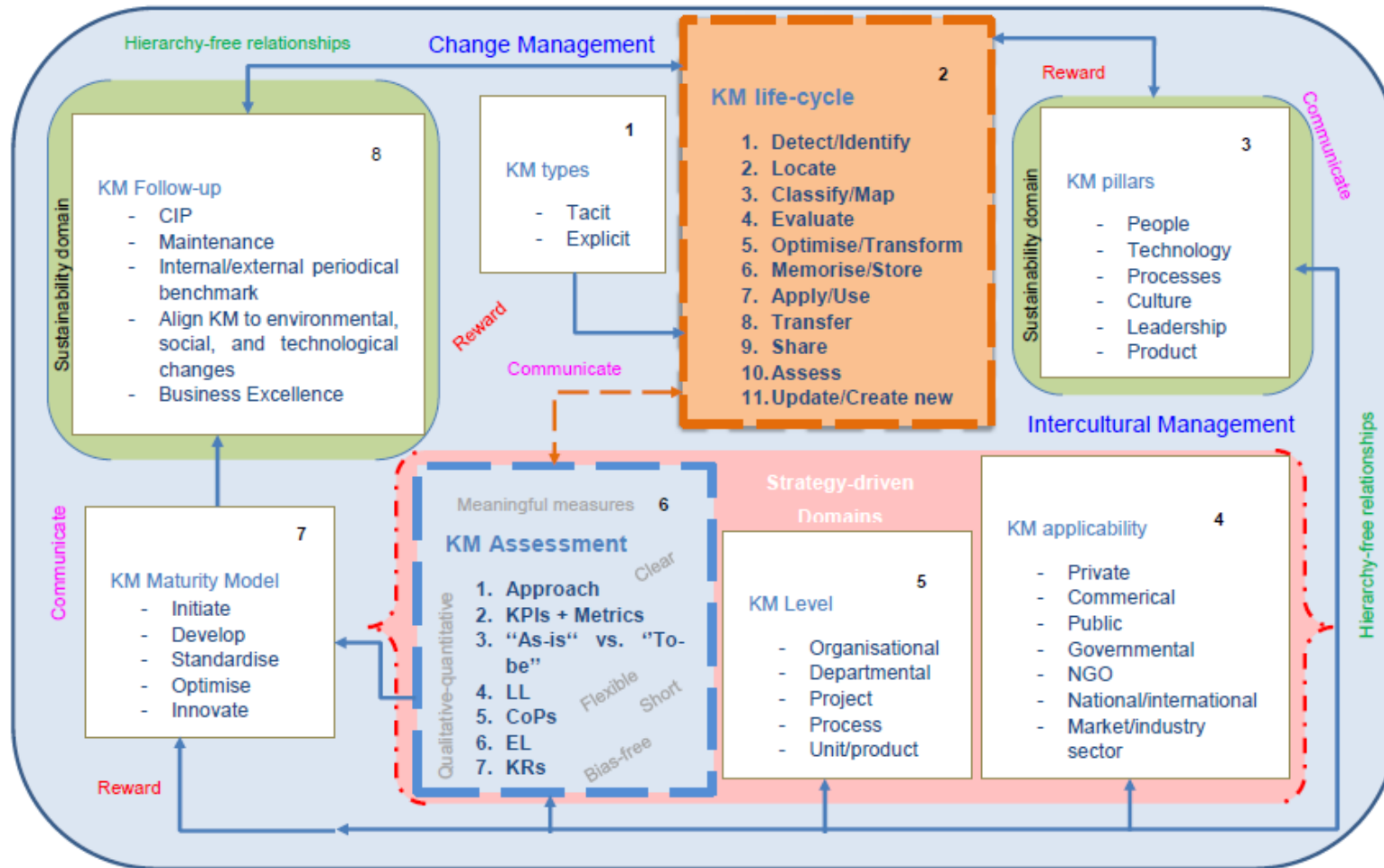
Figure 34: Optimized Knowledge Management Framework Criteria Domains[287]

Table 16: Optimized Criteria Catalogue for Successful KM[288]

Criteria	Comment	Fulfils the criteria	Impact on domain
Both tacit and explicit knowledge should be managed and measured.	People or databases, they all contain organizational knowledge.	Know-All 10/50, KMCAT	1
Every element of the KM initiative should be strategy oriented.	If no strategy is defined, wrong or not very desirable results might occur.	KMCAT, Know-All 10/50, APO, EKMF	All
KM and KMA Models should be easy, practical, compatible and flexible.	Every stakeholder must understand, like and grasp the meaning of the models.	KMCAT, Know-All 10/50	2, 3, 4
KM life-cycle should consider all the crucial processes the KM has to go through.	KM life-cycle is the most important domain.	Know-All 10/50	2
KM officers should consider people, technology, processes, leadership, and product as stability enabling pillars.	Based on the strategy and objectives of the organization, one or more pillars may require KM.	KMCAT	1, 3
KM should be possible for organizations of private, commercial, public, administrative, and NGO nature.	Models should be developed so that they are appropriate for the geographical area and market/industrial sector of operation.	KMCAT, Know-All 10/50	4
Models should be able to match organizational, departmental, process, product/unit levels and focus accordingly.	Managing individual or organizational knowledge of weak performing levels requires a ''fit for purpose'' KM model.	-	5
Assessment approach should provide both financial quantitative and qualitative knowledge driven results.	BSC and especially questionnaires are very effective.	KMCAT, Know-All 10/50, EKMF, APO	6
KM Maturity Models are a must.	KMMM provides information about the KM status-quo.	KMCAT, APO	7
KM and KMA models should take into account possible KRs.	Prevent knowledge loss, ''brain-drain'', and knowledge freeze.	KMCAT	6
Models should be aware of the follow-up commitment through CIP to reach Business Excellence.	Ensure ''state of the art'' and sustainability.	KMCAT	2, 6, 8
People talk, listen, understand, empathize and follow. Communicate, communicate, and communicate!	Communication is the key to success, no matter the circumstances or the difficulties, no matter the topic.	Know-All 10/50	All

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[288] Source: own table

Continuation of Table 16: Optimized Criteria Catalogue for Successful KM

Manage and measure with the help of Change Management and Intercultural Management.	Read and understand your people's culture, needs and behaviors.	-	All
Cultivate trust, enable motivation, establish hierarchy-free knowledge driven relationships.	Drive your business!	-	All
Managing and measuring people's knowledge is a challenge that requires experienced managers who pay people to work for them.	Be a KM manager!	-	All
Supporting people towards the desired knowledge-driven performance requires born leaders that can communicate with and invite people to work with them.	Be a KM leader!	KMCAT, Know-All 10/50	All

5 Conclusions and Outlook

''The empires of the future are the empires of the mind''[289]

Different KM and KM assessment models were presented with the main goal to understand and identify best practice criteria for a successful overall KM experience in organizations. The most important issues covered in this work refer to: the basics of KM, the purpose, challenges and benefits of KM, the importance of KM life-cycle, and the KM performance assessment models.

Knowledge is by far the most valuable asset of organizations. Knowledge is power and as such adds tremendous value to the organizations. Knowledge-centred organizations appear to slowly embrace the fact that knowledge is their promising and sustainable source of long-term survival and competitiveness.

Knowledge can be mainly divided into two forms: tacit and explicit. Managing this knowledge through detailed processes of KM life-cycle is the most crucial activity in a KM project. KM life-cycle ensures that knowledge in organizations is detected, located, mapped, evaluated, optimized, memorize, used, transferred, shared, assessed and continuously updated. While explicit knowledge can be easily managed and measured, this is not the case for tacit knowledge. This work attempts to identify existing theoretical and practical management and measurement models for tacit knowledge.

Based on the theoretical approach and deductive reasoning several KM and KMA models are discussed. There are as many KM and KMA models as there are benefits and challenges. Some of the benefits may be related to higher profit and revenues, lower production, maintenance, labour and training costs, more effective and efficient use of knowledge, high innovation, and better relationships within and beyond the organization. Some of the challenges may be related to employees having no time for KM, lack of knowledge sharing culture, lack of funding for KM, lack of top-management support, lack of rewards and incentives for knowledge sharers, lack of understanding KM and its benefits, and the inability to assess knowledge associated with employees of an organization. The work focused on identifying existing assessment models out of which four were selected for review. Both KM and KMA best practice models come from APQC. Findings in this work show that the most common way to assess KM performance is through bias-free assessments, flexible, short, and easy questionnaires. These questionnaires are based on a KM framework which must be aligned with the organization's business strategy. A KM framework is mostly affected by the ability to establish hierarchy-free relationships, by communicating, by implementing rewards and incentive systems, by calculating knowledge risks, by respecting and addressing intercultural differences, by defining KPAs (KM Pillars), by ensuring an effective knowledge flow (KM life-cycle) and by assessing knowledge flow performance in terms of organizational performance (KMA). Predefined meaningful metrics and KPIs for KMAs that can best reflect the performance of knowledge workers in different business

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[289] Refer to Churchill, W. cited in Allee, V. (2001), p. 1.

processes appear to be the most difficult part of a KM framework. Change Management and Intercultural Management are practices that can help KM to ensure support from all stakeholders involved and to guarantee successful KM. Due to the continuous change of external social, economic, technological and environmental factors, it is very important to update KM and KMA models regularly and to make sure that they are always aligned with the strategy of the organization. This thesis provides an integrative-comprehensive review and represents a contribution to KM literature. New optimized versions of KM life-cycle, KM definition, and KM framework are suggested claiming no full integrity of either. The suggestions are based on the knowledge gained throughout this thesis.

Future theoretical and practical research could shed more light on critical issues and answer questions like what should be measured, and what specific metrics and KPIs can be used to make KM benefits measurable; what Knowledge Risks affect organizational performance and are organizations aware of tacit knowledge-driven risks; do organizations apply KM follow-up programmes and are they beneficial to CIP of KM projects. Another important issue to address in future research is to study whether it is possible and useful to create a standardized continent-country-economy-sector oriented version of a KM framework and KM assessment. By doing so benchmarking would be easier and fair based on the same selection criteria.

Until 2020 and beyond, national and international organizations will embrace the fact that their individual knowledge workers are indeed the real source of their competitiveness, of their long-term success and survival, and of their overall business excellence.

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Annex

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KNOW-ALL 50: KNOWLEDGE MANAGEMENT ASSESSMENT

This assessment is provided to help you gauge how well your organization compares with world-class best practice. There are ten groups of questions, one for each important facet of a knowledge programme. Taking the view of each group of questions as a whole rate your organization (or part of it) on a score 0 to 10, where 0 is doing nothing at all, and 10 is world-class (an example of which is given at the end of each set of questions).

1. Leadership   Score

- Is there a compelling knowledge vision that is actively followed?
- Is the role of knowledge clearly articulated in organizational mission, objectives and plans?
- Are there clear responsibilities for knowledge strategy and activities, such as through a Chief Knowledge Officer?
- Are knowledge and information treated as vital resources and reviewed regularly at management meetings?
- Do your CEO and senior executives promote knowledge management within their team and to the outside world?   ....

Exemplar: BP-Amoco, which has a world-class knowledge programme strongly supported throughout the business and built into core activities. The Chief Executive, John Browne, continually stresses the role of knowledge and learning in public forums and in interviews

2. Culture/Structure

- Are project teams deliberately chosen to include people with a wide level of experience, different expertise and age ranges?
- Do personal performance reviews assess and reward individuals for their knowledge contributions?
- Is time for learning, thinking and reflection considered a good investment of time in your organization?
- Do workplace settings encourage interaction and free flow of information e.g. informal meeting areas, open plan offices, project rooms?   ....
- Are individual experts encouraged to contribute time and expertise to support other teams?

Exemplar: Steelcase has created environments that encourage active teamwork through office layouts. Its executive team work in an open area with extensive knowledge sharing

3. Processes

- Do you know what is vital knowledge - knowledge that underpins your core business processes?
- Is this knowledge readily accessible and naturally integrated into the flow of work?
- Does the organization have systematic processes for monitoring external knowledge sources and for gathering and classifying it?
- Are there clear policy guidelines on what is vital proprietary knowledge and needs to be protected?
- Does your organization benchmark its knowledge management activities against other firms and world class best practice?   ....

Exemplar: CIGNA insurance explicitly mapped its core processes and what knowledge was needed to run them successfully. As a result knowledge sources are embedded into the process as well as links to process experts.

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Know-All 50 KM assessment questionnaire[290]

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[290] Refer to Skyrme, D.J. (2000), p. 7.

4. Explicit Knowledge   Score

- Is there a readily accessible information and knowledge inventory within your firm e.g. on an intranet?
- Are the sources of information validated for quality?
- Are your databases, especially textual ones, regularly maintained?
- Are owners and experts regarding specific information databases clearly identified and held responsible for the integrity of the information?
- Do you have a mechanism e.g. an idea bank, such that ideas not immediately used are not lost for future use?   ....

Exemplar: Price Waterhouse's KnowledgeView^{TM} is a highly structured knowledge base organized to set standards and around a standard classification taxonomy. Entries are regularly validated and quality assessed.

5. Tacit Knowledge

- Do you know who are your best experts for different domains of knowledge?
- Are important meetings videoed or recorded for later reference and sharing of knowledge?
- Are key points of conversations documented in subsequent email memos or discussion databases?
- Is knowledge captured at the customer interface (e.g. call centres, visits) fed back and used in service improvement?
- Are experts encouraged to convert their tacit knowledge into explicit knowledge e.g. via seminars (videoed), "how to" guides etc.?   ....

Exemplar: Royal Mail regular organizes events that bring together internal and external people. These meetings are often video-recorded and used in later discussion.

6. Knowledge Hubs and Centres

- Is there a centre that act as a hub of knowledge flows i.e. it can point you to sources of knowledge?
- Is there a well catalogued library that holds external publications?
- Is the purchase of externally generated information co-ordinated to avoid duplication and fill essential knowledge gaps?
- Is there a core group responsible for creating and maintaining a map of vital knowledge?
- Is there a reservoir of information science and library skills that can act as a source of knowledge management expertise?   ....

Exemplar: Linklater and Paine (law firm) have a knowledge centre that both acts as a physical repository but also maintains key databases and provides external links. The centre manager works closely with senior partners to understand key business issues and therefore provide feeds of relevant external information.

Continuation of Know-All 50 KM assessment questionnaire[291]
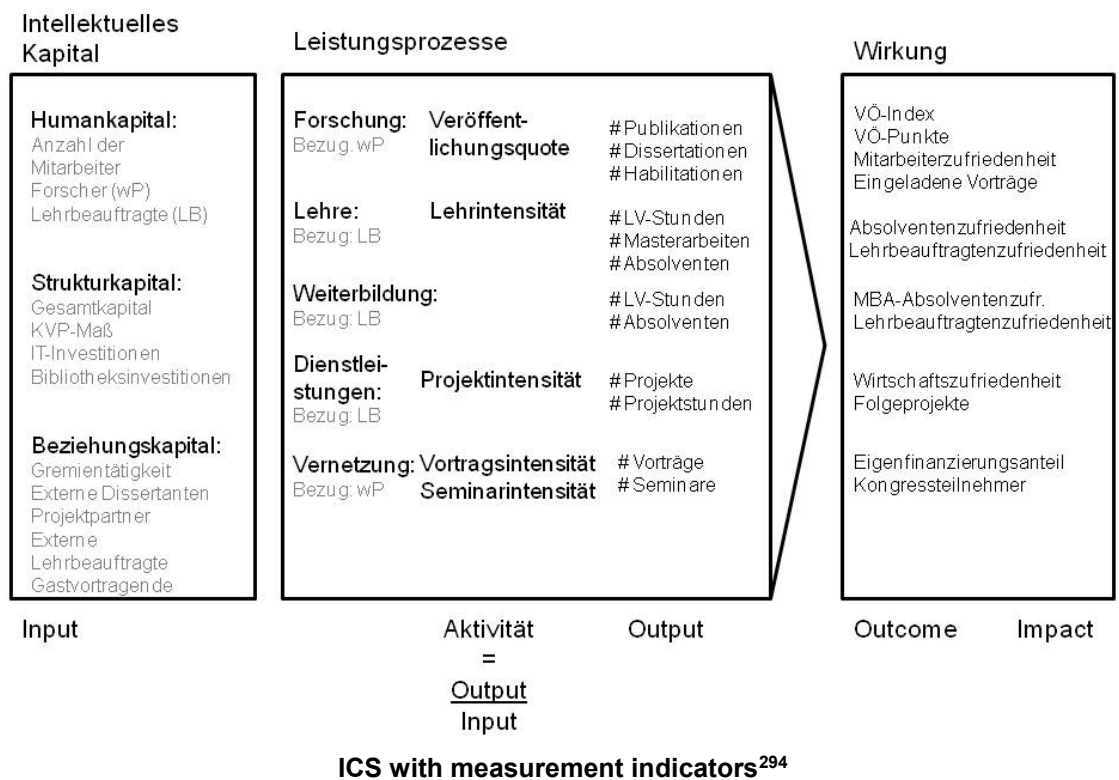
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[291] Refer to Skyrme, D.J. (2000), p. 8.

7. Market Leverage   **Score**

- Is information and knowledge readily available in a form that enhances your services to your stakeholders?
- Have you considered reselling your core expertise in ways that will generate new revenue streams?
- Are your services 'smart' i.e. customizable and adaptable e.g. by aggregating knowledge from disparate sources?
- Are you known among your clients and peers as exemplars of good knowledge management practice?
- Do your publicity and marketing messages convey the importance and depth of your know-how?

            ....

Exemplar: The Automobile Association who originally collected data for motoring purposes has now built up a series of businesses based around the customer information that is collected.

8. Measures

- Are the bottom line benefits of knowledge management clearly articulated in terms that all your managers understand?
- Does your organization measure and manage its intellectual capital in a systematic way?
- Do your performance measurement systems explicitly include intangible and knowledge-based measures e.g. customers?
- Do you report regularly on your knowledge assets, such as in supplements to your annual reports?
- Is your measurement system used as a focus for dialogue and learning?

            ....

Exemplar: Skandia Life has pioneered the measurement and reporting of its intellectual capital. The performance measures are an integral part of strategic planning and management objective setting.

9. People/Skills

- Have specific knowledge roles been identified and assigned e.g. knowledge editor, knowledge analyst?
- Is knowledge management considered a core management skill in which every manager and professional has some familiarity?
- Are there individuals in each main group who are responsible for demonstrating good knowledge practice within their group and acting as a coach to others?
- Is your training approach learner-centred and an integral part of the day-to-day activities of the organization?
- Are acquisition of knowledge management competencies and knowledge sharing behaviours recognized and rewarded?

            ....

Exemplar: Anglian Water makes learning an integral part of team and organizational activities. It is closely linked to its knowledge management programme.

Continuation of Know-All 50 KM assessment questionnaire[292]

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[292] Refer to Skyrme, D.J. (2000), p. 9.

Continuation of Know-All 50 KM assessment questionnaire[293]

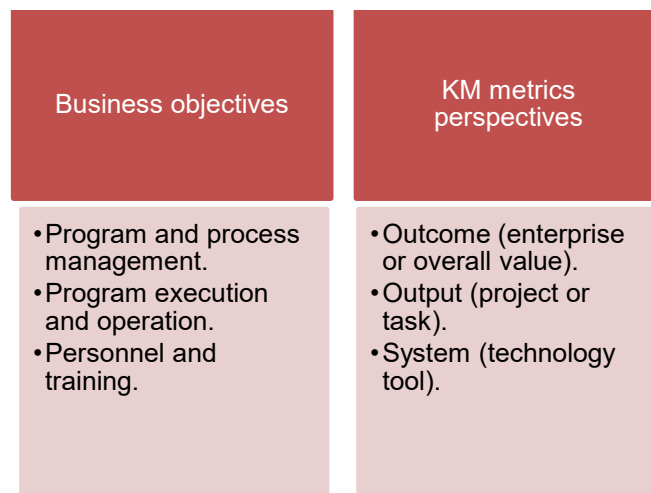**ICS with measurement indicators**[294]

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[293] Refer to Skyrme, D.J. (2000), p. 10.
[294] Refer to Lind-Braucher, S; Kohla, H (2013), p.306.

KCO model (2001)

KCO (Knowledge Centred Organization) tries to offer the reader a guide to design and implement KM performance measures. The authors suggest to first answer a set of questions that will help any organization understand how a KM initiative can enhance the objectives. Questions include the definition and clarification of issues and topics like business objective, what KM methods will be used, what do stakeholders need to know and who are they, which framework is relevant, what is to be measured, how will the measures be collected and analysed, what do they mean, how do we change towards improvement after that. KCO uses three classes of business objectives and three different perspectives from which KM is monitored.

Business objectives	KM metrics perspectives
• Program and process management. • Program execution and operation. • Personnel and training.	• Outcome (enterprise or overall value). • Output (project or task). • System (technology tool).

KCO KM metrics[295]

This model is very detailed and can be a very good approach to measuring the KM performance in organizations. The authors opine that all performance measures defined for the KM initiative:

- Should be familiar to all the stakeholders involved,
- Must reflect the overall mission and strategy of the organization,
- Support decision-making and communication throughout an organization and,
- Must be continuously assessed (KM).

The model is very comprehensive and offers a detailed description of the measurement processes which can start only after a business purpose of the KM has been defined. The first two steps (marked in red in the ''KCO KM metrics process'' figure) are not part of the original process but DON considers them crucial and suggest to complete with the help of brainstorming technique.

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[295] Source: based on DON, (2001), pp. 24 -27.
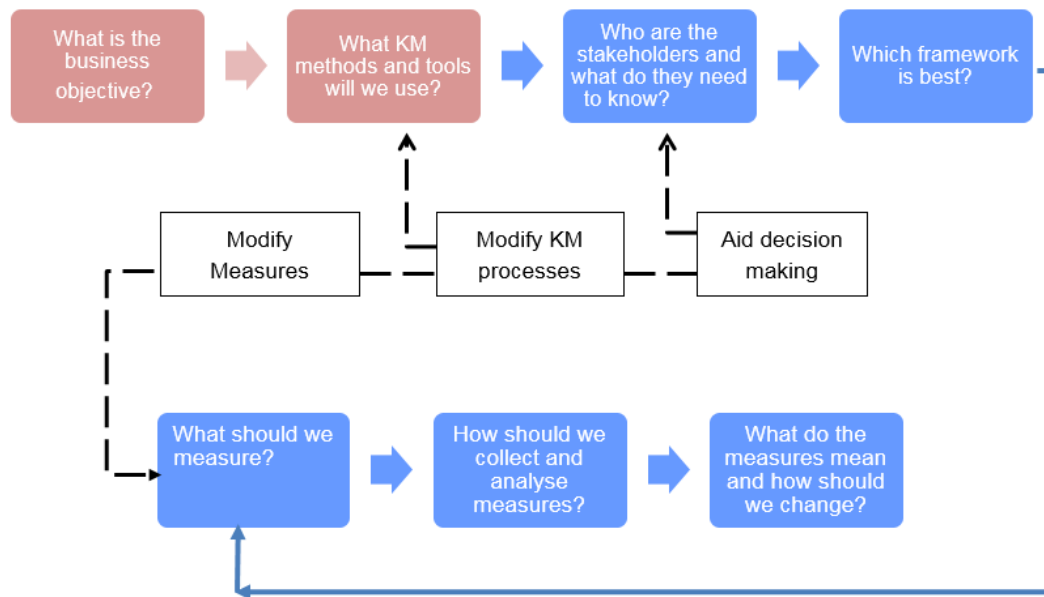
KCO KM metrics process[296]

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[296] Source: DON, (2001), p. 12 (slightly modified).

Summary of KM performance measures[297]

Common measures: These measures can be used for all KM initiatives:			
Outcome - Time, money, or personnel time saved as a result of implementing initiative - Percentage of successful programs compared to those before KM implementation *Output* - Usefulness surveys where users evaluate how useful initiatives have been in helping them accomplish their objectives - Usage anecdotes where users describe (in quantitative terms) how the initiative has contributed to business objectives		*System* - Latency (response times) - Number of downloads - Number of site accesses - Dwell time per page or section - Usability survey - Frequency of use - Navigation path analysis - Number of help desk calls - Number of users - Frequency of use - Percentage of total employees using system	
KM Initiative	**Key System Measures**	**Key Output Measures**	**Key Outcome Measures**
Best Practice Directory	- Number of downloads - Dwell time - Usability survey - Number of users - Total number of contributions - Contribution rate over time	- Usefulness survey - Anecdotes - User ratings of contribution value	- Time, money, or personnel time saved by implementing best practices - Number of groups certified in the use of the best practice - Rate of change in operating costs
Lessons Learned Database	- Number of downloads - Dwell time - Usability survey - Number of users - Total number of contributions - Contribution rate over time	- Time to solve problems - Usefulness survey - Anecdotes - User ratings of contribution value	- Time, money, or personnel time saved by applying lessons learned from others - Rate of change in operating costs
Communities of Practice or Special Interest Groups	- Number of contributions - Frequency of update - Number of members - Ratio of the number of members to the number of contributors (conversion rate)	- Number of "apprentices" mentored by colleagues - Number of problems solved	- Savings or improvement in organizational quality and efficiency - Captured organizational memory - Attrition rate of community members versus non-member cohort
Expert or Expertise Directory	- Number of site accesses - Frequency of use - Number of contributions - Contribution/update rate over time - Navigation path analysis - Number of help desk calls	- Time to solve problems - Number of problems solved - Time to find expert	- Savings or improvement in organizational quality and efficiency - Time, money, or personnel time saved by leveraging expert's knowledge or expertise knowledge base

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[297] Source: DON, (2001), p. 67.

Continuation of Summary of KM performance measures[298]

| KM Initiative	Key System Measures	Key Output Measures	Key Outcome Measures
Portal	• Searching precision and recall • Dwell time • Latency • Usability survey	• Common awareness within teams • Time spent "gathering" information • Time spent "analyzing" information	• Time, money, or personnel time saved as a result of portal use • Reduced training time or learning curve as a result of single access to multiple information sources • Customer satisfaction (based on the value of self service or improved ability for employees to respond to customer needs)
Lead Tracking System	• Number of contributions • Frequency of update • Number of users • Frequency of use • Navigation path analysis	• Number of successful leads • Number of new customers and value from these customers • Value of new work from existing customers • Proposal response times • Proposal "win" rates • Percentage of business developers who report finding value in the use of the system	• Revenue and overhead costs • Customer demographics • Cost and time to produce proposals • Alignment of programs with strategic plans
Collaborative Systems	• Latency during collaborative process • Number of users • Number of patents/trademarks produced • Number of articles published plus number of conference presentations per employee	• Number of projects collaborated on • Time lost due to program delays • Number of new products developed • Value of sales from products created in the last 3-5 years (a measure of innovation) • Average learning curve per employee • Proposal response times • Proposal "win" rates	• Reduced cost of product development, acquisition, or maintenance • Reduction in the number of program delays • Faster response to proposals • Reduced learning curve for new employees
Yellow Pages	• Number of users • Frequency of use • Latency • Searching precision and recall	• Time to find people • Time to solve problems	• Time, money, or personnel time saved as a result of the use of yellow pages • Savings or improvement in organizational quality and efficiency
e-Learning Systems	• Latency • Number of users • Number of courses taken per user	• Training costs	• Savings or improvement in organizational quality and efficiency • Improved employee satisfaction • Reduced cost of training • Reduced learning curve for new employees

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[298] Source : DON (2001), p. 68.

ICMS model (2010)

Developed by Auer, ICMS is an alternative measurement tool that can be easily adapted by any organization. The possibility for combination with other established tools such as IC, BSC, and Knowledge Matrix is good. This tool is an excellent tool to identifying, controlling, measuring and communicating intangible assets. The main goal is to consolidate and develop organizational core competencies. Knowledge resources may be technologies, processes, stakeholders and certainly, employees. In this context the three main aspects of knowledge centred organizations are:

- Knowledge based resources (efficient organizational operations),
- Tools and processes (problem solving capability), and
- Performance goals (innovative competence).

Systematic maintenance of intangible assets assures that only the relevant knowledge is identified, stored, accessed, shared and updated. Auer developed a BSC for knowledge which consists of five perspectives: knowledge creation, knowledge distribution, knowledge use, knowledge preservation, financial perspective. On the strategic level the model adds two more processes: strategic and operative knowledge goals, and knowledge audit through periodical evaluation. Knowledge goals come from the overall organizational goals that lead then to normative, strategic and operative knowledge goals, among which the last two are the most essential ones for the BSC.
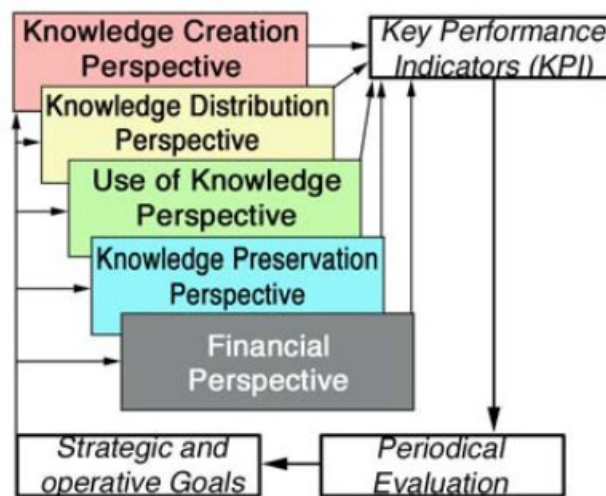
BSC for KM[299]

KPIs coming from all five knowledge perspectives feed into the periodical evaluation. Auer's credo about the KM BSC is that it represents an excellent tool able to steer, control and measure knowledge initiative of any organization. Taking ISO-9000 as a reference point, a European standard that measures quality assurance by assessing instruments, processes and procedures implemented to reach quality, Auer developed ICMS for knowledge. ICMS-15649 evaluates processes and tools correspondent to a previously defined framework which includes all components of the IC.

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[299] Source: Auer, T. (2010), p. 9.

ICMS-15649 architecture[300]

Different to ISO-9000 that uses online judgement (requirement fulfilled YES/NO?), ICMS checks HOW good the requirements are fulfilled and a taxonomy that uses ''best possible fulfilment'' as a reference. It allows comparisons of organizations. In order to achieve the most reliable solution, Auer extended his research by developing the knowledge matrix and then tried to combine it with the ICMS in an attempt to achieve a framework that best suits to organizations. He found out that among four possible combinations, the best combination proved to be between Knowledge Matrix and ICMS.

Knowledge Matrix and KMA combinations[301]

| Combinations	Observations	Conclusions
K-Matrix + Intangible Reports	Light version of an Intangibles Report, Extremely organization-specific content. Content hard to interpret.	No benchmark ability
K-Matrix + BSC + Intangible Reports	Many barriers and limitations.	Very limited benchmark ability
K-Matrix+ BSC + ICMS + Intangible Reports	Complete tool set for a sustainable knowledge work and reporting to external and internal stakeholders.	Benchmarking of different organizations possible.
K-Matrix + ICMS	Complete IC audit tool. Allows long term monitoring of the knowledge work. Recommendable for decentralized or multidivisional organizations.	Harmonized ICMS results offer benchmarking ability.

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[300] Source: Auer, T. (2010), p. 12.
[301] Source : based on Auer, T. (2010), pp. 26-27.

The final ICMS includes three IC categories: human, relational and structural aspects and the IC Management. This model is similar to Skandia Navigator. Reporting organizations are required to report 58 requirements with respect to organizational knowledge work. An ICMS-Requirements Catalogue is provided with the auditing questionnaire. After the IC Audit procedure, a report that describes the status quo of the maintenance of knowledge resources in the organization is presented within 72 hours.

Weaknesses that prevent performance goals are discussed in detail and the report contains audit key information on one single page.

Auer implemented ICMS successfully at the Department of Justice and Security in Lucerne. The author is convinced that this approach can be used in Financial Markets too, for ICMS is a standard tool that allows benchmark-comparisons due to the harmonized IC reports of diverse organizations. ICMS results do not come from retrospective data, but from prospective management of knowledge assets.
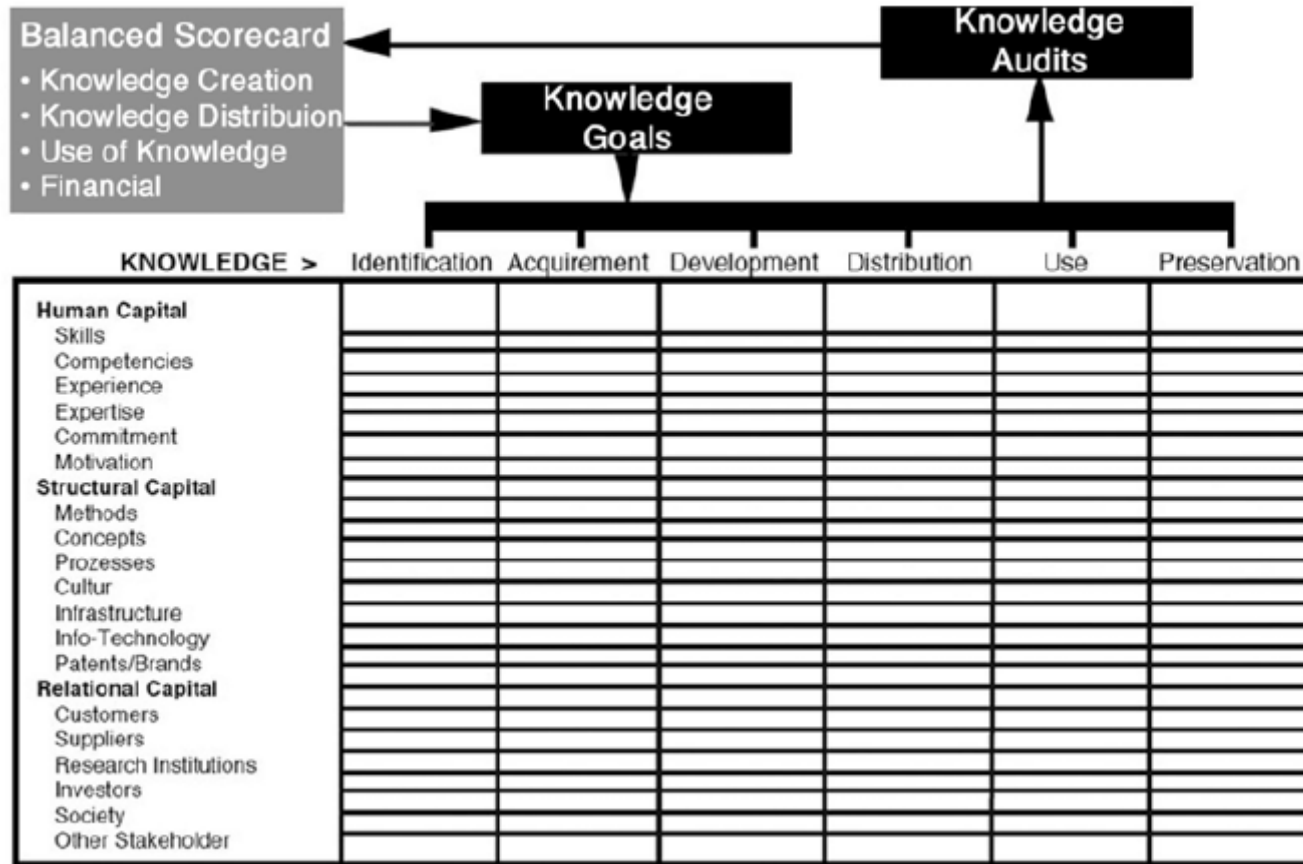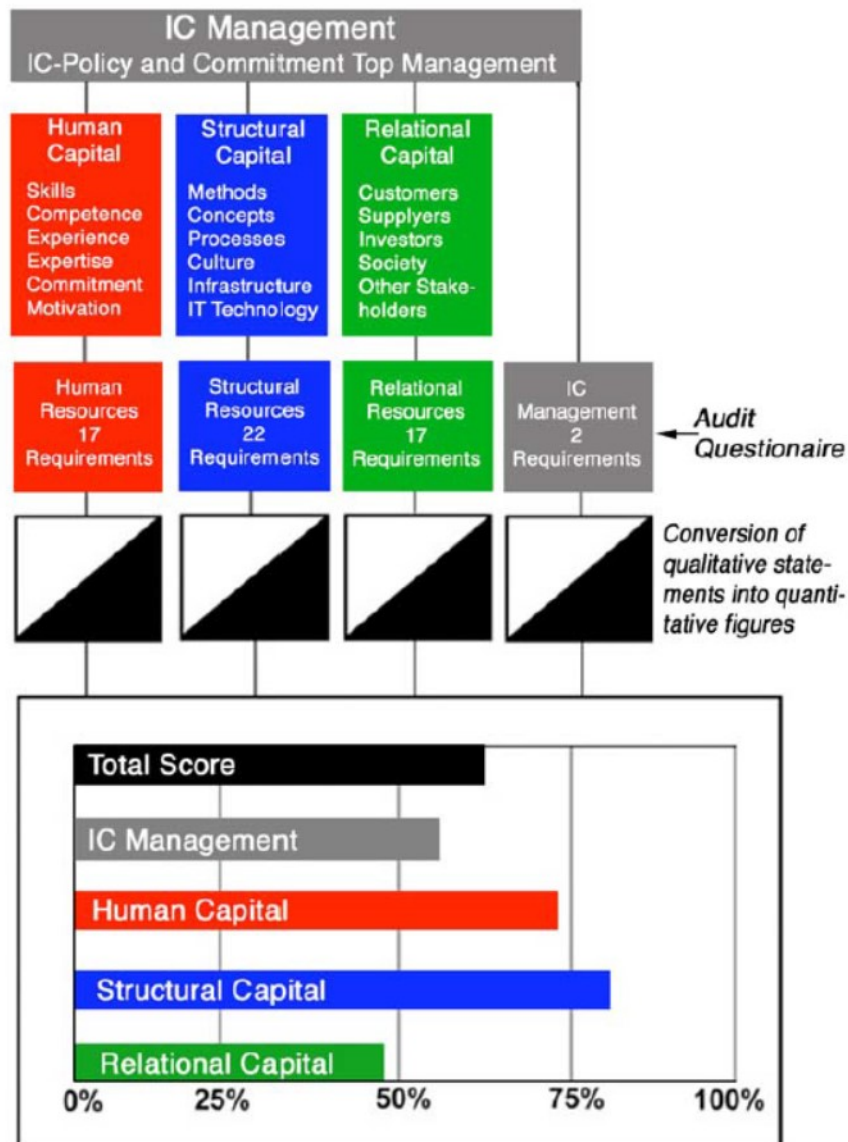
Knowledge matrix[302]

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[302] Source: Auer, T. (2010), p. 25.
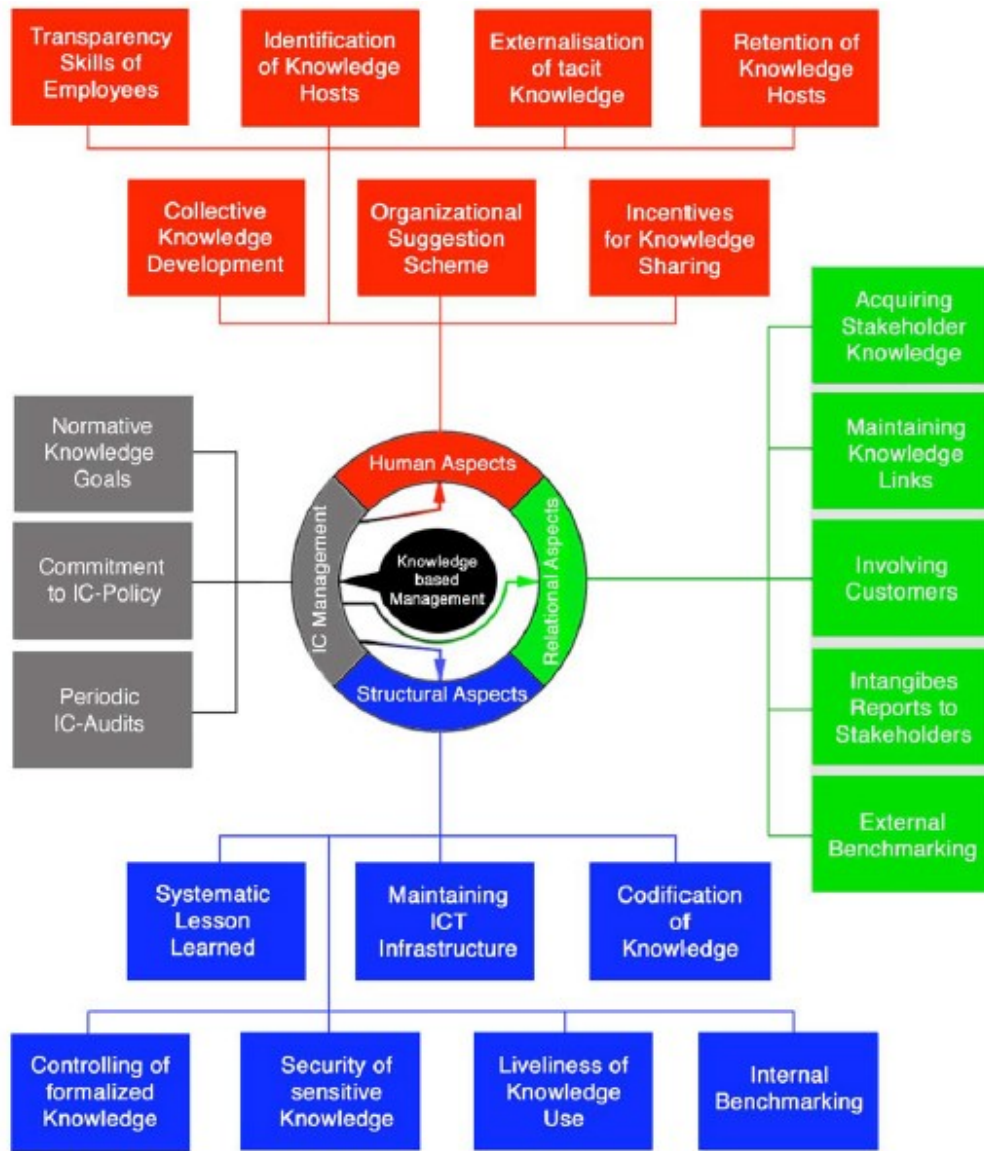
IC Management[303]

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[303] Source: Auer, T. (2010), p. 13.

IC Audit procedure[304]

Other reference KMA models:

1. KMAF model (1997) – Baskerville, R.; Dulipovici, A. (2006) adapted from Jordan and Jones (1997).
2. PROMOTE® model (2000) - Karagiannis, D.; Telesko, R. (2000).
3. KMBoost model (2011) – Kotarba, M. (2011).
4. COBIT 5 model (2014) – Delak, B. et al. (2014).
5. Knowledge Management Assessment - http://www.knowledge-management-online.com/Knowledge-Management-Assessment.html (accessed: 17.03.16).

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[304] Source: Auer, T. (2010), p. 18.