University of Tartu
Faculty of Social Sciences
Institute of Education
Curriculum of Educational Technology

Zarko Pasic

DESIGN OF KNOWLEDGE MANAGEMENT FRAMEWORK FOR CAPACITY BUILDING ACTIVITIES IN THE EU AGENCY - FOCUS ON KNOWLEDGE SHARING SYSTEMS

MA thesis

Supervisor: prof Emanuele Bardone

Tartu 2020

Abstract

Title of the thesis: 'Design of Knowledge Management Framework for Capacity Building Activities of EU Agency - Focus on Knowledge Sharing Systems'

With the present study, I would like to elaborate, identify and design the Knowledge Management - Knowledge Sharing Solution for EU Agency, in order to support the business needs of the Agency in its role of provider of capability building (training) related activities. The research question of this thesis is**: '**How to identify and potentially implement, an actionable Knowledge Management framework which will support the delivery of the capability building activities in the EU Agency?'. As a result, besides identifying the most suitable KM theoretical framework and model to be integrated into the proposed solution, the thesis also provides the concept design of possible implementing steps and IT tools for the Knowledge Management - Knowledge Sharing System of the Agency. The research method of this thesis is based on literature review.

Keywords: eu-LISA Agency, Knowledge Management, Knowledge Management Components, Knowledge Management Systems, Knowledge Management Processes, Knowledge Sharing Systems, Knowledge Management Technologies.

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Introduction

The **goal of this thesis** is to introduce the main concepts and theoretical framework of the Knowledge Management, align those with the environment and business needs in Knowledge Management field of EU Agency (eu-LISA) and finally propose basis for implementation of Knowledge Management framework in the Agency. In their work, 'Knowledge Management: Systems and Processes', authors Irma Becerra-Fernandez and Rajiv Sabherwal1, define four main components of Knowledge Management (KM): Knowledge Discovery, Knowledge Capture, Knowledge Sharing and Knowledge Application. The nominated components of discovery, capture and application of knowledge are essentially already defined in the Agency, however, the component of Knowledge Sharing needs elaboration with further definition of an applicable, practicable and technical solution to be integrated in the KM framework of the Agency. Therefore, the special emphasis in this study is given to the component of Knowledge Sharing. In addition to a broader presentation of KM, also a theoretical overview of the knowledge sharing topic will be provided, followed by the identification of the most suitable technical solutions, and with presenting, in conclusion, the proposal for a concept design of Knowledge Sharing solution to be integrated in the KM environment of the Agency.

This thesis aims at answering the following **research question:** 'How to identify and potentially implement, an actionable Knowledge Management framework which will support the delivery of the capability building activities in the EU Agency?'. Elaborating on the above presented objectives of this study will provide the required response.

Information and data gathered in this research occurred through literature review, bibliography study on the topics, documents analysis and web portal search (e.g. 'Google Scholar'[2] and 'ResearchGate'[3]). Therefore, the **method** used for this study is based mainly on literature review. The literature review include materials published in the time range from 1992-2019. The materials consulted for this thesis primarily focus on the general concepts of Knowledge management, KM Models, solutions and Knowledge Management tools. Further

[1] Becerra-Fernandez, I., & Sabherwal, R. (2010). Knowledge management: Systems and processes. Routledge. https://erl.ucc.edu.gh/jspui/bitstream/123456789/2999/1/%5BIrma_BecerraFernandez%2C_Rajiv_Sabherwal%5D_Knowledg%28BookZZ.org%29.pdf

[2] https://scholar.google.com/

[3] https://www.researchgate.net/

consultation of materials elaborated more in detail the concepts of Knowledge Management System with focus on Knowledge Sharing System. Materials dealing with corporate business processes for the integration of KM tools into working environment were part of the consultations for the concept note on the proposal for implementation of Knowledge Sharing System for eu-LISA Agency. Finally, in order to align the analysed theoretical frameworks and solutions on KM and the proposed educational technology solutions with the needs of the Agency in KM field, a series of, publicly available, corporate documents of eu-LISA Agency were consulted and integrated into the research as well (Strategy of the eu-LISA Agency, eu-LISA Programming documents, eu-LISA Training Strategy). As mentioned previously, the main framework for this thesis is the work of Irma Becerra-Fernandez and Rajiv Sabherwal, 'Knowledge Management: Systems and Processes' (2010). The Knowledge management solution proposed by the authors is very comprehensive and evaluated as the most suitable KM framework which will address in the best way the KM business needs of the Agency. As the main sources for articles and scientific papers on KM related topics, I used above indicated web portals ,'Google Scholar', and 'ResearchGate'. Various product company portals where used for research on KSS solutions. The detailed list of sources used is available in Appendix section of this thesis, especially on 'Additional resources used' subsection. Finally, the concluding note on the literature review refers to keywords used for the selection of articles via the previously indicated web portals; those keywords were the following: eu-LISA Agency, Knowledge management, Knowledge Management Components, Knowledge Management Systems, Knowledge Management Processes, Knowledge Sharing Systems and Knowledge Management Technologies.

Knowledge management is defined as the process of applying a systematic approach for capturing, structuring, managing and sharing knowledge throughout an organization with the purpose of working faster, reusing best practices and reducing costly rework (Nonaka, 1994)[4]. Knowledge Sharing, as integral part of KM is defined as the process through which explicit or tacit knowledge is communicated to other individuals. Those concepts are on the basis of this thesis, which structure develop as follows. First of all, I present the context of EU Agency (eu-LISA), its role in capability building activities, with focus on the training activities of the Agency and business needs in Knowledge Management field. The reasons why the definition of KM framework in the Agency is necessary will be presented as well. After the introductory part focusing on the environment of the Agency, the overview of KM

[4] Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization science*, *5*(1), 14-37.

general concepts, theoretical frameworks and models will be presented, with the selection of the most relevant ones, for this research ('SECI' and 'Wigg model'). The main focus of the study is on the specific KM solution as proposed by the above mentioned researchers, Irma Becerra-Fernandez and Rajiv Sabherwal, in 'Knowledge Management: Systems and Processes' (2010). Furthermore, an analysis of KM Processes, KM Systems and KM Technologies, based again on Fernandez- Sabherwal KM solution, will be provided. When analysing the four main components of Knowledge Management Processes, namely Knowledge Discovery Systems, Knowledge Capture Systems, Knowledge Sharing Systems and Knowledge Application Systems, for the reasons presented previously, particular attention will be given to the concept of Knowledge Sharing. Moreover, the analysis of the most suitable Knowledge Sharing System to be applied in the Agency will be provided. Potential KM, or more precisely, Knowledge Sharing Technologies (IT tools and platforms), to support the activities of the future Knowledge Sharing System of the Agency will be presented. KM - Knowledge Sharing Technologies for the following three categories of Knowledge Sharing Systems will be discussed: incident report databases, best practices databases and expertise locator systems. Finally, in the conclusion of the thesis, the results of the study will be summarised in the last chapter where recommendations and theoretical concept design for the implementation of the Knowledge Sharing System in the Agency, will be provided.

1. The context: eu-LISA Agency and Member States training activities (Capability building)[5]

1.1. eu-LISA and MS Training Activities

eu-LISA was established by virtue of Regulation (EU) No 1077/2011 of the European Parliament and of the Council of 25 October 2011 establishing a European Agency for the operational management of large-scale IT systems in the area of freedom, security and justice, which entered into force on 21. November 2011. The new eu-LISA establishing regulation

[5] More on: https://www.eulisa.europa.eu/ and https://www.eulisa.europa.eu/AboutUs/Documents/MB%20Decissions/2019-052_Training%20Implementation%20Report%202018.pdf

https://www.eulisa.europa.eu/AboutUs/MandateAndActivities/CoreActivities/Documents/eu-LISA%20Training%20Strategy%20and%20Training%20Plan.pdf

https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX:32018R1726

furtherly extended the tasks of the Agency[6]. The Agency is responsible for the long-term operational management of the European Asylum Dactyloscopy Database (Eurodac), the second generation Schengen Information System (SIS II) and the Visa Information System (VIS), the development and operational management of the European Entry/Exit System (EES) and European Travel Authorization and Information System (ETIAS). These systems are essential for the regular functioning of the Schengen Area, for the efficient border management of its external borders as well as for the implementation of common EU asylum and visa policies. The Agency has been entrusted with the centralised system for the identification of Member States holding conviction information on third country nationals and stateless persons (TCN) to supplement and support the European Criminal Records System (ECRIS-TCN) and with the development of interoperability solutions between large-scale IT systems. The core task of the eu-LISA is to ensure the effective, secure and continuous operation of the said IT-systems. The Agency is also responsible for taking necessary measures to ensure the security of the systems and the security of the data therein.

According to the Regulation, one of the main tasks of the Agency is to provide training on the technical use of large-scale IT systems. The training mandate of eu-LISA is provided for in the preamble paragraph 11, and Articles 3b, 4b and 5c of the Regulation. Paragraph 11 of the preamble sets out that the Agency should perform tasks relating to training on the technical use of **SIS II** (Schengen Information System - the largest information system for public security and law enforcement cooperation in Europe), **VIS** (Visa Information System - a system that allows Schengen states to exchange visa data relating to applications for short-stay visas to visit, or to transit through the Schengen area), **Eurodac** (a large-scale fingerprint database that assists primarily in the processing of asylum applications) and other large-scale IT systems which might be entrusted to it in the future.

Technical training provided by the Agency include training to new and existing Member States in order for them to achieve technical readiness integrating to the IT systems or to consolidate their existing use. According to Article 3b the Agency shall perform tasks relating to training on the technical use of SIS II, in particular for SIRENE (Supplementary

[6] Regulation (EU) 2018/1726 of the European Parliament and of the Council of 14 November 2018 on the European Union Agency for the Operational Management of Large-Scale IT Systems in the Area of Freedom, Security and Justice (eu-LISA), and amending Regulation (EC) No 1987/2006 and Council Decision 2007/533/JHA and repealing Regulation (EU) No 1077/2011 PE/29/2018/REV/1. Available on: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32018R1726

Information Request at the National Entries) staff and training of experts on the technical aspects of SIS II in the framework of Schengen evaluation. Article 4b states that the Agency shall perform the tasks relating to training on the technical use of VIS. Article 5c constitutes the Agency's tasks relating to training on the technical use of Eurodac.
According to Article 6 of the Regulation, eu-LISA may be tasked with the preparation, development and operational management of other large-scale IT systems than SIS II, VIS and Eurodac. The extended training mandate of eu-LISA will include: **Entry/Exit system (EES)** - an IT system to be developed to assist Member States in managing the entry and exit of third country nationals to and from the Schengen territory; **European Travel Information and Authorization System (ETIAS)** that will help to strengthen security checks on visa-free travellers, by gathering information on all those travelling visa-free to the European Union to allow for advance irregular migration and security checks; **e-CODEX**, a decentralized IT system used by judicial authorities aiming to improve communication between the judicial authorities across Member States; extending the **European Criminal Records Information System (ECRIS)** to third country nationals (TCN) by introducing, inter alia, the obligation to store criminal record information, including fingerprints, on convicted TCN and to exchange such information for the purpose of criminal proceedings and the **system for Dublin allocation of asylum applicants as per CEAS proposals**. In the coming years, it is proposed that the Agency also develop a number of technical components to enable the interoperability of large-scale IT systems at central level; as per Article 66 of the interoperability proposals, eu-LISA will be responsible for training on the technical use of these components. Detailed overview of training mandate of the Agency is available in **Appendix 1** of the thesis.

The provision of trainings on technical use of the IT systems to national authorities is an essential instrument of eu-LISA in order to fulfil its mission and vision. The **mission** of the training activities of eu-LISA is to provide the necessary expertise for effective use of the large-scale IT systems in the Member States by providing tailored training systems. Through the fulfilment of its mission, eu-LISA adds value to the Member States' policies in the area of justice and home affairs and supports their efforts for a safer Europe through the use of modern technology tools. The **vision** of eu-LISA is to be the centre of excellence by providing high quality and efficient IT services and solutions to Member States and continuously aligning capabilities of technology with the evolving needs of the Member States. In that sense, the eu-LISA Training Strategy is in line with and fully supports the implementation of the **eu-LISA long term Strategy 2018-2022**. The eu-LISA training

activities are focused on the strategic objective under strategic goal 1 of the eu-LISA Strategy – to continuously increase the added value of systems, data and technology to the stakeholders. By delivering appropriate trainings on the systems for the Agency's stakeholders, the strategic objective will be achieved.

The eu-LISA also pursues to implement its training activities in alignment with European strategies and principles in order to ensure the efficiency and conformity of the trainings to the external environment and the needs of stakeholders. The developing and delivery of the trainings of eu-LISA will be based on the following policies and frameworks:

-**European Agenda on Migration**, especially pillar 2 pointing out the relevance of the large-scale IT systems operated by the Agency. The full use of the systems can bring benefits to the border management, as well as reduce Europe's capacity to decrease irregular migration and return irregular migrants;

-**European Agenda on Security**, that points out the importance of the Justice and Home Affairs (JHA) agencies, including eu-LISA, and their role as providers of support and expertise for the Member States. According to the Agenda, security should be a key priority in the training initiatives, whereas existing priorities should be adjusted as required;

-**European Law Enforcement Training Scheme (LETS)**, especially Strand 1. Basic knowledge of the EU dimension of Law Enforcement, that points out the importance of effective use of EU information management tools (such as SIS). The aim of eu-LISA is to achieve the technical readiness of the Member States integrating in the information systems, thus establishing a solid ground for fulfilling the abovementioned strand;

-**European Training Framework**, which provides an overall framework for the European Training landscape and cooperation in education and training. By fulfilling its training mandate, eu-LISA promotes life-long learning, cooperation between Member States and helps to address the common challenge of technological development;

-**European Agenda for Adult Learning**, which promotes the comprehensive provision of high-quality education and training for adults acquiring key competences or leading to qualifications at all levels of the European Qualifications Framework (EQF). The curricula developed by eu-LISA are consistent and aligned with the principles of EQF;

-**Principles of Adult Learning** will be taken into account when developing and delivering the training programmes. The training courses will take into account the previous experience of the attendees and link the content of the courses to the practical issues the attendees might face. Further enhancement of eu-LISA Learning Management System will allow the attendees to use the training materials according to their preferences as well as actively participate in

experience sharing;
-and finally**, The Copenhagen principle** by fostering mutual learning at European level, involving all relevant stakeholders at national level to the training process and expanding lifelong learning

1.2. Target Audience for MS Training Activities

The target audience of the eu-LISA trainings is indicated in the establishing regulation and includes national IT operators managing the large scale IT systems on national level, SIRENE officers and Schengen evaluators. The end-users at national level, such as law enforcement authorities, judicial authorities etc. are not considered as eu-LISA target group; the training of end-users of the systems remain an exclusive responsibility of the Member States. The Agency is however supporting transfer of knowledge applying the 'train-the trainer' methodology to majority of its courses.

1.3. Why KM for capability building in eu-LISA

In the eu-LISA Agency, capability building activities are reflected in its corporate strategies and documents (Implementing strategies, Programming documents), and, for the training related activities, main focus goes to the development and delivery of training activities which bridge the gap in the skills which IT systems users (eu-LISA training target groups members) need to have in order to perform their tasks. Those training activities comprise not only the development or update on technical skills and knowledge people have, but also focus on the development of their qualities, attitudes and behaviours. The training, capability building, activities of the Agency provide specific skills, also if necessary in a short period of time - to meet an immediate need, or are designed to achieve broader requirements over a longer period. The eu-LISA is a fast growing Agency with accordingly a fast growing database of the related knowledge. Although the majority of main KM processes (Knowledge Discovery, Knowledge Capture, Knowledge Sharing and Knowledge Application) are currently covered, to some extent, also by supporting KM procedures and tools, there is a clear need to focus and address properly the process and tools for knowledge sharing for the internal audience and, far more importantly, the external audience, the previously indicated eu-LISA target groups (Member States using the Systems). In this sense, focus should be given also to share not only pure documents but also the experience, ideas and information, and to ensure these are

available in the right place at the right time, with the goal to re-use the existing knowledge and especially to reduce the need to rediscover knowledge.

2. KM - theoretical overview and selected solution

2.1. Defining knowledge and KM

From a large literature **defining the knowledge** I will highlight two definitions, which I consider as best fitting for the aim of the present work. The first one is from Davenport & Prusak (2000)[7] which states that 'the knowledge possessed by each individual is a product of his experience, and encompasses the norms by which he evaluates new inputs from his surroundings'. Based closely on the previous definition by Davenport & Prusak, other two authors, Gamble and Blackwell (2001)[8] define knowledge as "fluid mix of framed experience, values, contextual information, expert insight, and grounded intuition that provides an environment and framework for evaluating and incorporating new experiences and information. It originates and is applied in the mind of the knowers. In organizations it often becomes embedded not only in documents or repositories, but also in organizational routines, practices and norms." In the defining of knowledge, further analysis of literature confirms the common ground among researchers defining the knowledge either as explicit or tacit. The knowledge which is held in mind, is known as **tacit knowledge**, this type of knowledge is hard for others to use (Davenport et al, 1998).[9] Tacit knowledge is represented by the knowledge that is influenced by personal experiences, which are shared when employees meet and share their knowledge regarding the organization (Von Krough et al, 2000)[10]. Tacit knowledge was originally defined by Polanyi[11] in 1960s. Some authors define tacit knowledge also as know-how (Brown & Duguid 1998)[12] referring to intuitive, hard to define knowledge that is largely experience based. Because of this, tacit knowledge is often context dependent

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[7] Davenport, T.H., & Prusak, L. (2000), *Working Knowledge: How Organizations Manage What They Know*, Harvard Business School Press, Boston, MA.
[8] Gamble, P.R., & Blackwell, J. (2001), *Knowledge Management: A State of the Art Guide*, Kogan Page Ltd.
[9] Davenport, T.H. and Prusak, L. 1998. *Working knowledge: How organizations manage what they know.* Boston: Harvard Business School Press.
and
[10] Von Krough, G., Ischijo, K. & Nonaka, I. (2000). Enabling Knowledge creation: How to unlock the mystery of tacit knowledge and release the power of innovation [Google Booksversion]. Retrieved from: https://books.google.se/books?hl=en&lr=&id=JVESDAAAQBAJ&oi=fnd&pg=PP1&dq=tacit+knowledge&ots=BV4vRVYsdM&sig=dQBOpglOu56qWLM5rGNqtoNEBNQ&redir_esc=y#v=onepage&q=tacit%20knowledge&f=false
[11] Polanyi, M. 1966. *The tacit dimension.* London: Routledge and Keoan.
[12] Brown, J.S. and Duguid, P. 2000. Balancing act: How to capture knowledge without killing it. *Harvard Business Review*, May–June, 73–80

and personal in nature. It is hard to communicate and deeply rooted in action, commitment, and involvement (Nonaka 1994)[13]. Tacit knowledge is also regarded as being the most valuable source of knowledge, and the most likely to lead to breakthroughs in the organization (Wellman 2009)[14]. Finally, the previously mentioned Gamble & Blackwell (2001) link the lack of focus on tacit knowledge directly to the reduced capability for innovation and sustained competitiveness. Apart from tacit knowledge there is knowledge that is available for others in records, databases, systems etc. that is known as **explicit knowledge**. Explicit knowledge is the type of knowledge which is formalized and codified as information which can be found in a tangible form, such as documents and databases (Nonaka, 1994 and also Botha et al. 2008)[15]. It is therefore fairly easy to identify, store, and retrieve (Wellman 2009). This is the type of knowledge most easily handled by Knowledge Management Systems (more about this comes in the following chapters of the present thesis) which main goal is to facilitate the effective storage, retrieval, and/or modification of documents and texts. Many theoreticians consider explicit knowledge as being less important (e.g. Brown & Duguid 1991, Cook & Brown 1999, Bukowitz & Williams 1999, etc.)[16]. Explicit knowledge is simpler in nature and cannot contain the rich experience based on know-how that can generate lasting competitive advantage. Concluding the overview of definitions of what is knowledge, we can continue now with defining the Knowledge Management itself.

When **defining the Knowledge Management**, the first often quoted definition in the literature discussing the Knowledge Management topic is the definition provided by Davenport (1994)[17], who affirms: "Knowledge Management is the process of capturing, distributing, and effectively using knowledge". The second most cited definition in the literature is the definition provided by Duhon (1998)[18] "Knowledge management is a discipline that promotes an integrated approach to identifying, capturing, evaluating,

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13 Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. Organizational Science, 5(1), 14-37. Retrieved from: http://pubsonline.informs.org/doi/pdf/10.1287/orsc.5.1.14

14 Wellman, J. (2009). *Organizational learning: How companies and institutions manage and apply knowledge*. Springer.

15 Botha A, Kourie D, & Snyman R, (2008), *Coping with Continuous Change in the Business Environment, Knowledge Management and Knowledge Management Technology*, Chandice Publishing Ltd.

16 See more in: Bukowitz, W., & Williams, R. (1999), *The Knowledge Management Fieldbook*, Financal Times/Prentice Hall.
Brown, J.S. & Duguid, P., (1991) Organizational Learning and Communities of Practice. Toward a Unified View of Working, *Organization Science* vol.2, no.1.
Cook, S.D., & Brown, J.S. (1999), Bridging Epistemologies: the Generative Dance between Organizational Knowledge and Organizational Knowing. *Organization Science*, vol. 10, no. 4.

17 Davenport, Thomas H. (1994), Saving IT's Soul: Human Centered Information Management. Harvard Business Review

18 Duhon, B. (1998); It's all in our heads, Inform, Vol. 12, No. 8, September, 1998, p8-13.

retrieving, and sharing all of an enterprise's information assets. These assets may include databases, documents, policies and procedures". The additional definition of KM is the one provided by Drucker (1998)[19] who considers Knowledge Management as "the coordination and exploitation of organizational knowledge resources, in order to create benefit and competitive advantage". Wellman (2009) limits the scope of KM to lessons learned and the techniques employed for the management of what is already known. He argues that knowledge creation is often perceived as a separate discipline and generally falls under innovation management. Bukowitz and Williams (1999) link KM directly to tactical and strategic requirements. Its focus is on the use and enhancement of knowledge based assets to enable the firm to respond to these issues. A similarly broad definition is presented by Davenport & Prusak (2000), which states that KM "is managing the corporation's knowledge through a systematically and organizationally specified process for acquiring, organizing, sustaining, applying, sharing and renewing both the tacit and explicit knowledge of employees to enhance organizational performance and create value". Finally, the often cited authors in knowledge definition are (Gurteen, 1998 and Jennex, 2005)[20] who are stating that KM can be defined as 'an emerging set of organisational design and operational principles, processes, organisational structures, applications and technologies that helps knowledge workers dramatically leverage their creativity and ability to deliver business value' (Gurteen, 1998). Jennex (2005) define the KM as "the practice of selectively applying knowledge from the previous experiences of decision making to current and future decision making activities with the express purpose of improving the organization's effectiveness" (Jennex, 2005). I would like to conclude this introductory chapter on knowledge and Knowledge Management in making the connection between the previously presented types of knowledge (tacit and explicit) and Knowledge Management itself, by providing the view on the topic from the earlier mentioned authors, Nonaka and Botha. As elaborated by Nonaka (Nonaka 1994), the knowledge management of explicit knowledge is a process of collecting knowledge, while knowledge management of tacit knowledge is a process of connecting sources of experience. This concept introduced and developed by Nonaka in the 1990's remains a theoretical cornerstone of this discipline. On the other hand, Botha et al (2008) point out that tacit and explicit knowledge should be seen as a spectrum rather than as definitive points. Therefore, in

[19] Drucker, P. F. (1998). The discipline of innovation. Harvard business review, 76(6), 149-157.
[20] Gurteen, D. (1998). Knowledge, creativity and innovation. Journal of knowledge Management, 2(1), 5-13. and
Jennex, M. E. (Ed.). (2005). Case studies in knowledge management. IGI Global.

practice, all knowledge should be considered as a mixture of tacit and explicit elements rather than being one or the other.

2.2. KM Models

As mentioned in the introduction section, the research work on KM Solution proposed by Becerra-Fernandez, I. and Sabherwal, R. (2010) in Knowledge Management: Systems and Processes21, is very much on the basis for this thesis. The constant reference made by authors, in cited work, to **KM Model of Nonaka & Takeuchi**, necessitates a brief presentation of the nominated model. As mentioned previously, Nonaka's knowledge management model (Nonaka & Takeuchi, 1995[22]) presumes that knowledge consists of tacit and explicit elements. In this aspect, tacit knowledge is defined as nonverbalised, intuitive and unarticulated, whilst, explicit knowledge is articulated and can be specified in writing, drawings, computer programming and others. The proposed SECI[23] model of knowledge dimensions is a model which explains how tacit and explicit knowledge are converted into organisational knowledge. The SECI model distinguishes four knowledge dimensions – socialization, externalization, combination, and internalization. This KM model believes that tacit knowledge can be transferred into tacit knowledge in others by socialization and tacit knowledge can be transferred into explicit knowledge through externalization process. The model also considers that explicit knowledge can be transferred into tacit knowledge in others by translating theory into practice also known as a process of internalization and explicit knowledge can be transferred to explicit knowledge in others by combining various existing theories – known as combination process. Even though each of these modes may independently create knowledge, the organizational knowledge creation processes only occur when all the four modes are organizationally managed and dynamically interacted. This process which is highly iterative constitutes the 'knowledge spiral' which happens mainly through informal networks of relations in the organization starting from the individual level,

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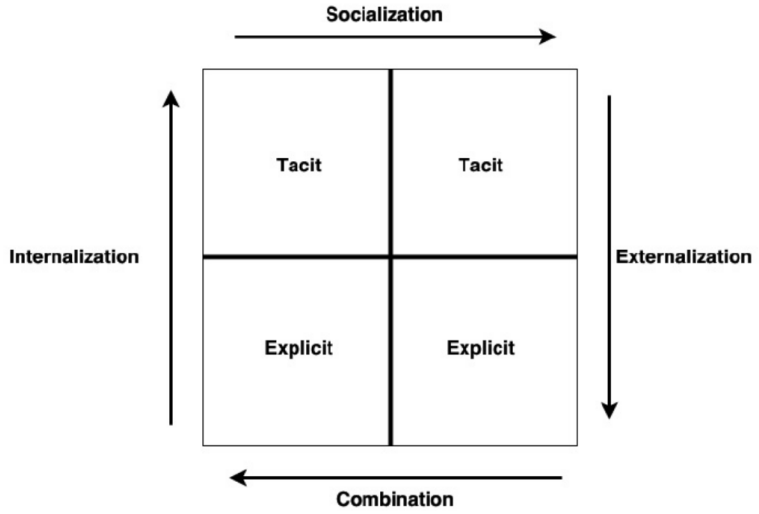
[21] Becerra-Fernandez, I. and Sabherwal, R. (2010). Knowledge Management: Systems and Processes. Armonk (N.Y.); London : M.E. Sharpe.

22 See: Nonaka, I. (1994). Theory of Organizational Knowledge Creation. Organizational Science, vol 5, no.1.
Nonaka I., Takeuchi H. (1995). The Knowledge-Creating Company, Oxford University Press.
Nonaka, I., and Takeuchi, H., (1996). The Theory of Organizational Knowledge Creation. International Journal of Technology Management, vol 11, no 7/8, 1996
and
Haslinda, A., & Sarinah, A. (2009). A review of knowledge management models. Journal of international social research, 2(9).
https://pdfs.semanticscholar.org/373d/e8306d919ac2300bffab88a8a0ddb7ae7b46.pdf.

[23] The SECI model was originally developed by Ikujiro Nonaka in 1990 and later further refined by Hirotaka Takeuchi.

then moves up to the group (collective) level and eventually to the organizational level. It creates a 'spiralling effect' of knowledge accumulation and growth which promotes organization innovation and learning (Nonaka, 1994; Nonaka and Takeuchi, 1995). 24

Figure 1:SECI Model[25]



SECI Model (Nonaka & Takeuchi, 1995)

To complete the description of the possibly best suitable KM models to be used in the definition of the KM for the final user of this research (eu-LISA Agency), I would also like to mention the **Wiig model** (Wiig, 1993). [26]

This model highlights the principle saying that in order for knowledge to be useful and valuable, it must be organized. In addition, knowledge should be organized differently depending on what the knowledge will be used for. This model also addresses the problem referring to how relevant can the knowledge be, coming from a specific source. Also, in this model, the source can be tacit or explicit. Another important aspect refers to the relations between different objects of knowledge. We will find that very few elements are completely disconnected, in other words, independent. Wiig model also defines levels regarding the internalization of knowledge. The levels of internalization span the classifications of novice, beginner, competent, expert, and master. A novice is unaware of the knowledge available and

[25] Source: https://www.researchgate.net/figure/SECI-Model-Nonaka-Takeuchi-1995_fig2_283485182
[26] Wiig, K. M (1999). Knowledge Management:An Emerging Discipline Rooted in a Long History. http://www.krii.com/downloads/km_emerg_discipl.pdf

how it can be used. A beginner knows that knowledge exist and where to get it but cannot reason with it. The competent knower knows about the knowledge, can use and reason with the knowledge given external knowledge bases such as documents and people to help. The expert knows the knowledge, holds the knowledge in memory, understands where it applies, reasons with it without outside help. The master internalizes the knowledge fully, has a deep understanding with full integration into values, and consequences of using that knowledge (Dalkir, 2011).27 Wing model also identifies the three knowledge forms: Public (explicit, can be learned and shared), Sharing expertise (intellectual assets which are held exclusively by employees and shared during work or embedded in technologies) and Permanent knowledge (the least accessible, but the most complete form of knowledge which is usually tacit and used without knowing). Besides these three forms, Wiig defines another four types of knowledge: based on facts, conceptual knowledge, methodological knowledge and expectation knowledge. Knowledge based on facts is about data, causal links, measures and readings – having an observable content, directly measurable. Conceptual knowledge implies systems, concepts and perspectives. Methodological knowledge is used by strategies, methods for decision refining and other techniques. Expectation knowledge refers to judgments, hypothesis and expectations of the persons that possess them. All three classical forms of knowledge, combined with the perspectives proposed by Wiig, are forming a matrix which constitutes the core of Wiig knowledge management model.28

To summarise, Nonaka/Takeuchi SECI models is centered on knowledge spirals, which can explain tacit knowledge transformation into explicit knowledge. Wiig model is mostly based on the principle saying that knowledge can be useful only when it is organized through semantic networks, in order to ensure perspectives and purposes. Wiig's model attempts to define different levels of internationalization of knowledge, and therefore could be seen as a further refinement of the fourth Nonaka and Takeuchi quadrant of internalization. 29. The above presented characteristics of both models, made them suitable for the environment and the required business needs in KM field of the Agency.

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27 Dalkir, K. (2011). *Knowledge Management in Theory and Practice*. Cambridge, Massachusetts: the MIT Press (Dalkir, 2011, p.80).

[28] Wiig, K.: "Knowledge management foundations: thinking about thinking. How people and organizations create, represent and use knowledge", Schema Press, Arlington, 1993

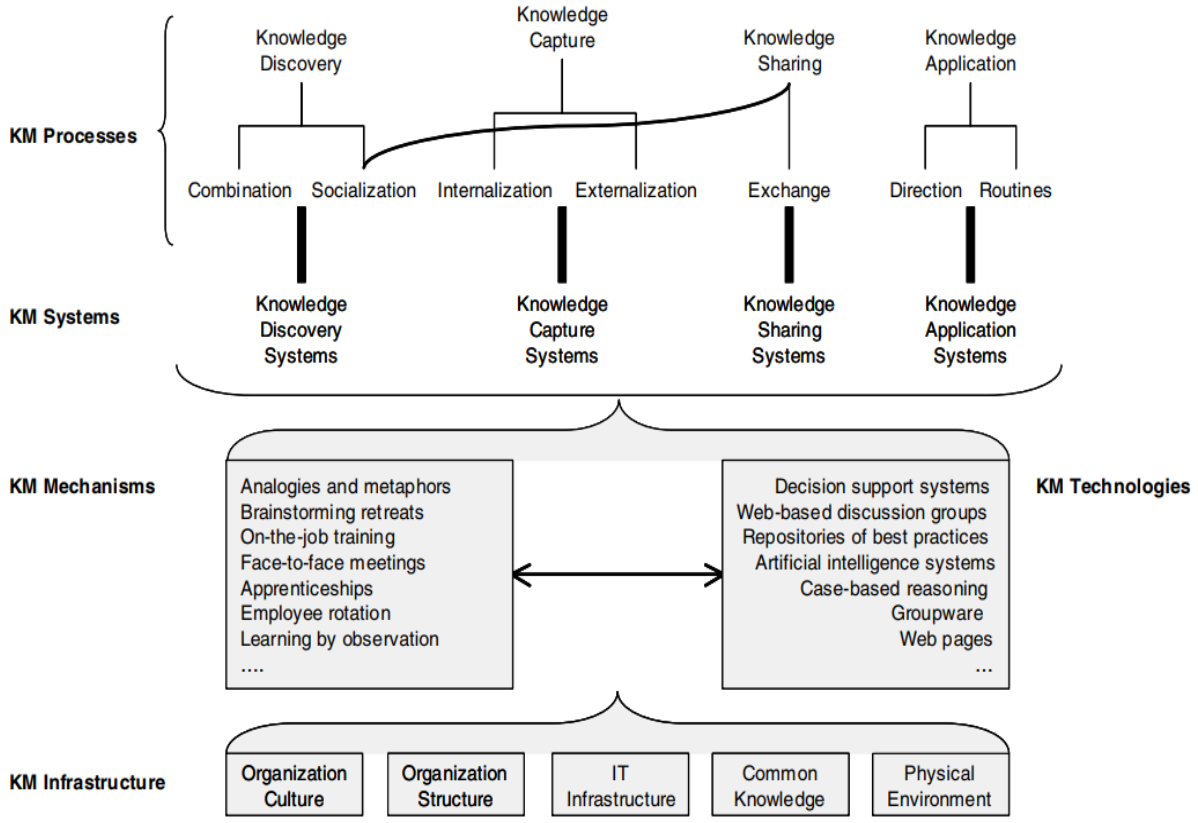
[29] The Annals of "Dunarea de Jos" University of Galati, Fascicle I – 2009. Economics and Applied Informatics. Years XV – no 2 - ISSN 1584-0409
https://core.ac.uk/download/pdf/26762758.pdf

2.3. Proposal of KM Solution for the eu-LISA (Fernandez-Sabherwal framework)

As already indicated, the above presented SECI Model (KM Model of Nonaka & Takeuchi), with a furtherly elaborated version summarised in Wiig model, are on the basis of the 'Knowledge Management Solution' proposed by Becerra-Fernandez, I. and Sabherwal, R. (2010) in Knowledge Management: Systems and Processes[30]. The comprehensible nature of the proposed solution, its main characteristics, together with a detailed insight on the topic which is the focus of this thesis, the Knowledge Sharing System, makes this framework very suitable for the definition of KM solution to be proposed for the implementation in the eu-LISA Agency.

The overall, visual, summary of the solution is presented here:

Figure 2: A detailed View of Knowledge Management Solution[31]



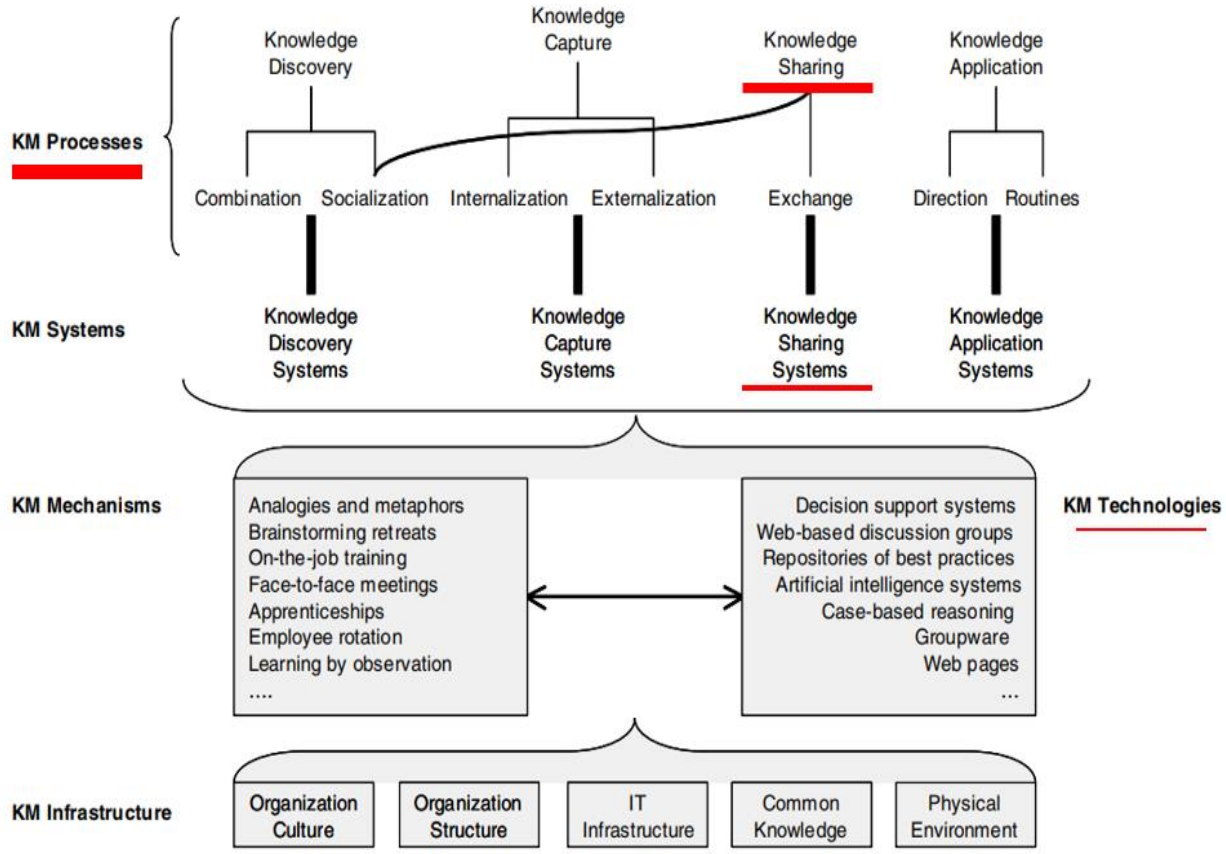
The objective of this chapter is not to provide the complete analysis of the entire Fernandez-Sabherwal framework for KM and its components, but rather to identify and focus on those

[30] Becerra-Fernandez, I. and Sabherwal, R. (2010). Knowledge Management: Systems and Processes. Armonk (N.Y.); London : M.E. Sharpe.

[31] Source: Becerra-Fernandez, I. and Sabherwal, R. (2010). Knowledge Management: Systems and Processes. Armonk (N.Y.); London : M.E. Sharpe., p.68

elements of the proposed framework which are most suitable to provide appropriate definition of the KM framework for the future Knowledge Sharing System of the Agency. Therefore, and also taking into account what was mentioned in the introductory part of this thesis regarding the adequate state of play of knowledge discovery, capture and application processes in the Agency, further analysis of this framework will concentrate on the Knowledge Sharing Systems only. Following this, the foreseen path of the research is summarised as follows: from four KM Processes indicated: knowledge discovery, knowledge capture, knowledge application and knowledge sharing, the latter, that is - knowledge sharing, is the process which needs special focus in defining the future KM solution for the Agency, with the mapping of the currently present and identifying possible additional IT solutions for Knowledge Sharing System of the Agency as the final point of this research path (see below Figure 3).

Figure 3: Proposed Research Path through the scheme of Fernandez-Sabherwal Knowledge Management Solution



2.3.1 KM Processes: focus on knowledge sharing process

As already mentioned before, Fernandez and Sabherwal consider that knowledge management processes rely on four main kinds of KM processes: knowledge discovery, knowledge capture, knowledge sharing and knowledge application. Following the definition, through those processes the knowledge is discovered, captured, shared and finally applied. These four KM processes are supported by a set of **seven KM sub processes:** combination, socialization, internalization, externalization, exchange, direction and routines. Of the seven KM sub processes, four are based on Nonaka (1994) who identified four ways of managing knowledge: socialization, externalization, internalization, and combination. In addition to what already presented above on Nonaka's KM framework, the sub processes and their relations with explicit/tacit knowledge, indicated here, can be furtherly summarised as follows:

- Combination (explicit to explicit)
- Socialization (tacit to tacit),
- Internalization (explicit to tacit)
- Externalization (tacit to explicit)

The other three KM subprocesses: exchange, direction, and routines, are largely based on Grant (1996) and Nahapiet and Ghoshal (1998).32. Those subprocesses are present in the knowledge application element of the framework, which is not the main topic of this thesis, hence those will not be further elaborated.

In their KM framework, Fernandez and Sabherwal define the **Knowledge discovery** as the development of new tacit or explicit knowledge from data and information or from the synthesis of prior knowledge. The discovery of new explicit knowledge relies most directly on combination, whereas the discovery of new tacit knowledge relies most directly on socialization. In either case, new knowledge is discovered by synthesizing knowledge from two or more distinct areas with explicit knowledge from two areas being synthesized through combination, and tacit knowledge from two areas being synthesized through socialization. The authors stress the importance to obtain the tacit knowledge from individuals' minds as well as the explicit knowledge from the manual, such that the knowledge can then be shared with others. This is the focus of **knowledge capture,** which may be defined as the process of retrieving either explicit or tacit knowledge that resides within people, artifacts, or

[32] Nahapiet, J. and Ghoshal, S., 1998, Social capital, intellectual capital, and the organizational advantage, *Academy of Management Review,* 23.2, pp.242-266.

organizational entities. Also, the knowledge being captured might reside outside the organization. The knowledge capture process benefits most directly from two KM subprocesses— externalization and internalization. Externalization is the sub-process through which an organization captures the tacit knowledge its workers possess so that it can be documented, verbalized and shared. This is a difficult process because tacit knowledge is often difficult to articulate. Internalization is the sub-process through which workers acquire tacit knowledge. It represents the traditional notion of learning. Knowledge capture can also be conducted outside an organization. Based on work by Nonaka (1994), externalization and internalization help capture the tacit knowledge and explicit knowledge, respectively. To complete the overview of proposed KM solution, reference will be made here also to **knowledge application**. As stated by Fernandez-Sabherwal, knowledge contributes most directly to organizational performance when it is used to make decisions and perform tasks. The process of knowledge application depends on the available knowledge, and knowledge itself depends on the processes of knowledge discovery, capture, and sharing. The better the processes of knowledge discovery, capture, and sharing, the greater the likelihood that the knowledge needed is available for effective application in the decision-making and task performance. In applying knowledge, the party that makes use of it does not necessarily need to comprehend it. All that is needed is that somehow the knowledge be used to guide decisions and actions. As indicated before, for the purpose of this thesis, from four indicated KM processes, the special focus will be given to the process of **Knowledge sharing**. Knowledge Sharing is the process through which explicit or tacit knowledge is communicated to other individuals.

Fernandez-Sabherwal provide three important clarifications on knowledge sharing. First, knowledge sharing means effective transfer, so that the recipient of knowledge can understand it well enough to act on it (Jensen and Meckling 1996)[33]. Second, what is shared is knowledge rather than recommendations based on the knowledge; the former involves the recipient acquiring the shared knowledge as well as being able to take action based on it, whereas the latter simply involves utilization of knowledge without the recipient internalizing the shared knowledge. Third, knowledge sharing may take place across individuals as well as across

[33] Jensen, M.C., and Meckling, W.H. 1996. Specific and general knowledge, and organizational structure. In *Knowledge Management & Organizational Design*, ed. P.S. Myers, 17–18. Newton, MA: Butterworth-Heinemann.

groups, departments, or organizations (Alavi and Leidner 2001)[34]. Sharing knowledge is clearly an important process in enhancing organizational innovativeness and performance, again in Becerra-Fernandez and Sabherwal (2010)[35]. Following the above presented clarification, and based on the provided definition of Knowledge sharing process, the proposed Knowledge Sharing solution for the Agency should ensure, in the first place, the effective transfer of knowledge, as the main goal, and secondly, focus on the business need that the recipient must acquire the shared knowledge in order to be able to take action based on it, rather than simply use the knowledge without really implementing it. Finally, the Knowledge Sharing Solution should address properly the need that knowledge sharing shall take place across individuals, organization as whole and especially with Member States, who are the main consumers of the provided knowledge (based also on Alavi and Leidner 2001).

2.3.2 KM System: focus on Knowledge Sharing System (KSS)

According to Damodaran and Olphert (2000)[36], KMS are information systems that are perceived as facilitating organizational learning by capturing knowledge, content and processes and making it available to employees as necessary. Alavi and Leidner (2001) defined KMS as "IT based systems developed to support and enhance the organizational processes of knowledge creation, storage/retrieval, transfer, and application". According to Abou-Zeid (2002)[37] there are two different perspectives of KMS and that complement each other, the knowledge perspective or the process perspective. Those are quite similar to the two common perceptions of organizational knowledge management systems (OKMS) according to Meso and Smith (2000)[38], the technical perception and the socio-technical perception. KMS create an identity that is associated and loyal to the company, in the same time as it make people in the organization promote trust, social norms, expectations and obligations (Sherif et al, 2006)[39]. According to Cerchione and Esposito (2017)[40] on the other hand, a

[34] Alavi, M., and D. Leidner. 2001. Knowledge management and knowledge management systems: Conceptual foundations and research issues. *MIS Quarterly*, 25(1), 107–136
[35] Becerra-Fernandez and Sabherwal, 2010, Chapter 4, P.60
[36] Damodaran, L., & Olphert, W. (2000). Barriers and facilitators to the use of knowledge management systems. Behaviour & Information Technology, 19(6), 405-413.
[37] Abou-Zeid, E. S. (2002). A knowledge management reference model. *Journal of knowledge management*.
[38] Meso, P., & Smith, R. (2000). A resource-based view of organizational knowledge management systems. *Journal of knowledge management*. Retrieved from: http://dx.doi.org/10.1108/13673270010350020
[39] Sherif, K., Hoffman, J., & Thomas, B. (2006). Can technology build organizational social capital? The case of a global IT consulting firm. Information & Management, 43(7), 795-804. Retrieved from: http://www.sciencedirect.com/science/article/pii/S0378720606000681
[40] Cerchione, R. & Esposito, E. (2017). Using knowledge management systems: A taxonomy of SME strategies. International Journal of Information Management, 37(1), 1551-1562. Retrieved from:

KMS can be divided in two categories, these are KM-practices and KM tools, which divide the specific IT-based system from the methods and techniques. In addition to what presented above, for a system to be classified as a Knowledge Management System, Alavi and Leidner (2001) argue that a chief purpose of the system must be to promote one or more of the four organizational processes: knowledge creation, storage /retrieval, transfer, and/or application. Although there is a diversification of KMS forms, three salient features of KMS are identified: knowledge repositories, knowledge maps, and collaborative tools (Alavi & Leidner, 1999). Knowledge repositories focus on the codification and storage of knowledge to encourage and support reuse of knowledge, and comprise databases that keep best practices, experiences and other codified knowledge of experts. Knowledge maps can be searchable indexes or catalogues of expertise held by individual employees (Gray, 2000)[41], providing a means of finding and contacting individuals who have specialized knowledge and experiences (Alavi & Leidner, 1999). Collaborative tools such as groupware, email, chat, electronic forums and conferencing, provide communication and collaboration services, enabling knowledge exchange among knowledge seekers and knowledge providers. The presented definitions and knowledge forms are very much echoed also in the work of Fernandez-Sabherwal who defined KMS as integration of technologies and mechanisms that are developed to support the KM processes. Based on the observations on the KM systems implementation organizational environment, Fernandez-Sabherwal propose, the previously indicated framework for classification of KM systems as: Knowledge Discovery Systems, Knowledge Application Systems, Knowledge Capture Systems and Knowledge Sharing Systems. Knowledge Discovery Systems support the process of developing new tacit or explicit knowledge from data and information or from the synthesis of prior knowledge. Knowledge discovery may be defined as the development of new tacit or explicit knowledge from data and information or from the synthesis of prior knowledge. The discovery of new explicit knowledge relies most directly on combination, whereas the discovery of new tacit knowledge relies most directly on socialization. New explicit knowledge is discovered through combination, wherein the multiple bodies of explicit knowledge are synthesized to create new, more complex sets of explicit knowledge (Nonaka, 1994). The process occurs

http://ux4tp7xg6h.scholar.serialssolutions.com/?sid=google&auinit=R&aulast=Cerchione&atitle=Using+knowledge+management+systems:+A+taxonomy+of+SME+strategies&id=doi:10.1016/j.ijinfomgt.2016.10.007&title=International+journal+of+information+management&volume=37&issue=1&date=2017&spage=1551&issn=0268-4012

[41] Gray, P. H. (2000). The effects of knowledge management systems on emergent teams: Towards a research model. Journal of Strategic Information Systems, 9(2-3), 175-191.

through communication, integration, and systemization of multiple streams of explicit knowledge. Existing explicit knowledge, data and information are reconfigured, recategorized, and recontextualized to produce new explicit knowledge. Knowledge Discovery Systems support two KM subprocesses associated with knowledge discovery: combination, enabling the discovery of new explicit knowledge, and socialization, facilitating the synthesis of tacit knowledge and therefore enabling the discovery of new tacit knowledge through joint activities (Becerra-Fernandez and Sabherwal, 2010). Knowledge Application Systems support the process through which some individuals utilize knowledge possessed by other individuals without actually acquiring, or learning, that knowledge. Knowledge application occurs when available knowledge is used to make decisions and perform tasks through direction and routines. Direction refers to the process through which the individual possessing the knowledge directs the action of another individual without transferring to that individual the knowledge underlying the direction. Routines involve the utilization of knowledge embedded in procedures, rules, norms and processes that guide future behaviour. Both direction and routines are applicable to either tacit or explicit knowledge. Application does not require the person applying the knowledge to understand it.

Knowledge Capture Systems support the process of retrieving either explicit or tacit knowledge. As mentioned in the previous chapter, Knowledge Capture is the process by which knowledge is converted from the tacit to the explicit form (residing within people, artefacts or organizational entities) and vice versa through the sub-processes of externalization and internalization. Being the main focus of this thesis, the theoretical overview of **Knowledge sharing system** will be provided in the following pages. Fernandez-Sabherwal states that Knowledge sharing systems can be described as systems that enable members of an organization to acquire tacit and explicit knowledge from each other. Therefore, Knowledge Sharing Systems support the process through which explicit or tacit knowledge is communicated to other individuals. Most of the Knowledge Sharing Systems are designed to share the explicit knowledge of individuals and organizations. These systems are also referred to as **knowledge repositories.** Systems that support tacit knowledge sharing are those typically utilized by **communities of practice,** especially web based communities. The authors also stress the role of corporate memory in relation to Knowledge sharing systems. **Corporate memory**, or organizational memory, is made up of the aggregate intellectual assets of an organization. It is the combination of both explicit and tacit knowledge. The loss of Corporate Memory often results from a lack of appropriate

technologies for the organization and exchange of documents. A knowledge sharing system helps to organize and distribute an organization's corporate memory so that it can be accessed even after the original sources of knowledge no longer remain within the organization, declares Fernandez-Sabherwal.

2.3.3 Knowledge Management Technologies

Literature sources and studies providing the theoretical framework and the definition of Knowledge Management Technologies quite differ in their conclusions.42. The most frequently used perspective to define KM technologies is based on the information resources management perspective. It regards KM technologies as a class of information technologies that may be applied to facilitate organizational knowledge processes43. These processes might refer to creation, storage, retrieval, transfer and application of knowledge 44 or they might refer to socialization, externalization, combination and internalization of knowledge.45 In this perspective, technologies are tools that provide the basic KM infrastructure, enabling knowledge workers and organizations to better access and exploit existing knowledge resources.46 The second perspective is more linked with the corporate, organisational context under a management viewpoint. A managerial perspective is used to understand KM technologies, and these studies relate KM technologies to business needs and focus on the functions KM technologies perform in the organizational context. The third main perspective present in the current literature dealing with the definitions and contextualising of Knowledge Management Technologies is under an information and communication technologies (lCTs) perspective. It is based on the above presented perspectives but with wider functionalities that combine KM theories and principles into applications (such as parallel multi-core processing, distributed computing and wireless communications). This perspective offers a synergy

[42] Retrieved also from An, Xiaomi & Wang, Wang. (2010). Knowledge management technologies and applications: A literature review. 1. 10.1109/ICAMS.2010.5553046. https://www.researchgate.net/publication/251947322_Knowledge_management_technologies_and_applications_A_literature_review

[43]See more in: Saito, A, Umemoto, K., & Ikeda, M. (2007). A strategy-based ontology of knowledge management technologies. Journal of Knowledge Management, 11,97-114. and
Marwick, AD. (2001). Knowledge management technology. IBM Systems Journal, 40(4),814-830.

[44] Alavi, M., & Leidner, D.E. (2001). Knowledge management and knowledge management systems: Conceptual foundations and research issues. MIS Quarterly, 25(1),107-136.

[45] Nonaka, I., Reinmoller, P., & Toyama, R. (2001). Integrated information technology systems for knowledge creation. Handbook of Organizational Learning and Knowledge, Dierkes, M. et al. (Eds.), Oxford University Press, Oxford, 827-848.

[46] Antonova, A., Gourova, E., & Nikolov, R. (2009). Extended architecture of knowledge management system with Web 2.0 technologies. Retrieved March 7, 2010, from Research at Sofia University website: http://research.unisofia.bg/bitstrearnlI0506/145/1/Antonova-ECKM-full.pdf

between ICT functionalities and main KM principles. As stated by Lu, R., & Liu, J. (2008), technologies play an important role in KM, but they cannot be overemphasized. In facilitating KM processes, human beings are at the center and technologies are just auxiliary tools 47. Nevertheless, technologies continue to be an essential tool for KM implementation, and for support of all human activities in organizations and enterprises (Albena, A, & Elissaveta, G. 2006). 48.

Researches on the topic do agree that KM technologies must provide certain functions in KM life cycle functionality (acquisition and capture, organization and storage, retrieval, distribution and presentation and finally maintenance). Taking into consideration that KM's major objective is to connect people and stimulate collaboration, the overall architecture and functionality must support this at all times. The ability to capture and manage human-added values makes IT particularly suited to dealing with knowledge.49 The previously mentioned authors Alavi and Leidner, have developed a framework to understand functions of IT in KM processes through the knowledge-based view 50. One important implication of this framework, as explained by the authors, is that each of the four knowledge processes of creation, storage and retrieval, transfer, and application can be facilitated by IT.

A classification of KM technologies and applications in literature are varied, mainly because of different problems users has to solve in KM practice. However, two main classifications may be of interest for the topic of this thesis: classification of KM technologies and applications which is Knowledge Flow Processes Oriented and classification of KM technologies and applications which is Oriented on Knowledge Conversion and Transfer Processes. Knowledge Flow Processes Oriented classification is very much discussed by Ruggles (1997) and Antonova et al (2006). Ruggles (1997) provides a classification of KM technologies, according to the processes in which they are applied, as those that enhance and enable knowledge generation, codification (making knowledge available for others) and transfer 51. Antonova et al. 52 provides classification based on Ruggles' classification, with

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[47] Lu, R., & Liu, J. (2008). The research of the knowledge management technology in the education. Proceedings of the 2008 International Symposium on Knowledge Acquisition and Modeling (KAM 2008), 551-554.
[48] Albena, A, & Elissaveta, G. (2006). Insight into practical utilization of knowledge management technologies. IEEE John Vincent Atanasoff 2006 International Symposium on Modern Computing (JV A'06), 169-174.
[49] DuffY, J. (2000). The KM technology infrastructure. Information Management Journal, 34(2), 62-66.
[50] Alavi, M., & Leidner, D.E. (2001). Knowledge management and knowledge management systems: Conceptual foundations and research issues. MIS Quarterly, 25(1),107-136.
[51] Ruggers, R.L. (1997). Knowledge Management Tools, Ruggers, R.L. (Ed.), Butterworth-Heinemann, 1-8.
[52] Antonova, A, Gourova, E., & Nikolov, R. (2006). Review of technology solutions for knowledge management. Retrieved March 7, 2010, from Research at Sofia University website: http://research.it.frnLuni-sofia.bg:8880/dspacelhandle/1234567891140

results from more practical surveys taken into account: generation of knowledge (authoring tools as knowledge content generation tools, data mining tools as knowledge discovery tools, etc.); storing, codification and representation of knowledge (data knowledge warehouses, databases / knowledge bases); knowledge transformation and knowledge use (expert systems, decision support systems, etc); and finally transfer, sharing, retrieval, access and searching of knowledge (enterprise information portals, SharePoint). The second classification, based on work of Carvalho, Ferreira (2001)[53], the Knowledge Conversion and Transfer Processes Oriented Classification, classifies the KM technologies to the following processes 54: socialization (tacit to tacit) technologies (e-meetings, synchronous collaboration, etc.); externalization (tacit to explicit) technologies, (groupware, e-learning); combination (explicit to explicit) technologies, (search engines, document management systems) and finally internalization (explicit to tacit) technologies (visualization, innovation support tools).

3. KM Technologies for Knowledge Sharing System for eu-LISA Agency

As already stated previously, the Knowledge Management Technologies are information technologies that are used to facilitate knowledge management. Knowledge Management Technologies support Knowledge Management systems and benefit from the knowledge management infrastructure, especially the information technology infrastructure. Knowledge Management Technologies are essentially not different from information technologies in general, however their focus is on Knowledge Management rather than only on information processing. Current technologies that support KM include artificial intelligence (AI) technologies including those used for knowledge acquisition and case-based reasoning systems, electronic discussion groups, computer-based simulations, databases, decision support systems, enterprise resource planning systems, expert systems, management information systems, expertise locator systems, videoconferencing and information repositories including best practices databases and lessons learned systems (Becerra-Fernandez and Sabherwal, 2010). In the following pages we will focus on KM Technologies, especially supporting Knowledge Sharing Systems and try to identify the most suitable solutions for the eu-LISA Agency.

[53] Carvalho, R.B., & Ferreira, M.A.T. (2001). Using information technology to support knowledge conversion processes. Retrieved March 10, 2010, from Information Research journal website: http://informationr.netlir17-lIpaperI18.html

3.1 Current eu-LISA solutions for KM/KSS: Moodle and SharePoint

At the eu-LISA agency, currently there are two main frameworks which are supporting the functions of Knowledge sharing: eu-LISA Learning Management System (Moodle based) and SharePoint. From my experience, none of them meets the necessary requirements to be considered as Knowledge Sharing Systems and still less as a technological answer to the business needs of the Agency in KSS field. By consulting various sources[55], including the on line reviews and my personal hands-on user experience of the platform, the overview of the limits of the SharePoint and LMS Moodle features as Knowledge Sharing tool will be summarised here. By consulting the available Microsoft SharePoint reviews, the user experiences with the software can be considered mainly positive, and indeed SharePoint does have a number of advantages (ease of integration with other systems in the Microsoft suite of programs, some user options have high level of customizability, it provides also certain flexibly in terms of use for customer). However, one of the strong limits of the tool, especially when dealing with knowledge sharing activities, are the limits that user faces when using a knowledge base built with SharePoint. SharePoint does not offer very much flexibility with the indexing of content and does not provide clear information on architecture possibilities when organizing the content. The indexing of content in SharePoint is very limited; even if material is uploaded directly to a page, the SharePoint can only read the metadata for that page. In practice, this means that customers have to spend an excessive amount of time searching the knowledge base to find the precise phrase used within existing metadata for a certain page. Secondly, SharePoint is lacking sense of context behind its information architecture. Documents and data are presented without taking into account what those data actually contain and mean. By its definition, SharePoint is anyway firstly constructed to be more of a (static) knowledge repository than a knowledge base. Terms may sound similar, but a knowledge base is better suited not only to store information, but to make it easy for users to find and share it, the action which SharePoint has limits to perform [56].

The Learning Management System in use of the Agency does reproduce the previously presented SECI model features. Starting with socialization, as the first element of KM, with

[55] https://www.knowledge-management-tools.net/sharepoint-knowledge-base.php; https://document360.io/blog/sharepoint-knowledge-base-software/; https://www.kpsol.com/microsoft-sharepoint-choice-for-knowledge-management/

[56] See also https://helpjuice.com/pdfs/Knowledge_Management_A_Theoretical_And_Practical_Guide_Emil_Hajric(PDF).pdf

free exchange of knowledge and information between LMS users (through e.g. chat rooms and webinars). Externalization occurs with linking the eLearning content to topics related to real use case problems in the real-life workplace. The combination portion is implemented in the LMS in a variety of ways in business (e.g asking feedback from LMS users and trainees, as well as trainers and subject matter experts, in order to continuously update the content and curricula of the training available on LMS). And finally, within the eu-LISA LMS the internalization of users occurs by focusing on the provision of the training that will help that the eu-LISA target group members learn or just update the necessary skills in a way that they can implement those in the real job environment. If considered as a basic Knowledge Sharing tool, the Learning Management System does provide a number of benefits, e.g. it is quite useful as a tool for capturing trainers' explicit and tacit knowledge which is then distributed to the users; additional potential for knowledge sharing occurs when deployed as collaborative tool especially across multiple institutions (e.g. other EU Agencies); for knowledge creation: through the development of knowledge artefacts by trainees and trainers. However, besides those potentially useful features of the Learning Management System in providing Knowledge Sharing features, Moodle like Sharepoint has its limits and it cannot be considered as an appropriate answer to fully address the knowledge sharing needs of the Agency. Those limits are especially visible when trying to address the specific needs of the Agency in sharing knowledge among users on incident reports, best practice in system problem solving and in rapidly identifying internal or external expertise in some specific topic or field. Those needs and the relevant answers will be addressed in the next chapter.

3.2. Knowledge Sharing System for eu-LISA Agency

When analysing the business needs of the Agency in KM sphere and focusing specifically on the KSS, besides the above indicated specific knowledge sharing needs on incident reports, best practices and identifying of expertise, the following additional desirable features of KSS were identified: the proposed KSS solution should be easy accessible and interactive. Special accent should be preferably given to mobile solutions (knowledge accessible everywhere); additional focus should be given on features of the KSS which will facilitate knowledge sharing (e.g. the proposed KSS solution should offer options like a chat, Q&A features, as well as a comments section, forums, collaborative space). In this way the users can interact with the already existing content and engage in discussions promoting also a general learning culture inside and outside of the Agency; the whole purpose of using a KSS is to help its users

to find the information they need fast, so it is mandatory to use a solution that align with this requirement. However, even though those features are present in the majority of KSS, it should be born in mind that it is possible to make full use of it only if the content is also indexed and categorized properly. Hence, particular attention should be given to proper taxonomy of the content to be uploaded to KSS. In that sense, the priority should be given to a KSS which allows users to organize the shared content using labelling and a classification system. Taking into consideration the main group of KSS users (external users: Member States managing the IT systems on national level), the KSS should allow the content sharing and interactive activities with large group of external users; so the possibility that KSS is integrated into other software available at the Agency should be taken into consideration when selecting the tool (e.g Moodle LMS or Document Sharing System); and finally, the requirement which is more beneficial for the internal purposes, the proposed KSS solution should have a robust analytics system. Analytics will provide insight on users and contributors and their role in the KSS, the frequency of access and nature of information provided and retrieved. All those elements are important to provide the necessary information on the potentially needed updates in order to maintain high quality standards of the KSS.

Before starting the analysis on the specific (software) KSS solutions, I would like to make a step back and refer to chapter 2.3.2 of this thesis (KM System: focus on Knowledge Sharing System - KSS), which provides a good basis for the definition of a broader framework and goals of KSS solutions which will be applied in the KM environment of the Agency. Taking into account the importance stressed by Fernandez-Sabherwal of the corporate memory component of KSS, one of the main goals of the KSS solution to be applied in the eu-LISA Agency should indeed focus on preventing the loss of corporate memory. Furtherly, in the process of identifying the most appropriate KSS framework and tool for the Agency, a starting point might be considered also the implementation of document management systems (DMS). At the core of every document management system is a repository, an electronic storage medium with a primary storage location that affords multiple access points. If properly implemented, with more user friendly knowledge sharing features, this DMS based repository may be the first KSS framework of the Agency which will fulfil the need for an effective sharing and reusing of individual and organizational knowledge. The possibility DMS offers on document management collaborative application will also potentially increase the knowledge sharing across the organization and externally reaching to a vast group of final users (internal users and Member States). An additional general KSS framework discussed by

Fernandez and Sabherwal is the workflow management system (WMS). The WMS is a set of tools that support defining, creating, and managing the execution of workflow processes, providing a method of capturing the steps that lead to the completion of a project within a fixed time frame. Workflow systems also provide a mechanism for the analysis and optimization of the entire process that make up a project. Workflow systems also offer a platform for the replication and reuse of stored processes, which is very much the case in the Agency's environment. The particular benefit of WMS is the fact that by providing a broad overview with detailed operations of tasks, it is possible to identify possible "weak links" in a process itself, the issue that can be further addressed in the capacity building activities of the Agency (e.g by providing dedicated training sessions). Taking into consideration the amount of workflows (protocols) applied by the Agency in the management of large scale IT systems in its remit, the WMS can easily find implementation ground in the KM landscape of the Agency. The above presented solutions can be part of a broader approach how to satisfy the knowledge sharing needs of the Agency.

Further focus in this thesis will be given now to more specific categories of Knowledge sharing systems (as identified by Fernandez-Sabherwal,) and especially to those which I consider most relevant for the implementation of the eu-LISA KSS. Following Fernandez-Sabherwal, Knowledge Sharing Systems are classified according to their characteristics and can be listed as follows:

- Lessons-learned systems
- Alert systems
- Incident report databases
- Best practices databases
- Expertise locator systems

As indicated by Fernandez-Sabherwal, the goal of **lessons-learned systems** is to capture and provide lessons that can benefit employees who encounter situations that closely resemble a previous experience in a similar situation. LLS could be pure repositories of lessons or be sometimes intermixed with other sources of information. **Alert systems** were originally intended to disseminate information about a negative experience that has occurred or is expected to occur. Alert systems could be used to report problems experienced with e.g. technology, IT. **Incident report** databases are used to disseminate information related to incidents or malfunctions. Incident reports typically describe the incident together with

explanations of the incident, although they usually do not suggest any recommendations. Taking into account the profile of the data that the Agency is managing, with strong orientation towards incident management, this category is of particular interest in the process of the KSS definition for the Agency. **Best practices** databases describe successful efforts, typically from the reengineering of business processes that could be applicable to organizational processes. Best practices differ from lessons learned in that they capture only successful events, which also may not be derived from experience. **Expertise locator systems (ELS)** are knowledge repositories that attempt to organize knowledge by identifying experts who possess specific knowledge. Expertise locator systems are also known as expertise directories, skill directories or skills catalogues. The main Goal of ELS is to catalogue knowledge competencies, including information not typically captured by human resources systems, in a way that could later be queried across the organization and externally to help locate intellectual capital.

Taking into consideration the presented main characteristics of KSS categories and also the above presented KSS business needs of the Agency, three KSS solutions have been identified as the most appropriate response for the Agency KSS needs: Incident report database**,** Best practices database and Expertise locator system.

3.2.1. Incident report database

In the process of the management of large scale IT systems, the eu-LISA collects the input from systems users on eventual incidents and errors. Those data are then stored in incident database. Incident report database is used to disseminate information related to incidents or eventual malfunctions. A known error is created and communicated to the end users when there is a workaround found for a specific problem. Information is disseminated on the need to know basis. In order to have a more efficient management and knowledge sharing of the incidents potential, the solution could be the '**Freshservice**'57 incident management tool. 'FreshService' is a cloud-based customer support platform which provides plug and play ITIL58 that complies with the best practices without the need for expensive consultations or expert opinions. Its key functionalities include a robust ticketing system, asset discovery and, more importantly in this case, an easy accessible and user intuitive knowledge base. The platform is also equipped with such capabilities as vendor management, incident

[57] https://freshservice.com/it-service-desk/incident-management-software
[58] Set of detailed practices for IT service management (ITSM) that focuses on aligning IT services with the needs of business.

management, problem management, change management and release management. Being cloud-hosted requires zero maintenance from the user side and keeps data with a strongly automated system. 'Fresh service' knowledge based platform offers possibilities to integrate service desk functions with a comprehensive knowledge base containing solutions to incidents and problems that can be furtherly offered to internal and external users. The Platform offers an easy to use editor for writing and formatting of articles on the collected incidents (cases). Before being published, articles are submitted for final review to senior experts or managers directly in order to ensure the correctness of the content before it is published. Managers can set approver (one or many) at folder level, and all articles created inside that particular folder will have to be approved before it can be published. Review date is another feature of the platform which helps content creators to keep the database updated, reminding them on that date to review the content of particular article. As for content management, the platform also supports solutions of using of tags and folders to keep articles organized as the knowledge base grows. The platform also offers roles access definitions. Platform manager can restrict users to have view-only permission to the article and not have edit permissions to a particular article. Finally, as regards analytics, with this platform it is possible to receive feedback and understand which articles (incident cases) were helpful in resolving an issue. It is possible to see the number of views for each article, along with the helpful and not helpful votes and number of times an article was inserted into a ticket by an agent. Although there are some limits indicated in the reviews by users on e.g. lack of possibility for integration with apps, in general the reviews for this platform as a knowledge sharing system for incident report files are quite high and users do recommend it. '**JIRA Service desk'**[59] is another solution with fitting potential into the KSS of the Agency regarding incident management. Similarly, like 'Freshservice', this tool is built primarily for incident management but it also has well developed features for management and knowledge sharing databases on IT incidents. In 'JIRA service desk' tool, the knowledge database platform is based on knowledge base software, called 'Confluence'[60]. 'JIRA service desk' with 'Confluence' knowledge base offer the possibility to create knowledge base space which can be linked directly with internal, corporate service desk directly from 'Jira Service Desk'. In this knowledge base, space systems users and administrators can add content and documentation. Content can be collaboratively created, for which purpose the content contributor can also use pre-made

[59] https://www.atlassian.com/software/jira/service-desk#
[60] https://www.atlassian.com/software/confluence

templates. The update of the content is also manageable by using the content library and the function of automatic versioning. The list of the most frequently asked questions can be inserted in the database as well. Once the article in the knowledge base is published, the user automatically sees other recommended articles as they type their requests into Jira Service Desk. The process is fast and intuitive for users. An additional feature the 'JIRA service desk/Confluence' offers for knowledge sharing is a Smart Graph technology, which is built on machine learning. Smart Graph's algorithm learns to associate popular keywords from past requests. Again, as for 'Freshservice', high reviews on the tools provided by administrators and users also made this tool listed here as a possible solution.

3.2.2. Best practices database

The goal of rthe best practices database of the Agency is to present and describe the successful efforts and events the Agency reached in fulfilling its core task of the management of large scale IT systems. The examples of projects, the most effective approaches and solutions are to be proposed as the central artefacts of this database. Similarly as to incident report database, the best practices database will be used as knowledge sharing tools to be deployed for internal and external (eu-LISA target group users). Being essentially a file sharing platform, there is a large variety of possibilities available on the market to be used for the distribution of those best practices files (to mention here only a few: 'EdCast'[61], 'Gsuite'[62], 'Zoho'[63]). However, in this case, rather to apply an 'in detail approach', by selecting one of those share file software, I would use the occasion to introduce those solutions that can offer also additional features in knowledge sharing and knowledge management in general: Knowledge management platforms. From the research conducted on line, the following examples of KM platforms with a strong knowledge sharing features suitable also for sharing of best practice database were identified. **'Sabio'**[64] the knowledge management platform with features including Cataloging/Categorization, Collaboration, Content Management, Discussion Boards, Full Text Search and Knowledge Base Management. One of its most notable tools, applicable also to the best practice database needs, is its "Tree" tool that lets users quickly browse through related (e.g. best practice) articles and documents in its knowledge base. This feature significantly improves user experience because it proactively suggests content that's relevant to the user's goals.

[61] https://www.edcast.com/
[62] https://gsuite.google.com/
[63] https://www.zoho.com/docs/
[64] https://www.getsabio.com/

'**Bloomfire'**[65] is a cloud-based knowledge management software which uses AI-generated tags to categorize information, making most-used data easier to access. Knowledge sharing features are well supported in this KM Platform which also supports a wide range of integrations making possible connections with connect tools like Dropbox, and Google Drive. Users can upload content in any format (including word documents, PDFs, videos, audio recordings, and slide decks) or create new content directly in the cloud-based platform. An advantageous feature, especially for document search activity, is that Bloomfire deep indexes every word in every file, including words spoken in videos, so that users can benefit most from the term search.

3.2.3. Expertise locator system

This tool should allow efficient expertise identification, provide expertise classification (specifying the type and level of expertise of an expert and then possibly group those into expert clusters divided by topic), foster expertise collaboration (in, for example, the process of creating of new training curricula of the Agency) and finally make possible the monitoring of the expert databases (e.g. by providing user friendly tools for updates on experts profiles). The goal of the expert locator system of the Agency should not be only to identify specific expertise available, internally or externally, but also to enhance the collaborative knowledge creation environment of the Agency. The identified possible software solutions which might meet the listed needs for Expertise locator System in the Agency may be **'BA Expertise Locator'**[66] and '**IBM Expertise Locator'**[67]. 'BA Expertise Locator' is a software that is used to identify and engage with experts in an organization to enable employees to take advantage of their company's collective intelligence. The tool can be used also to include external expertise. 'BA Expertise Locator' taps diverse sources to define experts' digital footprints – including documents, user profiles, tags, project histories, bios, blogs, posted discussions, and emails; it allows Filtering by Criteria which makes it easy to specify what the user is looking for, and filter across experts' profiles and related records providing also evidence for why experts are ranked as they are; users can also take advantage of internet-like sliders to perform interactive exploration of the tradeoffs between criteria (users can easily adjust criteria to select the best overall fit); users can also consult Expert Cart, which allows internet-like selection and comparison of experts; finally Skype integration enables chat, phone, video, or email directly from results or from the Expert Cart. The 'IBM Expertise Locator' has to some

[65] https://bloomfire.com/
[66] http://bainsight.com/expertise-locator
[67] https://connections-apps.com/product/ibm-expertise-locator/)

extend a more elaborated approach and offers more fluid method of seeking and finding expertise. Its Key Features & Functions can be summarised as follows: user can search for subject matter experts based on their expertise; tools offers the possibility to browse keyword categories and select from a list of popular keywords; the tool can be customized to search and analyse existing knowledge repositories and data sources; it provides portray of the expertise of every expert through their digital footprint to highlight their skills, knowledge, experience, network and contributions to other users; experts prioritize and redirect to another expert when needed fostering collaboration; finally, IBM Expertise Locator offers also access through a mobile app (iOS & Android). The overview of potentially applicable IT solutions presented here is not exhaustive, but it offers possibly the best suitable products to satisfy the KSS requirements of the Agency. In the possible selection and implementation process of the selected software, special attention will be given to the fulfilling of all the necessary security requirements as foreseen by the security policy of the Agency.

4. Potential road map for the implementation of Knowledge Sharing System for the eu-LISA Agency

After identifying the potential technological tools for the KSS to be applied, in this chapter I would like to offer the concept design proposal which will focus on the possible implementing steps to allow an effective integration of those tools into the KM environment of the Agency and the creation of KSS.

4.1. Recommendations for an effective KSS framework setup

In the research work of Jennex and Olfman, entitled 'Assessing Knowledge Management Success/Effectiveness Models' (2004)[68], the authors provide e **list of recommendations** which organisation have to take into account when developing KMS. The indicated recommendations can be the starting point also as recommendations for the development of the KSS environment of the Agency. The development of a good technical infrastructure by using a common network structure would be the first recommendation to follow: the need to incorporate the KSS into everyday processes; have an enterprise wide knowledge structure in place; have senior management support; allocate maintenance resources for KSS; train users on use and content of the KSS; create and implement a general KM Strategy/Process for

[68] Jennex, M.E. and L. Olfman, "Development Recommendations for Knowledge Management/ Organizational Memory Systems" Information Systems Development Conference 2000.https://www.researchgate.net/publication/221182288_Assessing_Knowledge_Management_SuccessEffectiveness_Models

identifying/maintaining the knowledge base; expand system models/life cycles to include the KSS and finally to design security into the KSS and KMS in general. Although broad in its definition, the indicated recommendations provide indications on the important aspects the implementing environment needs to have before starting the implementing process.
The recommendations for organisations intending to develop KM/KSS as proposed by Khun and Abecker (1997)[69] are very much in line with recommendations provided above by Jennex and Olfman (2000). Although Khun and Abecker focus very much on KM in industrial practice, the main proposed guidelines can be applied also to the environment and needs of the eu-LISA Agency. The authors recommend to collect and systematically organize the currently available information and sources across the organization; to exploit user feedback for maintenance and evolution, so the knowledge can be updated and relevant; furthermore, Knowledge Sharing Systems should be designed to support user's needs and their business process workflows, and the final recommendation by Khun and Abecker invites to integrate the KSS into the existing environment. I would add here that the possibility of integrating the KSS tolls listed in the previous chapter with Moodle LMS in use of the Agency and/or the previously proposed Document Management System framework should be explored. The indicated recommendations are also summarised in Fernandez-Sabherwal proposal for the implementation of KSS design process who propose: collection and systematic organization of information from various sources; exploiting user feedback for maintenance and evolution and integration (of new solution) into the existing environment. In elaborating the topic of the design process of KSS and KMS in general, I would like to extend the above summarised Fernandez-Sabherwal points and provide a more tailored solution for the eu-LISA Agency.

4.2. Concept design for KSS implementation in the eu-LISA Agency

The basic structure for the proposal of a framework for the KSS implementation in the Agency is the Technology (implementation) Plan created by Riley (2002)[70]. I used the main components of the framework adapting it to the specific framework and needs of the Agency in KSS filed. The modified version containing a proposal for the implementing steps is available below.

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[69] Khun, O. and Abecker, A. 1997. Corporate memories for knowledge management in industrial practice: Prospects and challenges. *Journal of Universal Computer Science*, 3(8), 929–954.
[70] Shannak, R. O., Ra'ed, M., & Ali, M. (2012). Knowledge management strategy building: Literature review. *European Scientific Journal*, *8*(15).https://www.researchgate.net/publication/257922672_Knowledge_Management_Strategy_Building_Literature_Review

As a prerequisite for the implementation of the KSS in the Agency, the analysis of Knowledge sharing needs of the Agency should be executed. Chapter 3.2. (Knowledge Sharing System for eu-LISA Agency) of the present thesis provides and overview of the functional features of the KSS to be implemented. In addition to this, the knowledge sharing needs should be aligned also with the following features of the KSS: the KSS should allow accessibility to all its users who should be able to access or share any information from their locations; the KSS must be measurable in the sense that it must be able to measure data (e.g. who accesses which information from which location, who contributed to topics/expert portfolio definition, measuring number of contribution from users, number of access etc); the KSS and its components must be highly customizable and flexible in order to make way for better usability and better individual experience of the users and finally, KSS should strongly embrace the security component addressing properly the threat of possible loss of information, the threat of information leakage and other security issues.

When concretely proposing the steps, the first step in the implementation of the Knowledge Sharing System for the eu-LISA Agency is aligned with the above recommendations and it should focus on the

- **identification and evaluation of existing knowledge in the Agency**.

Particular attention in this step is to be given to the existing codification (taxonomy) and storage systems. Where possible the same categories of databases (e.g. related to specify large scale IT systems in the remit of the Agency) are to be used also in the new KSS. Automated Categorization Tools can be used in this process to improve the overall speed of categorizing knowledge and its accuracy. As a Deliverable for this step, a comprehensive knowledge database containing a list of the currently available knowledge, possibly including the categorization of knowledge (topic) clusters, are to be prepared.
The second step should focus on

- **identifying and evaluating the existing knowledge distribution systems and sharing mechanisms.**

As indicated previously, the knowledge sharing activities in the Agency are embedded in Moodle and Sharepoint tools. In addition to an analysis of the tools (distribution systems), the focus of this step should also be to analyse how the existing explicit and tacit knowledge is shared and communicated (internally and externally, toward eu-LISA training target group members). The outcome of this exercise will be the creation of inventory of knowledge sharing and communication tools and techniques in use in the Agency. The inventory will be

furtherly framed in the Knowledge Warehouse of the Agency, combining the features of the previously proposed KSS tools and platforms. Special attention should be given also to the identification of potential gaps in knowledge sharing, identifying and proposing solutions.
Third step will focus on

- **designing and implementing the necessary knowledge distribution systems**, **sharing mechanisms and organisational support systems.**

Chapter three of the present thesis addresses this step, proposing alternatives to current knowledge sharing setup of the Agency and offering a more innovative and adequate solution. The focus in this step is always to cover the knowledge sharing needs for the previously identified three main sector of KSS of the Agency: knowledge sharing of the incident, on best practices and available expertise. Later on in this phase, starting the expansion of Knowledge Warehouse should be also considered. KSS users should start to contribute to the Knowledge Warehouses starting to expand the available database of information. Defining and implementing the polices that reward those who share knowledge should also be considered. As the outcome of this step, knowledge sharing tools and mechanism, embracing formal and informal, explicit and tacit knowledge inside and outside of the Agency, should be defined, fully tested and finally implemented in the KM framework of the Agency.
Finally, after the establishment of the KSS framework in the Agency, the implemented KSS should be

- **monitored and maintained.**

In order to effectively achieve this, the definition of the assessment tools (Key Performance Indicator- KPI) is to be established. KPI will monitor the use and application of knowledge sharing, internally and externally, in order to understand if the objectives of the Agency in the delivery of its training mandate are reached. The main deliverable of this step is the creation and operational assessment of the monitoring tool which is fully integrated in the KSS.
In addition to the prerequisites listed at the beginning of the chapter and related to general system features, many authors analysing the topic agree also on the importance of ‘culture’ as one of the most critical elements in implementing KSS and KM in general. The promotion of learning, or in this case the knowledge sharing, culture and attitude across the Agency, and externally with the eu-LISA training target group members, has to be considered among top prerequisites to be fulfilled. This is particularly important for the correct implementation of some of the proposed elements of KSS which activities are based exclusively on knowledge sharing (e.g. Expertise locator system). The majority of people do have a natural inclination

and desire to share their knowledge. Therefore, this attitude should be further encouraged with providing aid and training to all actors and contributors involved, in order to have a fully collaborative group of users in the KSS of the Agency.

The process of defining of KSS framework of the Agency should also take into account **potential risks**. Those were very much in focus of research of Weber (2007) [71] who pointed out some of the risks as summarised here. Weber stresses the importance of integrating humans, processes, and technology in KM (KSS), since technology alone will not achieve acceptance if both people and processes, the main component in delivering the organizational goals, are not adequately associated with the KM (KSS) (Abecker et al. 2000)[72]. In fact, KM approaches are likely to fail if they are designed as stand-alone solutions outside of the process context, Weber and Aha (2003)[73]. Another reason for potential failure is lack of measurement and lack of clearly stating of the KSS benefits for its users. A further failure factor is the storing of knowledge (only) in textual representations; knowledge artefacts that are stored in textual format may lack the adequate representation structure, including long texts that are hard to review, read, and interpret, therefore, almost guaranteeing their lack of reusability and vital contents due to their difficulty in comprehension (Weber and Aha 2003). Furthermore, a potential risk for KSS failure stays in the fact if users are afraid of the consequences of their contributions. In addition to the above indicated importance of the organization to provide incentives for the contributors (internal and external) to the knowledge repository, there may be some organizational barriers that actively act against knowledge sharing (Weber et al. 2001). And finally, a potential risk of success of KSS is indicated by Weber, from work of Disterer (2002)[74], in the possibility that the users perceive a lack of leadership support, lack an understanding of the generalities that would make their knowledge useful, or just do not feel it is worth their time to make a contribution (Disterer 2002).

Finally, I would like to present a possible method to be used to evaluate the **successfulness of the implemented KSS proposal for the Agency.** According to DeLone and McLean (1992,

[71] Weber, R. 2007. Addressing failure factors in knowledge management. *Electronic Journal of Knowledge Management*, 5(3), 333–346.

[72] Abecker, A., Bernardi, A., Hinkelmann, K., Ku, O., & Sintek, M. (2000). Context-aware, proactive delivery of task-specific information: The knowmore project. *Information Systems Frontiers*, *2*(3-4), 253-276.

[73] Weber, R. O., & Aha, D. W. (2003). Intelligent delivery of military lessons learned. *Decision support systems*, *34*(3), 287-304.

[74] Disterer, G. 2002. Management of project knowledge and experiences. *Journal of Knowledge Management*, 6(5), 512–520.

2003)[75], KM success can be defined as reusing knowledge to enhance organizational effectiveness by providing the appropriate knowledge to the people who need it when it is needed.

More in detail, the success of Knowledge Management Systems, point valid also for KSS success, can be defined as making the components of KMS more effective by improving search speed, accuracy, and similar. It is implied that by increasing KMS effectiveness, the KMS success is enhanced, and the decision-making capability is improved. Only a successfully implemented KSS environment will fulfil the main function of KSS. The available literature analyses various models to evaluate the success of KM solutions. I have not, however, found specific studies which propose a model of the evaluation for, exclusively, Knowledge Sharing Systems. Hence, the here proposed evaluation model is primarily tailored for a general, KM, framework. However, taking into account the characteristics of the proposed model and comparing it with other models[76], I found it as the most suitable for the evaluation of the here presented KSS framework of the Agency.

The model is presented in the research paper prepared by Jennex and Olfman (2003) 'Assessing Knowledge Management Success/Effectiveness Models'77. The authors describe KM success as a multidimensional concept, which is defined by capturing the right knowledge, getting the right knowledge to the right user, and using this knowledge to improve organizational and/or individual performance. KM success is measured by means of the dimensions: impact on business processes, impact on strategy, leadership, and knowledge content." [78] Figure 4, below, shows the Jennex and Olfman KMS Success model. As mentioned previously, the model evaluates success as an improvement in organizational effectiveness based on use of and impacts from the KMS.

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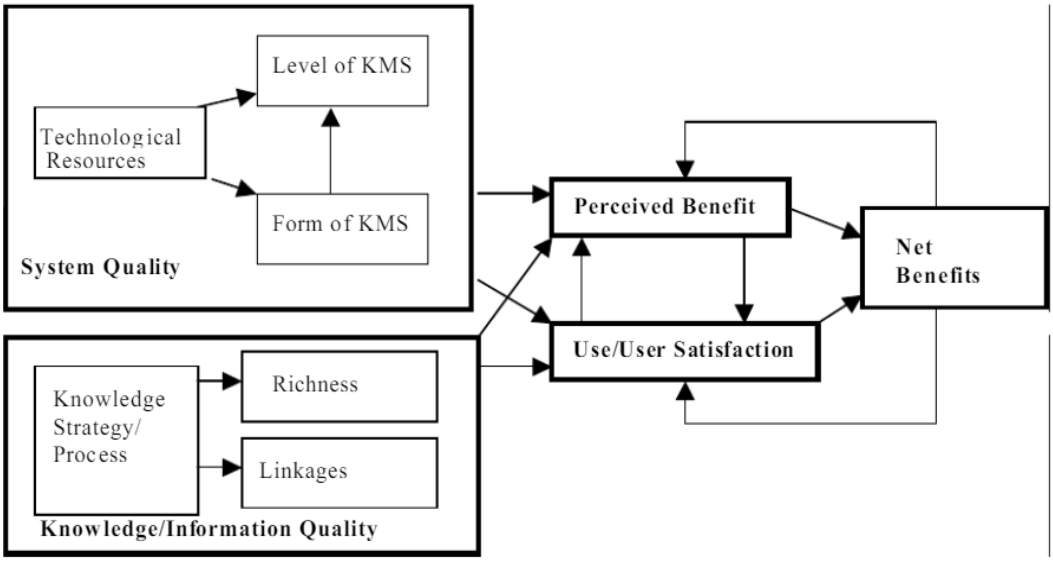
[75] Urbach, N., & Müller, B. (2012). The updated DeLone and McLean model of information systems success. In *Information systems theory* (pp. 1-18). Springer, New York, NY.

[76] E.g Massey, Montoya-Weiss, and Driscoll KM Success Model and Lindsey KM Effectiveness Model

77 Jennex, M. E. and L. Olfman, L., "A Knowledge Management Success Model: An Extension of DeLone and McLean's IS Success Model," Ninth Americas Conference on Information Systems, 2003. https://www.researchgate.net/publication/221182288_Assessing_Knowledge_Management_SuccessEffectiveness_Models; and also in Murray E. Jennex , Stefan Smolnik, David Croasdell , Knowledge Management Success in Practice, (2014) International Conference on System Science https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=6759052

[78] Jennex, M.E., Smolnik, S., and Croasdell, D.T., (2009). "Towards a Consensus Knowledge Management Success Definition." VINE: The Journal of Information and Knowledge Management Systems, 39(2), pp. 174-188, and Jennex, M.E., Smolnik, S., and Croasdell, D., (2012). "Where to Look for Knowledge Management Success," International Conference on System Sciences, HICSS45, IEEE Computer Society, January 2012. Jennex, M.E., Smolnik, S., and Croasdell, D., (2012). "Where to Look for Knowledge Management Success," 45th Hawaii International Conference on System Sciences, HICSS45, IEEE Computer Society, January 2012.

Figure 4: Jennex and Olfman KMS Success Model[79]



The model includes five main components, which define KM success metrics. 'System Quality' defines how well the KMS performs the functions of knowledge creation, storage/retrieval, transfer, and application; it also defines how much of the organisation memory is codified and included in the computerized portion of the KMS; 'Knowledge/Information Quality component', ensures that the right knowledge and organisation memory with sufficient context is captured and available for the right users at the right time; 'User satisfaction' indicates the actual levels of KMS use as well as the satisfaction of the KMS users. In addition to those, 'Perceived Benefit', which measures perceptions of the benefits and impacts of the KMS by users[80] and finally 'Net Impact', measuring how the use of a KMS produces an impact on users' performance in the workplace.

For the evaluation purposes of the here presented KSS solution, from the above indicated metrics elements of the model, and with the goal to create the potential evaluation (metrics) framework of the KSS, I would focus on the 'System Quality', 'Knowledge/Information Quality' and 'User satisfaction' as elements relevant for this KSS case. System quality evaluation will provide input on how well KMS (KSS) perform with regard to knowledge creation, storage, retrieval and application. Knowledge/information quality will provide input from users on usefulness of knowledge artefacts in terms of their correctness and inclusion of

[79] Source: https://www.researchgate.net/figure/Jennex-and-Olfmans-2003-KMS-Success-Model_fig4_228894794

[80] Based on the Perceived Benefit Model: [28] Thompson, R.L., C. A. Higgins, and J. M. Howell, "Personal Computing: Toward a Conceptual Model of Utilization" MIS Quarterly, March 1991, pp. 125-143.

contextual meaning. Finally, user satisfaction will provide evaluations on support for the systems in use. System Quality, Knowledge/Information Quality and User Satisfaction are also the main functional drivers of the KSS solution proposed, which outcome of evaluation results will provide the necessary input in order to monitor, and improve, the performance of KSS solution applied in the Agency.

5. Limits of the study and Recommendations for Further work

As a limit of this study, I would indicate the limitations of the research method applied. This research is based only on literature review. On the one hand, the KM topic is well represented in the existing literature which indeed provides enough strong inputs to understand the topic and to create solutions. However, the extension of research methods to other possible sources and contributions (e.g. interviewing the practitioners in KM field form other EU Agencies, distributing tailored questionnaires to eu-LISA target group members with focus on identifying their specific need in KSS filed, etc), would definitely provide a far more detailed insight and potentially offer a more elaborated frameworks for more solutions and best practices to be integrated in this study. In addition, the proposal for the implementation of the Knowledge Sharing System for the eu-LISA Agency is based on theory only. No pilot project was implemented to test this solution in a real, production environment. Therefore, the recommendation for further study will be to set up the test project in the real environment in order to see which challenges the proposed solution will face in its implementation and how to overcome those. The result of this pilot project (research study) should be lessons learned, a revised KSS implementing solution, which only then can be fully applied.

Acknowledgments

I would like to express my appreciation to my supervisor Emanuele Bardone, for his guidance and formative feedback during the development of this thesis.

Author's declaration

I hereby declare that I have written this thesis independently and that all contributions of other authors and supporters have been referenced. The thesis has been written in accordance with the requirements for graduation theses of the Institute of Education of the University of Tartu and is in compliance with good academic practices.

Zarko Pasic

17 August 2020

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- ResearchGate. https://www.researchgate.net/

On eu-LISA Agency:

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- https://www.edcast.com/
- https://gsuite.google.com/
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- https://bloomfire.com/
- http://bainsight.com/expertise-locator
- https://connections-apps.com/product/ibm-expertise-locator/

Appendices

Appendix 1: Training Mandate of the eu-LISA Agency

The eu-LISA new establishing regulation

LEGAL BASIS:

Regulation (EU) 2018/1726 of 14 November 2018 on the European Union Agency for the Operational Management of Large-Scale IT Systems in the Area of Freedom, Security and Justice (eu-LISA), and amending Regulation (EC) No 1987/2006 and Council Decision 2007/533/JHA and repealing Regulation (EU) No 1077/2011

STATUS: Entered into force on 11 December 2018

TRAINING RELATED PROVISIONS:

- Art. 3(b): **the Agency shall perform tasks relating to training on the technical use of SIS II, in particular for SIRENE staff and training of experts on the technical aspects of SIS II in the framework of Schengen evaluation**;

- Art. 4(b): **the Agency shall perform tasks relating to training on the technical use of the VIS and training of experts on the technical aspects of VIS in the framework of Schengen evaluation**;

- Art. 5(b): **the Agency shall perform tasks relating to training on the technical use of Eurodac**;

- Art. 6(b): **the Agency shall perform tasks relating to training on the technical use of the EES and training of experts on the technical aspects of EES in the framework of Schengen evaluation**;

- Art. 7(b): **the Agency shall perform tasks relating to training on the technical use of ETIAS and training of experts on the technical aspects of ETIAS in the framework of Schengen evaluation**;

- Art. 8(b): **the Agency shall perform tasks relating to training on the technical use of DubliNet**;

- Art. 8a(b): **the Agency shall perform tasks relating to training on the technical use of ECRIS-TCN and the ECRIS reference implementation**;

- Art. 9: **when entrusted with the preparation, development or operational management of other large-scale IT systems** referred to in Article 1(5), **the Agency shall perform** (…) **tasks relating to training on the technical use of those systems, as appropriate**.

SYSTEM: SIS II

LEGAL BASE:

- **Regulation (EC) No 1987/2006** of 20 December 2006 on the establishment, operation and use of the second generation Schengen Information System (SIS II)
- Council **Decision 2007/533/JHA** of 12 June 2007 on the establishment, operation and use of the second generation Schengen Information System (SIS II)
- **Regulation (EU) 2018/1860** of 28 November 2018 on the use of the Schengen Information System for the return of illegally staying third-country nationals
- **Regulation (EU) 2018/1861** of 28 November 2018 on the establishment, operation and use of the Schengen Information System (SIS) in the field of border checks, and amending the Convention implementing the Schengen Agreement, and amending and repealing Regulation (EC) No 1987/2006
- **Regulation (EU) 2018/1862** of 28 November 2018 on the establishment, operation and use of the Schengen Information System (SIS) in the field of police cooperation and judicial cooperation in criminal matters, amending and repealing Council Decision 2007/533/JHA, and repealing Regulation (EC) No 1986/2006 of the European Parliament and of the Council and Commission Decision 2010/261/EU

STATUS: New SIS II legal basis (*Regulation (EU) 2018/1860, Regulation (EU) 2018/1861, Regulation (EU) 2018/1862)* entered into force on 27 December 2018.

Please note that all the relevant training-related provisions from the New SIS II legal basis, according to Art. 66(5) of Regulation 2018/1861 and Art. 79(5) of Regulation 2018/1862 respectively, will become applicable subject to the Commission decision, to be adopted no later than 28 December 2021.

TRAINING RELATED PROVISIONS:

- Art. 14 of both Regulation 1987/2006 and Council Decision 2007/533/JHA: Before being authorised to process data stored in SIS II, the staff of the authorities having a right to access SIS II shall receive appropriate training about data-security and data-protection rules and shall be informed of any relevant criminal offences and penalties.

- Recital 10 of both Regulation 2018/1861 and Regulation 2018/1862: In order to ensure the efficient exchange of supplementary information, (…) it is appropriate to reinforce the functioning of the SIRENE Bureaux by specifying the requirements concerning the available resources and user training, and the response time to inquiries they receive from other SIRENE Bureaux.

- Recital 12 of both Regulation 2018/1861 and Regulation 2018/1862: (…) Member States should ensure that end-users and the staff of the SIRENE Bureaux regularly receive training, including on data security, data protection and data quality. SIRENE Bureaux should be involved in the development of training programmes. To the extent possible, SIRENE Bureaux should also provide for staff exchanges with other SIRENE Bureaux at least once a year.

- Recital 14 of both Regulation 2018/1861 and Regulation 2018/1862: (…) To further increase the quality of data in SIS, **eu-LISA should also offer training on the use of SIS to national training bodies and, insofar as possible, to the SIRENE Bureaux and to end-users**.

- Art. 14(1) of both Regulation 2018/1861 and Regulation 2018/1862: before being authorised to process data stored in SIS and periodically after access to SIS data has been granted, the staff of the authorities having a right to access SIS[81] shall receive appropriate training on data security, on fundamental rights including data protection, and on the rules and procedures for data processing set out in the SIRENE Manual.

- Art. 14(2) of both Regulation 2018/1861 and Regulation 2018/1862: Member States shall have a national SIS training programme which shall include training for end-users as well as the staff of the SIRENE Bureaux. That training programme may be part of a general training programme at national level encompassing training in other relevant areas.

- Art. 14(3) of both Regulation 2018/1861 and Regulation 2018/1862: **Common training courses shall be organised at Union level at least once a year to enhance cooperation between SIRENE Bureaux**.

- Art. 15(5) of both Regulation 2018/1861 and Regulation 2018/1862: eu-LISA shall also perform tasks related to providing training on the technical use of SIS **and on measures for improving the quality of SIS data.**

SYSTEM: VIS

LEGAL BASE:

- **Regulation (EC) No 767/2008** of 9 July 2008 concerning the Visa Information System (VIS) and the exchange of data between Member States on short-stay visas (VIS Regulation)
- **Council Decision 2008/633/JHA** of 23 June 2008 concerning access for consultation of the Visa Information System (VIS) by designated authorities of Member States and by Europol for the purposes of the prevention, detection and investigation of terrorist offences and of other serious criminal offences

STATUS: In force

TRAINING RELATED PROVISIONS: none[82]

[81] This article applies also to Europol [Art. 48(5)(e)] and EBCGA teams members [Art. 50(1)]

[82] Obligation for eu-LISA to deliver VIS training is provided for in Art. 4(b) of eu-LISA new establishing Regulation 2018/1726

SYSTEM: EURODAC

LEGAL BASE:

Regulation (EU) No 603/2013 of 26 June 2013 on the establishment of Eurodac for the comparison of fingerprints for the effective application of Regulation (EU) No 604/2013 establishing the criteria and mechanisms for determining the Member State responsible for examining an application for international protection lodged in one of the Member States by a third-country national or a stateless person and on requests for the comparison with Eurodac data by Member States' law enforcement authorities and Europol for law enforcement purposes, and amending Regulation (EU) No 1077/2011 establishing a European Agency for the operational management of large-scale IT systems in the area of freedom, security and justice (recast)

STATUS: In force

TRAINING RELATED PROVISIONS:

Recital 19: (…) all authorities with a right of access to Eurodac should invest in adequate training and in the necessary technological equipment and should inform the Agency of specific difficulties encountered with regard to the quality of data, in order to resolve them.

SYSTEM: EES

LEGAL BASE:

Regulation (EU) 2017/2226 of 30 November 2017 establishing an Entry/Exit System (EES) to register entry and exit data and refusal of entry data of third-country nationals crossing the external borders of the Member States and determining the conditions for access to the EES for law enforcement purposes, and amending the Convention implementing the Schengen Agreement and Regulations (EC) No 767/2008 and (EU) No 1077/2011

STATUS: In force

TRAINING RELATED PROVISIONS:

- Art. 38(5): Before being authorised to process data stored in the EES, the staff of the authorities having a right to access the EES shall be given appropriate training on, in particular, data security and data protection rules, as well as on relevant fundamental rights.

- Art. 70: **eu-LISA shall perform tasks related to provision of training on the technical use of the EES in accordance with Regulation (EU) No 1077/2011**[83]**.**

SYSTEM: ETIAS

LEGAL BASE:

[83] eu-LISA repealed establishing regulation

Regulation (EU) 2018/1240 of 12 September 2018 establishing a European Travel Information and Authorisation System (ETIAS) and amending Regulations (EU) No 1077/2011, (EU) No 515/2014, (EU) 2016/399, (EU) 2016/1624 and (EU) 2017/2226

STATUS: Entered into force on 9 October 2018

TRAINING RELATED PROVISIONS:

- Art. 74(4): **eu-LISA shall also perform tasks related to providing training on the technical use of the ETIAS Information System.**

- Art. 75(2): Before being authorised to process data recorded in the ETIAS Central System**, the staff of the ETIAS Central Unit** having a right to access the ETIAS Central System shall be given appropriate training on data security and fundamental rights, in particular data protection. **They shall also take part in training offered by eu-LISA on the technical use of the ETIAS Information System and on data quality**.

- Art. 76(3): Before being authorised to process data recorded in the ETIAS Central System**, the staff of the ETIAS National Units** having a right to access the ETIAS Central System shall be given appropriate training on data security and fundamental rights, in particular data protection. **They shall also take part in training offered by eu-LISA on the technical use of the ETIAS Information System and on data quality**.

- Art. 77(5): Before being authorised to undertake any of the tasks referred to in Articles 34 and 35**, the staff of Europol** shall be given appropriate training on data security and fundamental rights, in particular data protection. **They shall also take part in training offered by eu-LISA on the technical use of the ETIAS Information System and on data quality**.

SYSTEM: DubliNet

LEGAL BASE:

Commission Regulation (EC) No 1560/2003 of 2 September 2003 laying down detailed rules for the application of Council Regulation (EC) No 343/2003 establishing the criteria and mechanisms for determining the Member State responsible for examining an asylum application lodged in one of the Member States by a third-country national

STATUS: In force

TRAINING RELATED PROVISIONS: none[84]

[84] Obligation for eu-LISA to deliver DubliNet training is provided for in Art. 8(b) of eu-LISA new establishing regulation

SYSTEM: ECRIS-TCN

LEGAL BASE:

Regulation (EU) 2019/816 of 17 April 2019 establishing a centralised system for the identification of Member States holding conviction information on third-country nationals and stateless persons (ECRIS-TCN) to supplement the European Criminal Records Information System and amending Regulation (EU) 2018/1726

STATUS: Entered into force on 11 June 2019

TRAINING RELATED PROVISIONS:

- Art. 11(15): **eu-LISA shall perform tasks related to providing training on the technical use of ECRIS-TCN and the ECRIS reference implementation**.

- Art. 12(2): Each Member State shall give the staff of its central authorities who have a right to access ECRIS-TCN appropriate training covering, in particular, data security and data protection rules and applicable fundamental rights, before authorising them to process data stored in the central system.

- Art. 16(2): Eurojust, Europol and the EPPO shall provide appropriate training covering, in particular, data security and data protection rules and applicable fundamental rights to those members of their staff who have a right to access ECRIS-TCN before authorising them to process data stored in the central system

- Art. 40(2) inserts *i.a.* Art. 8a(b) to new eu-LISA establishing Regulation 2018/1726:

    - In relation to the ECRIS-TCN system and the ECRIS reference implementation, **the Agency shall perform tasks relating to training on the technical use of the ECRIS-TCN system and the ECRIS reference implementation**.

OVERARCHING SOLUTION [incl. components]: Interoperability

LEGAL BASE:

- **Regulation (EU) 2019/817** of 20 May 2019 on establishing a framework for interoperability between EU information systems **in the field of borders and visa** and amending Regulations (EC) No 767/2008, (EU) 2016/399, (EU) 2017/2226, (EU) 2018/1240, (EU) 2018/1726 and (EU) 2018/1861 of the European Parliament and of the Council and Council Decisions 2004/512/EC and 2008/633/JHA
- **Regulation (EU) 2019/818** of 20 May 2019 on establishing a framework for interoperability between EU information systems **in the field of police and judicial cooperation, asylum and migration** and amending Regulations (EU) 2018/1726, (EU) 2018/1862 and (EU) 2019/816

STATUS: Entered into force on 11 June 2019

TRAINING RELATED PROVISIONS:

- Art. 55(4) of both proposals ["Responsibilities of eu-LISA following the entry into operations"], as well as Art. 76 of Regulation 2019/817 and Art. 72 of Regulation 2019/818 ["Training"]: **eu-LISA shall perform tasks related to the provision of training on the technical use of the interoperability components in accordance with Regulation (EU) No 2018/1726**[85]

- Art. 76 of Regulation 2019/817 and Art. 72 of Regulation 2019/818 stipulates also:

    - Member States authorities and Union agencies shall provide their staff authorised to process data using the interoperability components, with appropriate training programme concerning data security, data quality, data protection rules, the procedures **applicable to data processing and the obligations to inform under Articles 32(4), 33(4) and 47.**

    - **Where appropriate, joint training courses on these topics shall be organised at Union level to enhance cooperation and exchange of best practices between the staff of Member States authorities and Union agencies who are authorised to process data using the interoperability components. Particular** attention shall be paid to the process of multiple-identity detection, including the manual verification of different identities and the accompanying need to maintain the appropriate safeguards of fundamental rights.

[85] eu-LISA new establishing regulation reference

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