

**Scientific Approach on OSINT Training Program Development based on a
Skill-Management-System for European Law Enforcement Agencies**

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Abstract – OSINT – Open Source Intelligence OSINT stands for the collection and analysis of publicly available data and information for the purpose of producing actionable intelligence to provide answers to questions asked. With the triumph of the Internet and social media these are an almost inexhaustible source of information, especially for law enforcement. In order to be able to satisfy the LEA (Law Enforcement Agencies) needs on this topic, skills have been developed and defined that are required or desired for different roles and activities. Based on the developed and defined skills and roles, available trainings were determined and a Gap Analysis was created. On the basis of the gaps a blended learning training of the topic OSINT was developed. One approach could be implemented in form of a pilot-project within the SENTER-network (<https://www.senternetwork.eu/>).

I. OSINT

Introduction

OSINT means obtaining intelligence from publicly available sources that are legally and ethically accessed and are available at low cost measured on the return value (Johnson, 2006). It is gaining greater emphasis since the number of exploitable open sources has increased after the Cold War and with the evolution of the Internet/WWW (Antoniou, 2013). The intelligence products started to be based mostly on open sources thus providing efficient use of the resource capabilities of the intelligence community. Estimates assume that between 80 and 95% of the information an organization needs are freely available on open sources (Pallaris, 2008).

Intelligence is not information, and information is not intelligence. Intelligence is a product that enables an organization or decision maker to make a decision or conclusions operationally, strategically, and/or tactically with the given information. Intelligence is also an iterative process and a way of thinking.

Categories of intelligence:

- Strategic Intelligence - aims to provide insight and understanding into patterns of criminal behavior and the functioning of the criminal environment, and aims to be future-oriented and proactive.
- Tactical Intelligence - This level of analysis supports front-line enforcement officers and investigators in taking case-specific action in order to achieve enforcement objectives such as tactical plans. This is the most dominant form of Intelligence analysis across the world (Ratcliffe, 2007).
- Operational Intelligence - supports area commanders and regional operational managers in planning crime reduction activity and deploying resources to achieve operational objectives.

Intelligence Cycle / Process

The Intelligence Process, also known as the Intelligence Cycle, focuses on the transformation of information into actionable intelligence.



Figure 1 Intelligence Process

Intelligence is not always 100% accurate, but when it is properly processed and disseminated, it is the process most advantageous to those involved in the decision-making process.

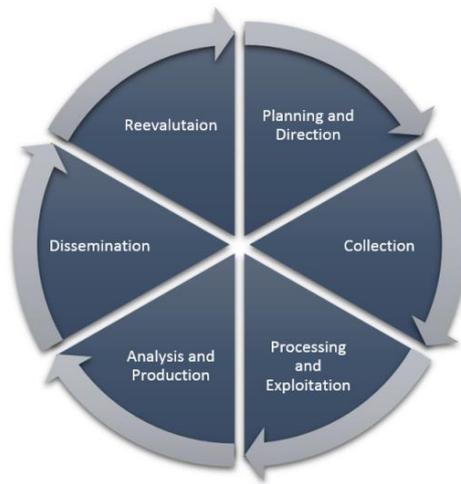


Figure 2 Intelligence Cycle

Different organizations have their own “version” of the Intelligence Cycle.

1. *Planning and Direction* – The action in this step is to plan the intelligence activities according to the process, and from this, all Intelligence Cycle activities are started. It includes identifying and determining the information needs, the decision on how this information is collected, and drawing up of a timetable. The Intelligence Cycle activities are planned by the responsible persons on the basis of the customer’s requirements. Among others, a methodology to define the requirements might be using the “Five W’s” (Who, What, When, Where, Why, and How).

2. *Collection* – The second step includes all the different activities. That involves the collection of (raw) data to satisfy the defined requirements. This step usually includes a mass collection of information and the review of previous intelligence with the need to be vetted by careful and critical examination for relevance, significance, and accuracy. The collected information is correlated and forwarded to analysts. The collection phase alone is quite complicated, and includes, for example, source vetting / reliability testing, information weighting, application of the scientific analysis methods.

To gather the right data and to avoid overload, collectors should always have the following questions in mind:

- What information do we want?
- Where do we get it from?
- Who does what?
- How much data can we handle?
- What is our goal?

3. *Processing and Exploitation* – The collected raw data becomes useable information through interpretation, translation and conversion. Therefore, all collected information will be transformed and analyzed for relevance and priority.

Further activities are the review and evaluation of the reliability of the source and the validity and accuracy of information with the help of standardized information evaluation systems, such as 4x4 by Europol (Statewatch, 2018), 5x5x5 or 6x6, Admiralty System by NATO, and others (Towilson, Leigh and Mathers, 2018).

4. *Analysis and Production* – In the analysis, the analyst continues to study and evaluate the facts, and relates them to other sources of the gathered information. The analysis should be objective, timely, and accurate. To produce intelligence objectively, the analysts apply four basic types of reasoning: induction, deduction, abduction and the scientific method. Bias and misperceptions can influence the

analysis, thus structured analysis methods should also be used (CIA, 2009). For the analytical process, effective training, policy orientation, monitoring and an operational plan are indispensable. The scientific approach in problem solving is essentially important. This requires qualified and well-trained staff to give the processed information a meaningful relation to the requirements (Carter, 2009). The results of this step are reports that are value-added actionable information tailored to a specific need, referred to as intelligence products.

5. Dissemination and Integration – This is the delivery of the finished intelligence product to the (authorized) consumer(s) for adding value. The intelligence product is produced and created from the analysis results combined with strategic options and action recommendations.

6. Reevaluation – This is the continuous evaluation during all steps in this process or cycle. The process is acting like a system. The individual steps are related to each other, and changes in one step have effects on the other steps. All steps must always be in a consistent state. Reevaluation also serves as a measurement to determine if the intelligence products created by the process are valuable.

Problematics existing in the OSINT field of action:

At present, available qualification programs are non-transparent, courses are difficult to compare, very different in quality and only in the fewest cases they are developed on competencies that are requested and validated by practitioners. Trainings often do not provide the desired benefits, since learning outcomes do not correspond to the required role profile. In order to compensate for this lack, individuals will complete as many training courses as possible - which is not economical for the authorities. Roles or career paths (seniority levels) are not defined and standardized. This leads to a time-consuming selection of the right training program for a specific career path.

People are frustrated in their workplace because their competencies do not correspond to the job profile of their posts; they are therefore under- or over-burdened with tasks. The problematics can be summarized as:

- Within a field of action, many people have gained their knowledge autodidactically, but reach their limits with increasingly complex issues.
- Experts with existing knowledge, in particular within special areas in a field of action e.g. OSINT, are difficult to locate.
- It is difficult for authorities to compare qualification levels of their employees internally and externally.

What can be done to improve the situation?

“Human resources development research can overcome deficits by being embraced as an interdisciplinary science and bringing together individual knowledge of neighboring scientific disciplines to arrive at an orderly foundation of scientific evidence as an integrated human resource development theory” (Beck, 2007). Skill Management Systems have been successfully used in personnel development for many years, e.g. for qualification of employees, competency-based onboarding on projects or the comparison of qualification levels of employees between companies or within an industry. In a Skill Management System, relevant skills are logically categorized and defined within so-called Skill Catalogs. Thereupon roles can be defined within an organization, which can be seen like a set of required skills with the optimal characteristics for fulfilling the respective tasks of a specific role. An employee who possesses all these skills in the right level is the ideal match for this role within an organization.

The applied business case

One possible application of a Skill Management System with answers to related issues has been developed during the last two years (2016-2017) within the SENTER project. One of the project goals was the establishment of a Skill Management System that enables international cooperation and harmonization of police authorities of all EU member states.

The SENTER project, which is funded by the Internal Security Fund (ISF), ISF Police - Fight against crime, has discovered that having the right skills at the right time is one of the key productivity drivers. Within the project, thematically relevant competencies and skill definitions from publicly available sources were researched, sorted and enhanced in a suitable taxonomy, called the Skill Catalog. Skill Management in the SENTER project was supported by a web-based skill-management platform called *décidalo*®. This is recommended to work on collaboratively between departments and training providers.

Gap-Analysis

To determine LEA OSINT training needs and related topics that a specific learning module has to cover, a Gap Analysis is an appropriate method to use. A Gap Analysis can be run on existing skills and skill-levels of a Skill Catalog. Likewise, the contents conveyed in determined OSINT trainings can also be conveyed. In addition to training gaps, training needs of the LEAs also play a role, as well as the training capacities offered to cover the needs of LEAs. In discussions with training coordinators of LEAs it could be ascertained that increased needs of certain skills and skill levels exist.

Results of a Gap Analysis provide information about:

1. Which skills are required by the LEAs that are not covered by existing trainings.
2. Which of the required skill levels are not covered by the existing training.

Based on the results of a Gap Analysis, following exemplary OSINT training modules can be seen as necessary to fulfil currently required LEA training needs:

- OSINT Intelligence Techniques
- Online Investigation Security, Privacy, Anonymity and Workstation Technologies
- Basic Internet Technologies
- Browser Technologies
- OSINT Gathering Techniques
 - Search Engines
 - Social Media and Social Networks
 - Blogs, Forums and Wikis
 - Network Technologies
 - Virtual Currencies
 - Images and Video Recognition Technologies
 - Darknet Investigation
 - Open Source Tools
 - Structured Analysis Techniques and Tools

Preliminary work and overview of reference libraries and frameworks

“Competency libraries refer to lists of competencies from which to select when developing a competency model. The advantage of competency libraries is efficiency. They make the development of competency models easier and faster because the users simply have to select the competencies that apply to their jobs. Competency libraries capitalize on the experience gained in other competency modeling projects, either in other companies or elsewhere in the same organization. Aside from efficiency, competency libraries have two other key advantages. First, they help ensure consistency of competency language across an organization. The same competency is called the same way in different parts of the organization. Second, they help ensure that all potentially relevant competencies are considered. By being presented with a fairly thorough list of competencies, the chances are smaller that an important competency will be overlooked. Competency libraries are common offerings of consulting firms because of their experience developing competency models across many organizations. However, the idea of a competency dictionary (i.e., for using similar labels for competencies and learning from other competency modeling efforts) can be applied within large companies that have different competency models in different parts of the organization” (Campion, 2011).

In order to get an overview of what already exists so far and also to weigh up different approaches within already existing skill frameworks used in other organisations, an initial research phase should be undertaken. Research activities involve the collection, analysis, clustering and data preparation of relevant roles and skills. Applicable frameworks can serve as a basis for further developments of a Skill Matrix. For European Law Enforcement Agencies, particular focus should be given to European frameworks to prevent redundant work, enable better exchange of knowledge and build up on each others work.

Recommended and for OSINT relevant reference frameworks:

- E-Skills UK / The National Academy for IT
- CESG Certified Professional (UK National Cyber Security Centre)
- IISP Skills Framework UK, Institute of Information Security Professionals
- National Initiative for Cybersecurity Education (NICE), USA
- (ISC)² Competencies and Certifications, University of Phoenix
- European e-Competence Framework and ICT Profiles, The European Committee for Standardization (CEN)
- TCF Training Competency Framework on Cybercrime (ECTEG = Europol EC3 + CEPOL + Eurojust)

II. Training Course Development

Competencies that are acquired in the course of one’s professional life can be gained via several ways. Training Development requires innovative methods of motivation, supported by an inspiring management team. Expertise in Open Source Intelligence (OSINT) is in an overall perspective missing in Europe’s Law Enforcement Agency (LEA) departments. Needs for hands-on training in combination with further education possibilities are extremely high, but there are too few suitable courses on the academic level to meet their exact training demands.

Many companies and, above all, public authorities want to train their employees in specific areas at an academic level whereas there is not always enough time to attend entire study programs. More suitable therefore are study modules that can be individually selected and completed with an equivalent certification.

The aim of the training programs developed within the SENTER project is to provide urgently needed Online Investigators with training and education on “Internet Technologies” and “OSINT Open Source Intelligence Techniques”, help building up capacities and provide LEA with a strengthened workforce

to combat cybercrime. Both training modules were developed on the basis of the blended-learning system. Moreover, acquired ECTS points (5 ECTS points per course) can be added on a student's amount of ECTS points (European Commission, Education and Training, 2018).

The origin of all training programs is initialized by their target group: Thus for LEA, training courses should be aligned in form of part-time studies to allow students from LEA organizations to continue their jobs without interruption. Therefore, it is appropriate to develop suitable blended learning formats which can as well be implemented in subsequent measures of the SENTER network. Prior to the development of a study module, it is first necessary to understand basic facts such as characteristics of the target group, the approach of the didactic concept and learning objectives. Once the characteristics of the target group (full-time or part-time students), like country, profession (role), existing and desired skillset, as well as personal characteristics such as age, background, prior knowledge or time preferences of the students are framed, learning modules can exactly be adjusted to enable students to reach their desired career path fast, aligned with individual learning and temporal preferences.

Based on the Gap Analysis, as mentioned above, entirely new learning content was developed up to a micro module level. Learning content can be created based on the atomic skills defined in a skill matrix. In order to enable a competence-oriented creation of the learning content, predefined data needs to be compared and gaps can be analyzed by means of specific queries. The skills collected in collaboration with Online Investigators of several EU member states were the basis for a practice-based view. Previous gaps were discovered that yet have not been covered in other training programs.

Requirements towards didactical concepts, in particular like the blended-learning system, is to keep the learning experience high by encouraging active exchange through appropriately selected practice-oriented learning elements, exercises, real-use cases and a learning management system. The depth of the study material can be determined according to the duration of the study module.

The purpose of a study module is to deepen or broaden the skillset also with regard to examinations and certifications. Standards of certifications also determine the difficulty level of the modules.

Certificate:	University Certificate
Applicability:	Prerequisite for other courses in the context of LEA cybercrime
Persons:	1 lecturer 1 tutor 1 administration
Time frame:	2 months
Credits:	5 ETCS-credits
Target group:	Law enforcement investigator / online investigator Preservation of evidence officers
Study- and exam achievements:	1. Written report of the reading guide exercises 2. Class exam 90 min. or a seminar work with 15 min. oral exam
Necessary qualifications:	Familiar with computers and internet in general
Recommended qualifications:	Computer skills and internet and network knowledge like handling command lines on different operating systems (Linux, Windows)
Workload:	Attendance and distance learning: 150 hours Attendance: 10 hours Distance learning 140 hours thereof self-study 85 hours thereof exercises 50 hours thereof online assistance 5 hours Sum: 150 hours 30 h = 1 CP according to ECTS
Lectures and teaching method:	Attendance: Lectures and exercises Online courses: Lectures, focus on individual topics, web-based dialogue, exercises and examples Virtual machine with installed tools for practical testing and doing the exercises
Media forms:	Digital study packages, course materials, exams and corrections electronically submitted. Web-based learning platform: <ul style="list-style-type: none"> • General course information

	<ul style="list-style-type: none"> • Course material and notes • Material and recordings of the online meetings • Information, material and recordings of the personal presence event • Mentor forum • Participant forum • Exercise submission (with commented feedback and sample solution) • Exam (seminar work) information, submission and preparation <p>Online-lectures and presentations are hold via web-conferences</p>
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Figure 3: Study-Letter overview of the OSINT training module, provided by Albstadt-Sigmaringen University

Didactical Method: Blended-Learning Cycle

Blended learning is an integrated learning concept, which optimally uses the combination of media-based and other qualification formats - often with tutorial accompaniment. It enables interactive learning, independent of time and place, e.g. in combination with the exchange of experience, role playing and personal encounters in the classical presence training.

As defined by Gabler Wirtschaftslexikon, Blended-Learning can be described as:

Blended learning is the combination of different methods and media, such as face-to-face classes and e-learning. The mixture of formal and informal learning and the enrichment of print media with 2D codes can also fall under this concept.

1. Term: The term Blended Learning (“blended, mixed, combined”) is the combination of different methods and media, such as face-to-face classes and e-learning. In a scientific context, it’s also described as learning in the media group or of hybrid learning arrangements. The mixture of formal and informal learning is also widely accepted [...].

2. Approach: The aim of an educational program is to be achieved as efficiently and effectively as possible by means of a suitable combination. For example, individual modules of different methods and media used for presence events and e-learning measures build on top of one another and complement each other. This is often the case at the beginning of a course, where a presentation session takes place, in which the participants get to know each other, creating an important prerequisite for learning and working together in the community. Alternatively, web-based trainings (WBTs) and virtual classrooms are used to bring learners to a common level of knowledge in preparation for their attendance lessons. By empowering informal learning, the process of studying can be done flexibly between work and self-study, formal learning is “relieved”, e.g. of conceptual work and beneficial for (on-site or networked) dialogues and discussions. [...]

3. Dissemination: Blended learning is the usual form of teaching and learning at modern universities and large companies. Through learning platforms and learning and knowledge portals, not only information and materials are provided and managed, but also complex blended learning courses are organized. Smartphones and tablets are used to inform students and provide support for mobile workers. [...] While pure e-learning has only been implemented in exceptional cases, blended learning has become a normal case in the industrialized countries and information societies. The digital divide between and in the states and societies is a subject of information ethics.

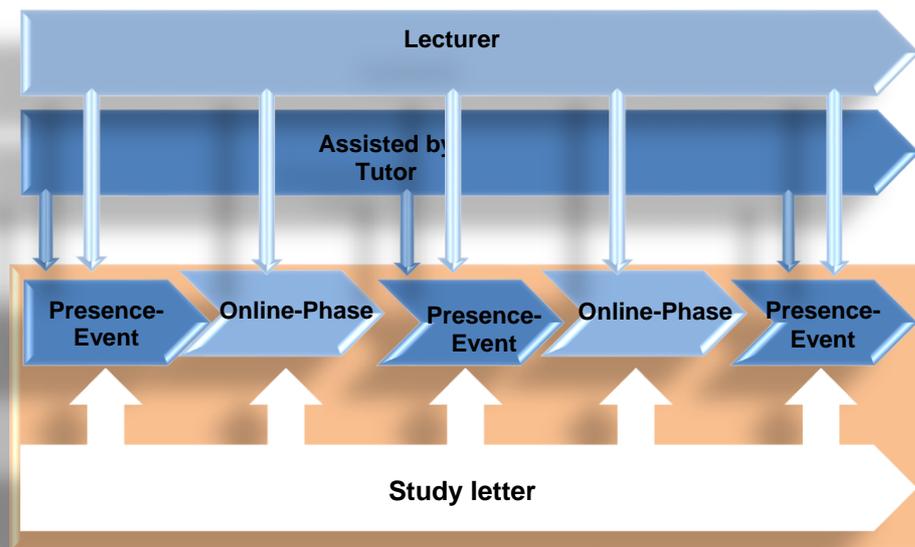


Figure 3: Blended-Learning System (figure provided by Albstadt-Sigmaringen University, https://www.hs-albsig.de/hochschule/Organisation/iww/Seiten/Hochschulzertifikate_im_IT-Security_Bereich.aspx)

Future-oriented company learning arrangements are characterized by the following key characteristics of the didactic concept (Sauter and Scholz, 2015):

- **Strategy-based education:** The didactic decision on the selection and design of competence profiles, learning objectives and learning content is oriented towards the strategic goals of the organisation. It takes place in the context of social, economic and technological framework conditions. Learning concepts are based on the real world of work and therefore integrate new media and innovative communication platforms that are used in practice.
- **Primacy of Didactics:** The decision about learning and content goals determine the methodology. The selection of learning forms, social forms and media can only be meaningful, if goals and contents of a learning concept are determined.
- **Primacy of goals:** In future learning concepts, learners' individual competence goals determine their learning processes. The learning content in this target framework mainly results from the real challenges in practice.
- **Principle of exemplary learning:** The learning objectives are aimed at representative problems from practice or projects.

The requirements for the methodology of the learning arrangements are derived from these characteristics. A methodology is needed that ensures the creation of a framework for enabling individual learning arrangements with real and virtual learning places, forms of learning, social forms and forms of communication as well as media, and in particular competence-oriented knowledge management. The learning processes will increasingly be characterized by self-responsibility, self-organization and collaborative learning, at the workplace and in the network. This requires a corresponding learning culture, which can only gradually be developed.

In order to foster the best possible connection between learning contents and professional requirements, the results obtained in a Gap Analysis can be played with when creating exercises. The active application of real use cases increases the attention and learning experience of students. By independently finding solution paths of the theoretical learned, with the practical application of programs e.g. during internet search exercises, it is possible to better recognize contexts and at the same time to explore own work paths.

The following approach could be helpful for the creation of real use cases:

1. Usage of results of the Gap Analysis as a basis
2. Elaborations of all skill areas that can be interlinked with each other
 - a. Technical skills
 - b. Investigation skills
 - c. Management skills
 - d. Psychological skills
3. Definition of suitable use cases that occur in real criminal cases by combination of skills from all areas (synthetically generated via software or individually constructed on showcases of historic data provided by LEA). E.g. Technical Skill (Semantic Search) + Management Skill (Cooperativeness) + Investigation Skill (Case Handling) + Psychological Skill (Framing). Important: Use cases have to be highly relevant to practice.

For applying generated real-use-cases within training sessions, an IT environment has to be set up beforehand, ensuring that a dedicated test-server or even a test-environment can be accessed by the students.

For a smooth performance of the exercises, the following technical prerequisites should be considered:

1. Installation of a dedicated test-server or even a test-environment
2. Development of a test or dummy website that can be used e.g. for website-analysis, if possible, on various web-server technologies, shop-systems etc.
3. Fictional creation of a perpetrator's profile and its traces
4. Provision of traceable and interlinked fake accounts e.g. on social media channels, commercial platforms, forums or dark web sites etc. depending on exercise
5. Distribution of exercise content and data on the web
6. Enabling technically that the demanded exercises can be carried out
7. Ensuring high availability of the spread contents

III. Skill-Management System

The basic idea of Skill Management is to systematically identify, use and develop employee competencies. An up-to-date and constantly maintained Skill Catalog in form of a well-formed set of capabilities and competencies provides a complete and role-based employee profile. This enables to make better decisions as well in recruiting, staffing, resource management, and as well efficient training and development. Classic Skill Management, which has an isolated HR and personnel development view with a "Stand Alone" IT solution, has become obsolete. The future belongs to Skill Management concepts that support classic human resources as well as original value creation and strategic decision-making in the company (Detecon Consulting, 2010). In IT-oriented organizations, such as Cybercrime departments, the demand for Skill Management derives directly from the nature of the activity being performed. The high dynamics and complexity of a permanently changing technological world pose specific challenges for cybercrime investigating authorities.

In general, a Skill Management System has to achieve three functions (Lars Dittmann, 2003):

1. It has to support the complete and systematic acquisition of knowledge about skills of members of an enterprise
2. It has to provide the knowledge about skills and the skill owners
3. And it has to apply the available knowledge to serve a purpose

Dr. Axel Völker, Founder and Managing Director of Data Assessment Solutions (www.data-assessment.com), is known as an international expert when it comes to the system introduction of an organization-oriented and individually designed Skill Management System. He meets the requirements of a Skill Management System with the following questions: "How can I keep skill data current and accurate? Which skills and competencies will be needed over the next six months and which in two

years? How do I optimize the capacity level within projects? What are our most valuable skills? Which skills and competencies are decisive for the success of a project?”.

“Due to rapidly changing market requirements, organisations must be able to adapt quickly and flexibly to new goals and challenges. This fact requires the efficient use of the resource “employee”. To meet this requirement, there are a number of objectives for Skill Management. A basic task of Skill Management is to develop a catalog that shows and collects required skills and qualifications for a company’s operations. For example, to ensure rapid team building, there must be transparency of active and passive employee skills. This transparency is a prerequisite for fast and flexible deployments of employees in projects and teams. Another goal of Skill Management is the optimal utilization of experts or their integration into further projects” (Thomas Hodomszky, 2007).

These are also the basic questions facing cybercrime departments of all police forces. According to Europol’s latest Internet Organized Crime Threat Assessment (Europol, 2017), cybercriminals are showing a trend towards more aggressive and confrontational approaches. The report focuses on the following crime areas: Criminal online markets, darknet, sexual exploitation of children, payment fraud and terrorism. With a shortage of skilled workers, especially for filling the needs of LEA cybercrime departments, the efficient management of available skills and resources of already trained professionals is at the forefront of the agenda. For this reason, authorities of all EU member states are moving towards a more efficient and better-directed development of staff when using a common Skill Management System.

Methodology

In practice, the diverse competency models differ primarily through the differentiation possibilities of employee roles. According to Werner Sauter (Sauter and Staudt, 2016), company-specific competence models can be divided into three classifications, which are:

- **Single-job model:** Each “individual activity” is considered specifically to define necessary competency requirements. Thus, individual, needs-based personnel development measures can be derived, so that the acceptance of the employees is very high. However, this approach requires great efforts to create and maintain the model. As a result, the acceptance among executives is rather low and makes the implementation in the company quite difficult.
- **One-size-fits-all model:** The “business competencies” necessary to implement the corporate strategy are generally defined for all employees. There is no distinction according to role-specific behavior, requirements for respective activities or tasks are disregarded. The development and maintenance effort is therefore very low. However, it is relatively difficult to derive individual development measures.
- **Multiple Job Model:** This model combines the advantages of the other two models without taking their disadvantages. In addition to the general approach of defining targeted actions throughout the company, additional competence requirements are included. As a result, the various employee groups find themselves in the competence model again, so that the acceptance is significantly increased.

The Skill Management process for itself starts with the determination of the roles and functions that the organization needs. From this starting point, required profiles (target skillsets) are derived for each role and function, and required skills are mapped for each profile on a scale. Finally, employees also estimate their own abilities on a scale and thus create the actual profiles. Although it sounds relatively simple at first, there are a number of success factors that have to be taken into account. In a Skill Management concept, the objectives and the benefits have to be clearly defined right from the beginning. E.g. key questions such as whether Skill Management should be aimed at targeted personnel development, or at developing roles with a certain competency (Is it also necessary to define the design and structure of the Skill Catalog)? Will the Skill Catalog be organized in a functional or organizational manner, and in what depth should the skills be collected? In addition, the processes should be fully defined, for example, how exactly the implementation process will be performed and how the processual sequences look like.

Providing an Online-based Skill-Platform

When taking a look at upcoming trendlines, the Korn/Ferry Institute predicts the following scenario: “Looking ahead, what do the next two decades hold for competencies and competency modeling? For one, we can only imagine that the technology systems that support the integration of talent management systems will become increasingly sophisticated. More detailed and more integrated data will allow HR professionals to become very precise as they assess, develop, and deploy talent across an organization. We also expect to see additional breakthroughs in the science of leadership specifically regarding what variables predict success in various positions or functions. Finally, we anticipate that talent management professionals along with line managers will become more and more adept at using competencies to manage talent - paving the way for more fine-tuned, sophisticated competency-based talent management systems”.

Departments have a repertoire of personnel management instruments such as recruitment, salary management or succession planning. These instruments can not be viewed in isolation; innovative Skill Management should be linked to them. Moreover, available training programs have to be gathered and connected with corresponding skills from the centralized Skill Catalog and continuously maintained on an integrated training database.

Skill Management should be supported by a web-based skill-management platform. Web access is recommended to enable collaborative workflows between departments and training providers. Skill Management Systems like *décidalo*® (<https://www.data-assessment.com/en/decidalo/>) enable to complete and refine a unique Skill Catalog supported via a preconfigured hands-on software. Necessary adaptations of functionalities result from the previously defined Skill Management concept. For this purpose, it should be defined who should have access rights, for example, management, staff, training providers or Law Enforcement research departments.

The following table lists the phases of the implementation process in short.

Phase 1 Validation	<ul style="list-style-type: none">• Clarification of process and general conditions• Coordination of project plan and responsibilities• Clarification of data protection laws• Qualification of all people involved
Phase 2 Identification	<ul style="list-style-type: none">• Definition of core functions that have to be established• Systematic elaboration of target situation• Definition of relevant target skillsets• Scaling of target competencies with necessary quantifier
Phase 3 Transfer	<ul style="list-style-type: none">• Determination of competency catalogue for predefined core functions (within phase 2)• Consolidation of competency catalogue

Figure 4: Phases of the Implementation process

IV. How can skills be defined?

The idea of Ontological Reduction. During the course of action of defining terms precisely, it was found that the conceptual object “skill” is treated and lived differently within in several languages. In order to get a little closer to the elementary concept of the term “skill”, the idea of Ontological Reduction was applied. A reduction is the action or fact of making something smaller or less in amount, degree or size, e.g. the reduction of an entity B to another entity A. Entity A is somehow more elemental than entity B.

Specifically, reductions can be understood as:

- Elimination of the original entity B (“entities of type B do not exist”)
- Consolidation of entity B (“entities of the alleged type B are actual entities of the species A”)
- Transformation of the subordinate entity B (example: “The propositions of the theory B are special cases, e.g. a subset of the superordinate basic theory A.”)

Wikipedia describes Ontological Reduction as: “Ontological reductionism is the belief that reality is composed of a minimum number of kinds of entities or substances. This claim is usually metaphysical, and is most commonly a form of monism, in effect claiming that all objects, properties and events are reducible to a single substance. In Linguistics reductionism is the idea that everything can be described or explained by a language with a limited number of concepts, and combinations of those concepts” (En.wikipedia.org, 2018).

Key question: Which skills describe the core function, which a role should be created for?

- Which competencies does a position holder have to have, to be able to fulfill actual and future tasks?
- What exactly does a position holder have to know or be able to do? How do I explain these competencies to somebody from outside, e.g. another, third party?
- In which emphasis or level does a competency have to be present?

Core functions: Relevant core functions within the field of action should be developed in a separate document. Core functions have to be differentiated from each other highly selective. Defining core functions is a necessary intermediate step, that isn’t configured within a Skill Management System (e.g. decidalo software). Only roles and skills are configured and defined in the Skill Management System. Core functions include:

- Tasks, that directly serve to maintain core skills of an organisational entity resp. a department
- Tasks, that are necessary to reach the pursued goals
- Tasks, that are not able to be replaced by technology
- Tasks, whose execution requires certain special and interdisciplinary competencies

Competencies: Although the definition appears to vary widely (Schippmann, et al., 2000), competencies are typically defined as a combination of knowledge, skills, abilities and other individual characteristics (often called KSAOs; including but not limited to motives, personality traits, self-concepts, attitudes, beliefs, values, and interests) that can be reliably measured and that can be shown to differentiate performance (Mirabile, 1997; Schippmann, et al., 2000; Spencer, McClelland, & Spencer, 1994).

Competency Modeling: The global strategy consultancy ICF International describes it as follows: Competency modeling is typically defined as the identification, definition, and measurement of the KSAOs that are needed to perform successfully on the job (Bartram, 2004; Schippmann, et al., 2000). Competency modeling can be carried out using a few different approaches, but the most common are the individual job level and the organization level (Mansfield, 1996). The former deals with identifying the characteristics (i.e., KSAOs) that are necessary to be successful in a particular job (often referred to as a bottom-up competency model, and is quite similar to job analysis), whereas the latter takes into

account organizational objectives, vision, and strategy and attempts to develop a set of competencies that are applied to the entire organization, a department within the organization, or a job family within the organization (Lawler, 1994; Prahalad & Hamel, 1990). Whereas KSAOs is an acronym for Knowledge, Skills, Abilities and Other Characteristics. They are extremely helpful for recruiting personnel, KSAOs describe the skills and attributes required for a particular position in an organization (Chrmglobal.com, 2018).

Skill Management: Skill Management can be described as the whole of all operational activities that determine and reflect individual change processes of functional and methodical skills or capabilities of a staff member. Skill Management aims at supporting the operational business with personell development, -planning, recruitment and project management. Focussed on by Skill Management are mainly the so called hard skills.

Skill Management Systems: Skill Management Systems are databases with the goal of making the management of employee skills more efficient and effective by exactly matching skills and experiences in accordance with the needs required.

Skill: An applicable definition of a skill was found in the Online Cambridge Dictonary. It describes a skill as: “an ability to do an activity or job well, especially because you have practised it”.

Atomic skill: Atomic skills are what the user assesses in a skills assessment. These can be compared as the leafs in a tree structure.

Composite skill: Composite skills are composed of a set of atomic skills. (Theoretically they could be composed of composite skills and atomic skills, using a generic composite pattern). Composite skills don't have defined skill requirement levels that can be assessed. The user assesses the atomic skills and an average assessment result is calculated for the composite skill by averaging the results for the contained atomic skills. For example, the composite skill “Object Oriented Development” is defined by the three atomic skills “Object Oriented Concepts”, “Object Oriented Analysis” and “Object Oriented Design Patterns”. Composite skills are used to break complex skills down to a set of sub-skills.

Skill folders: Folders are used to organize skills into a logical tree structure. A folder can contain other folders, atomic skills or composite skills. Folders cannot be assessed and no assessment result is calculated for a folder. Folders can contain several sub-folders or groups.

Skill levels

Very important to clarify and set are the levels of expertise. For most of the skill matrices usually versions are set with either 3 or 5 skill levels. The determination of the right level is essential for the subsequent definition of the skills, in particular to enable the illustration of a career path. Skill levels are the qualitative measurement within the matrix.

Each of the skills defined for a role are scaled with their necessary target-level:

- Target-level (general proficiency scale) of a competency can be used for all roles
- Special target-levels for roles of individual staff members are not being displayed
- Target-level “0” can't be selected for roles

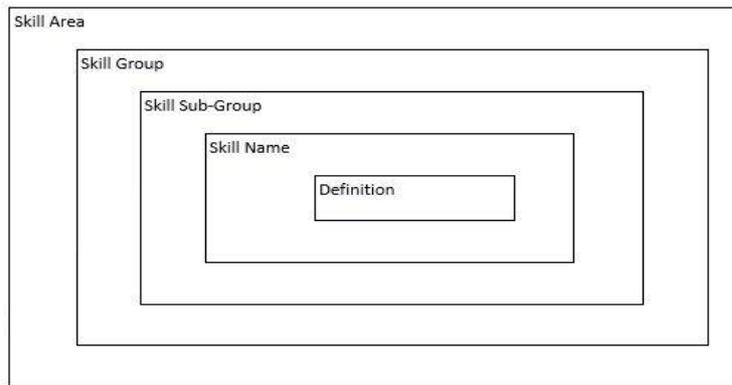


Figure 5: Taxonomy of a Skill Catalog

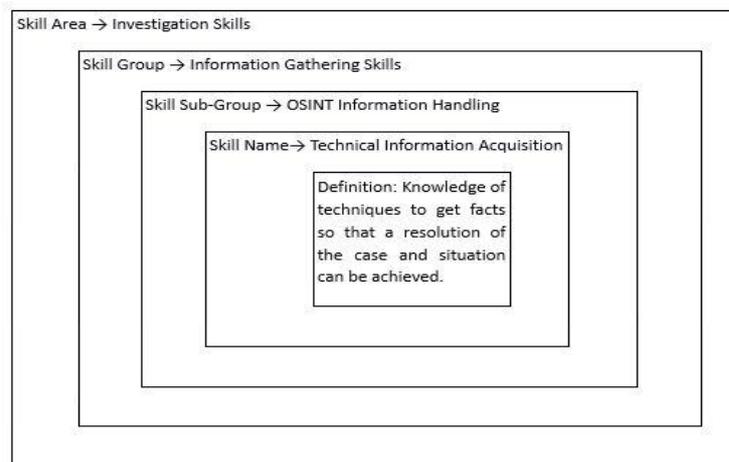


Figure 6: Example of a taxonomy of a Skill Catalog

When working on the skill definitions, following rules have to be paid attention at:

There shouldn't be displayed the skills of all present staff members, but rather it is crucial to determine the skill requirements of the core functions of a role

The determined skills have to be applicable to all position holders of an assigned core function

- Special skills for unique staff members are not collected within a core function
- Naming of skills as well as skill groups must not be longer than 100 characters
- Every skill has to be described transparent and comprehensible. Skill definitions can consist out of 3 – 5 explicit and precise statements per definition. Skill definition statements can begin with: “Knows”, “Can”, “Is able to”, “Ability to”, “Is capable of”, “Knowledge of”, “Knowledge in using”
- Formal hiring requirements (e.g. graduation, diploma, etc.) are not subject matter of the survey
- There are as many skills gathered related to a core function, as it is necessary to describe the core function in a comprehensible way. Focussed concentration on a few but especially important skill requirements enable practicability of profiles as well as an economic and valid capture of actual profiles
- From experience, out of approximately 10 skills, that are significant for a core function, circa 80 % of the requirements are covered (pareto-principle 80/20-rule).

V. Future of Skill Management and Open Source and Intelligence

The perspective of contingent competence development shows that organizations can gain strength by overcoming the boundaries between their environment and competence development, by integrating knowledge about societal environment changes into competence development. To include the knowledge about the impulses of the environment changes into competence development is decisive for its utilization and continuous developments. While disruption is the holistic reconfiguration of the environment, transformation is the result of adapting and redeveloping the possibilities of action in the organizational context. The knowledge of the forces acting on an organization allows a reflection of the consequences and influence zones on the whole system. At the same time, the adaptations of the competence base leads to the formation of unstable states of action in the organization, which in turn are transmitted to the environment. This continuum between environmental change (disruption) and the development of new action structures (transformation) is the framework of understanding in which competence development takes place (Reinhardt, 2014).

OSINT has changed significantly during the past 10 years. In the digital age of social media, mobile apps and artificial intelligence. The ongoing exponential growth of publicly available data will continue. This development cannot be ignored by Law Enforcement Agencies. OSINT will continue as a key role in the field of crime prevention and intelligence procurement. With the increase of publicly available data demands for analysts and investigators will also increase. In future, more people and sophisticated skills are needed to search the vast amounts of intelligence data to provide actionable intelligence for decision-making. This will lead to a new development of skills, abilities and knowledge of OSINT analysts. There will be more challenges such as the automation of data collection and analysis, and the handling of misinformation and counterfeit messages.

VI. Final conclusion:

Resolving competency gaps and enabling the cooperation within and outside the European Union are essential objectives of national cyber security strategies and, besides of capacity building, in focus of the police authorities. While cybercriminals are increasingly professional and networked, police often lack systematization and standardization of targeted cyber training courses as well as sophisticated tools for identifying experts in a specific field e.g. Open Source Intelligence (OSINT).

To fill capacity gaps, a systematic Skill Management System has to be developed with a clear overview of the skills that a role (e.g. an Online Investigator) needs, to be successful, now and in the future. Moreover, Law Enforcement Agencies need to have an overview of the skills and competencies that employees on board already have. When developing a skill-based management system, the skillset of the whole information security field as a whole has to be looked at. Skill-based learning management helps to strategically develop know-how and personnel. Employees are deployed in a more targeted way and are thus getting a broader or a deeper level of expertise in their position.

But there are several things to consider. Practitioners from different locations (departments and countries) have to complete and refine the Skill Catalog, which is quite time consuming. Furthermore, available training programs for European police have to be continuously gathered and connected with corresponding skills from the Skill Catalog and maintained on an integrated training database.

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