Organized Crime Structure Modelling for European Law Enforcement Agencies Interoperability through Ontologies

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Abstract. Nowadays, organized crime networks share intelligence and knowledge as a fundamental asset for their members, thus making criminal organizations more global in nature and activities. Internet has consequently become the natural environment for these organizations. This evolution has put a bigger pressure in Law Enforcement Agencies (LEAs) demanding more efforts and resources in the fight against transnational organized crime. LEAs can therefore profit from international cooperation in fighting these organizations. However, differences among legal frameworks, languages and police and judicial culture may create interoperability issues. The CAPER project addressed the prevention of transnational organized crime by trying to provide the needed interoperability among the different European LEAs. In this work, we introduce a supranational Organized Crime Structure (OCS) modelled through an ontology in order to improve European LEAs Interoperability (ELIO). Results suggest that ELIO is able to provide the required interoperability features, overcoming the issues that arise in this scenario.

Keywords: Law Enforcement Agencies cooperation, transnational organized crime, knowledge acquisition, ontologies, interoperability.

1 Introduction

Nowadays, global criminals are sophisticated managers of technology [1], consequently, this high level of knowledge shown by these networks requires more efforts to be put in place by governments, Law Enforcement Agencies (LEAs) and citizens. Central networked intelligence and coordinated knowledge are fundamental assets shared within organized crime organizations. Moreover, online child pornography [2], prostitution [3] and all sorts of extortion and aggressive behaviour have been fuelled by the explosion of the Web 2.0. The Internet is not only the tool, but the condition and natural environment of organized crime. In this scenario, the work introduced in [4] suggests that utilizing information

from multiple jurisdictions provides higher quality information about criminal networks. Furthermore, Europol[1] latest analysis [5] states that there are an estimated 3,600 organized crime groups currently active in the EU. These organizations show a tendency to be more international in nature and activity which creates an even greater need for international cooperation in fighting crime. As a result, LEAs can greatly benefit from sharing information, however, an interoperability issue arises due to EU countries having different legal frameworks as well as cultural and language differences.

The CAPER[2] project addresses the prevention of organized crime through sharing, exploitation and analysis of open and private information sources. Its main targets are: information acquisition, processing, exploitation and standardisation; integration with large scale systems, secure knowledge sharing and collaboration; and legal issues. Specifically, knowledge share and collaboration lie in an interoperability issue as we stated before.

This work is twofold. Firstly, we propose a Organized Crime Structure (OCS) based on Europol Annual Reviews and the International LEAs cooperation literature. This structure is devised to provide a common supranational structure in order to perform interoperability for European LEAs. Secondly, we also introduce an ontology, named as European LEAs Interoperability Ontology (ELIO), which models the OCS, the relationships among its concepts, the attributes and all the knowledge directly gathered from LEAs. The main idea is to ease the sharing of information related to organized crime among LEAs.

This paper is organized as follows: Section 2 briefs the problems on the definition of a conceptual structure of organized crime in Europe; Section 3 addresses International LEAs cooperation literature, annual reviews published by Europol and our proposal of organized crime structure focus on bringing interoperability among European LEAs; Section 4 sums up the related work with ontologies, legal ontologies and interoperability; Section 5 introduces ELIO and its iterative knowledge acquisition process, structure and evaluation; and finally, Section 6 points out some conclusions.

2   Problems on the Definition of a Conceptual Structure of Organized Crime in Europe

The attempt to define a conceptual structure of the field of cross-border organized crime presents mainly two problems that have to do with the very nature of organized crime. First, the lack of a consolidated definition of what organized crime is and, second, the dynamic, ever-changing nature of the phenomenon itself. When trying to define a conceptual structure of organized crime for the concrete purpose of facilitating LEAs interoperability, it is unavoidable to face a

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[1] EUROPOL is the European Union's LEA. Home page:
http://www.europol.europa.eu/

[2] "*Collaborative   information   Acquisition   Processing   Exploitation   and   Reporting   (CAPER)   for   the   prevention   of   organized   crime*". Home   page:
http://www.fp7-caper.eu

third problem: the diverse conceptualization of the different crimes both from a semantic perspective and in the different legal system of the European countries.

The first problem, i.e., the lack of a non-contested clear concept of organized crime has been extensively discussed and some consensus has been reached over the years [6,7]. The first one focuses on the idea of "crime" and tries to build the concept around different categories of criminal manifestations, emphasizing the element of criminal activity [6]. This notion of organized crime takes the different crimes identified in each legal system as a starting point and analyses the existence of certain elements such as continuity, sophistication or seriousness to apply the label "organized" to a certain event. Hagan [7] suggests that this last type of occurrences be identified as "organized crime", as opposed to the cases in which there actually is an organization, which he names "Organized Crime".

The second issue arisen in the process of defining a conceptual structure of the field of organized crime is the changing nature of both the activities and the associative forms of this kind of criminals. Nowadays, every LEA, either national or international, points at cybercrime as one of the main threats our societies are exposed to [8,5,9], even though up to ten years ago this form of criminality was not even on the map of these very same agencies. Clearly, any possible conceptual structure of organized crime constructed around typologies of felonies would differ according to the moment in which it is designed. The geographical scope of the structure, moreover, would also have a relevant impact on the design itself. Although organized crime is intrinsically linked to the international dimension as it mostly occurs in cross-border circumstances, the relevance or the impact of a certain type of activity is not the same in different areas of the world, or in different countries in the same area.

Apart from these two general problems, the design of a conceptual structure in the field of organized crime for the purpose of improving the interoperability between LEAs in a transnational environment presents the additional issue of the different legal and semantic constructs that each criminal type bears in each country. This dimension implies the emergence of a semantic problem when interoperability is sought between LEAs from countries with different languages [10]. A fitting example, again in a situation of cooperation between Spanish and a British LEA, is that of money laundering. In Spain this crime is referred to as "blanqueo de capitales", which translates literally as "whitening of assets". The difference between the use of laundering or whitening is not relevant for the content of the illicit activity but how about the money-assets binomial? Does the fact that the crime in UK only refers to "money" mean that other financial products cannot be investigated? These are the problems that a simple translation cannot solve when defining a structure of organized crime.

3 Methodology for the Definition of a Conceptual Structure of Organized Crime in Europe

Once we have explained the three main problems encountered in the task of mapping organized crime in Europe for interoperability between LEAs purposes, we

will present both the methodology used in an attempt to overcome these issues and the results obtained from the process. Taking into account the impossibility to identify an unambiguous concept of what organized crime is, the preferred option was to reflect upon the adequacy of the different perspectives for the concrete purpose pursued in this research, i.e., improving the interoperability capabilities of LEAs. In this regard the definition of organized crime as a series of crimes that are committed in a certain manner "is a practical way of understanding and tackling it."[3] It is true that an idea of organized crime that focuses on the criminal activities and especially on a classification of its manifestations lacks completeness, as it leaves out one of the distinctive element of this phenomenon: the organizations. Nevertheless, this methodological choice can be explained because of the horizontal cross-border nature of the characteristics that the academic literature attributes to the "organized" element of the concept. For instance, if we take the works of Hagan, Finckenauer [11] or Albanese [12], we can see, as Hagan himself summarized [7], that there are four distinctive traits of criminal organizations: the continuing organized hierarchy, the profit from illegal activities, the use of violence or threats, and the fact that they represent corruption and immunity. As mentioned before, these identifying elements are horizontal and do not depend on the specific legal system of a specific country. Although it is true that the regulation of "organized crime" varies within European Union countries, these traits are abstractions of the basic idea of criminal organization that any European LEA uses. The conclusion, therefore, is that a structure of the field of organized crime in the European Union for the purposes of improving interoperability would not benefit from an "organized"-based perspective. On the contrary, a concept that focuses on the criminal activity can have an impact on the fight against transnational forms of criminality and help improve the cooperation experiences of police officers, since this is how LEAs organize their work, their internal structures and their databases.

After it was established that the "crime"-based concept would be used to build the structure for the interoperability ontology, a second problem needed to be addressed, i.e., the changing nature of organized crime. This issue has been haunting every work on organized crime because, by its own nature, crime-whether organized or not, international or localis not a stable concept. It is not possible to define, therefore, an immutable structure to represent either the crime typologies or even the defining traits of the organizations. The only possible solution, consequently, is to design an open structure that enables the updating and adjustment of the contents, thus keeping the framework developed.

The main issue regarding the improvement of interoperability possibilities between LEAs is related to the third problem mentioned above, the different semantic and legal configuration of each crime in the different Member States of the

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[3] This assertion can be found in the website of the newly founded "National Crime Agency", established by the UK Government and that replaced the famous Serious Organized Crime Agency (SOCA). `http://www.nationalcrimeagency.gov.uk/` crime-threats Last accessed: 18/11/2013.

European Union. The first element, semantic differences, concerns not only the name of the crimes but also its internal configuration in the "working language" of each LEA. It is very unlikely; therefore, that one could be able to address it in an abstract way. The solution is then to extract that knowledge from the LEAs themselves in order to be able to include in the process the specific terms they use when referring to certain crimes. This part of the work performed in this research will be explained in Section 5.1 of this paper, under the title of knowledge acquisition. Even if these semantic issues –if not properly solved– can have a negative impact on the interoperability between LEAs in their fight against international organized crime, the different conceptualization of crimes has a bigger potential to pose serious problems to the collaboration between police authorities from different countries, problems that most certainly arise when criminals have to be brought in front of a judicial authority and the procedure followed by the LEA will be judged under national law requirements. In a situation of not-harmonized criminal law systems, such as that of EU countries, the structure used in a platform that is built with the purpose of improving the acquirement and sharing information process between European LEAs cannot be based on a particular national structure and has to take into account all the specificities of the different national structures. If the aim is to design a conceptual structure of the field of organized crime in the European framework, these national structures need to be embedded in a supranational structure. This is why in this case, and considering that the subjects of our investigation are the LEAs, the solution is to refer to EUROPOL and its definition of organized crime [4].
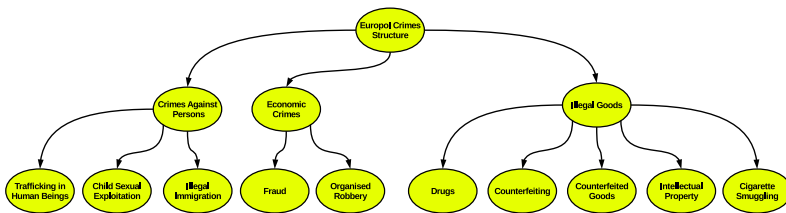

Fig. 1. Europol Organized Crime Structure (OCS)

There were several possible options to extract this structure from the work of EUROPOL. The first one was to look at the internal sections/divisions of the Database of the European agency. In order to better organize its task-forces and the intelligence gathered and obtained from national LEAs, EUROPOL organizes its database in theme-guided sub-units that were traditionally known as EUROPOL Analytical Workfiles (AWF) and have recently been renamed as Focal Points. The main problem with this approach is the fact that the decision about which broad categories become Focal Points is made at a European

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[4] Terrorism is out of the scope of the CAPER project and therefore has been left out on the structure designed although is part of the EUROPOL activities and has been included in their reports since 2007.

level, that of EUROPOL itself, and therefore do not necessarily coincide with the national criminal law outlines. Focal Points may be very useful for structuring the intelligence gathered by national police agencies and communicated to EUROPOL; nevertheless another product seems better suited to define a general framework of the phenomenon of organized crime: the EUROPOL Reviews. These reviews can be defined as "a compilation of national annual reports on the domestic crime situation". The EUROPOL Reviews should not be mistaken for the so-called SOCTA/OCTA Reviews, the Serious and Organized Crime Threat Assessment, also published by EUROPOL on a yearly basis. The latter had also been considered as a source in the designing work but were deemed not suitable as they present the most dangerous threats Europe faces for the near future according to EUROPOL's analysis, thus leaving aside organized crime activities that continue to take place on the territory of the European Union but do not qualify as significant enough in a specific year. The EUROPOL Reviews were thought to be the most relevant documents to be studied as the main source when defining the structure. These reviews have been published for the last decade, since 2004, and have varied in their name and structure. Until 2008, they were issued as "Annual Reports" and not EUROPOL Reviews.

General trends and the crime typologies were taken into account to build the taxonomy needed to implement the interoperability ontology. As for the temporal scope of the analysis, and bearing in mind that organized crime is, as explained before, a rapidly changing phenomenon, the last three reports were studied in order to identify the "individual criminal activities" to be included[5]. The previous reports where used as a complementary source in order to define the broader categories included in the structure. We can dissect the process through an example. The criminal activity of "Trafficking in Human Beings" is reported in the 2010, 2011, and 2012 reviews as one of the relevant manifestations of organized crime in the European Union context. Taking a closer look to these last three reports, it can be noted that this crime is always reported together with two other criminal types: "child sexual exploitation" and "facilitated illegal immigration". The reason for this association lies in the subject of these criminal activities since all three of them "abuse individual's human rights", as expressed in the words of EUROPOL itself in the analysed reports. Through the reasoning explained above, the three criminal activities, all of them present in these reports, have been included together under the category "Crimes against persons". Furthermore, a complementary justification for this choice of words in the definition of the wider level can be found in the annual reports from 2005 to 2008, in which the crimes mentioned above were encompassed under the heading "Crimes against persons".

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[5] This refers to the reports of the years 2010, 2011 and 2012 as at the time of writing this paper the 2013 report was not yet available.

4   Ontologies, Legal Knowledge and Interoperability

Interoperability is the ability of two or more systems or components to exchange information and to use the information that has been exchanged. The Semantic Web and ontologies provide the abstraction layer needed to carry out a "negotiation" or "dialog" between the participant systems to put in common concepts, vocabulary, terms, etc. Therefore, all the participants will know the meaning (not necessarily the content) of the exchanged information. For instance, an ontology-based framework devised to exchange meaningful representation of product data for collaborative environments is introduced in [13]; information exchange for different network management devices through ontologies is discussed in [14]; [15] proposes an approach devised to handle Electronic Health Records; and [16] brings together Clinical Research and Clinical Care fields through Semantic Web and ontologies.

On the other hand, legal professionals are used to consume an important part of their time searching, retrieving and managing legal information. Therefore, the organization and formalization of legal knowledge for computer processing produce many desirable features such as enhance of information search, retrieval and knowledge management. However, legal systems are complex, integrated search between the legislation of several European countries; e-government and e-administration; electronic institutions, privacy or digital rights management systems, are just some examples. Ontologies have been used successfully in these fields: in [17] the legal knowledge modelling and acquisition, the knowledge applications and the integrated applications are discussed; and [18] reviews and discusses different purpose legal ontologies.

Therefore, from the European LEAs interoperability point of view, ontologies provide these needed capabilities for exchanging meaningful information through the OCS introduced in Section 3. The main features that make ontologies suitable for LEAs interoperability are: i) ability to share common information; ii) enabling reuse of knowledge; iii) resilience to changes in the acquired knowledge; and iv) reasoning to determine interoperability.

5   European LEAs Interoperability Ontology

In this Section, the development of ELIO is discussed. The first step consists of gathering both domain and development requirements that define the ELIO build-up process. Table 1 consists of two different parts that collect these requirements. The top of the table sets the domain requirements: i) *competency questions* which set the domain, range and scope of the ontology; ii) *sources of knowledge*, which is a main point since the knowledge acquisition process is usually a bottleneck; iii) *conceptualization* of the ontology; and iv) *development approach*. On the other hand, the bottom of the table states the development stage requirements: i) *methodology* (based on METHONTOLOGY [19], On-To-Knowledge (OTK) [20], HCOME [21], UPON [22] and [23]); ii) *ontology editor*; iii) *reasoner*; and iv) *representation language* are the topics addressed in this part.

Table 1. ELIO Ontology requirements document. *Top*: Domain requirements. *Bottom*: Development requirements.

ELIO Domain Requirements	
Competency questions	Which techniques exist to commit these crimes? Which is the relation between techniques and crimes? Which are the EC* for these crimes in each country? Which are the related EC* from other countries? Which EC* belongs to a specific country? *EC stands for Essential Conditions
Sources of knowledge	Europol's Reviews International LEAs cooperation literature Expert elicitation
Purpose	Provide LEAs interoperability focusing on both EU legal frameworks and languages
Conceptualization	According to the issue of the conceptualization into [24], it is a specific ontology which represents knowledge related to a particular domain. **Domain Ontologies** provide vocabularies about concepts in a domain and their relationships, or about the theories governing the domain.
Development approach	The methodology approach begins with abstract concepts; how those concepts map to physical data is addressed later. Then, one begins with the data necessary for a specific analytic use-case, and models the concepts necessary for performing such analysis on the physical data. (**Middle-out Strategy**)
ELIO Development Requirements	
Methodology approach	The ontology development methodology is based on three main steps: 1) **preparatory stage**; 2) **development**; 3) **evaluation**
Ontology editor	**Protégé v4.3**
Reasoner	**Pellet** [25]
Representation Language	**OWL 2** [26]

There are three main points that define the process of creating an interoperability ontology in this scenario: knowledge acquisition, ontology structure and evaluation. Therefore, Section 5.1 sums up the knowledge acquisition process; Section 5.2 shows the structure that defines ELIO; and Section 5.3 addresses the evaluation literature and tests the level of interoperability.

5.1   Knowledge Acquisition

In the specific framework of each research project which deal with Law and Semantic Web issues, we use to apply a socio-legal approach [27]. It combines qualitative and quantitative methodologies depending on the sort of problems that have to be solved, the concrete objectives to be achieved, and the type of ontology that should be built up to modelling expert knowledge. The aim of this kind of approach is to provide the technology needed to solve specific end users needs.

The traditional means of knowledge acquisition is the traditional talking and question answering method which takes knowledge engineers as the intermediary of domain experts and computer systems. This method has drawbacks such as time and resources consume and prone to errors, but it is still one of the most basic knowledge acquisition methods. Fully automatic methods can not obtain totally correct and sufficient knowledge, even if acquiring knowledge, its reasonable and reliability have yet to be verified by experts. There are many works in literature addressing the knowledge acquisition issue. For instance, in [28], different families of techniques specifically devised to elicitation and analyse of knowledge acquired from experts are discussed. In our scenario, taking into account the socio-legal approach and the techniques reviewed in [28], we propose an iterative knowledge acquisition process based on five stages: elicitation, collection, analysis, modelling and validation.
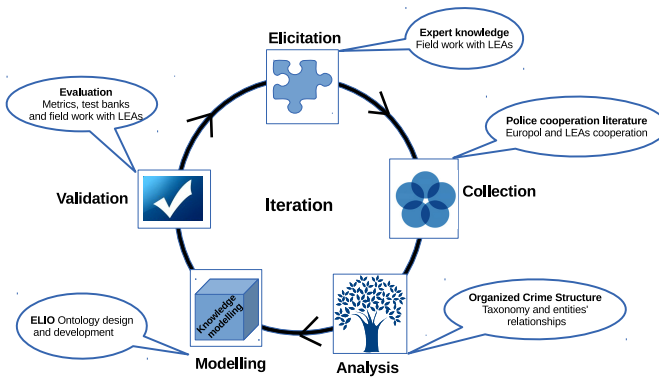

Fig. 2. Iterative knowledge acquisition process in this work lies in an iterative five process paradigm: elicitation, collection, analysis, modelling and validation.

Figure 2 depicts the five stages of the iterative knowledge acquisition process. The first one consists of expert knowledge acquisition devised to: i) validate the OCS definition; and ii) provide the essential conditions for each LEA. The second stage is based on the international LEAs cooperation literature reviewed in Section 3. The third stage carries out the analysis of the first two stages in order to define the concepts and their relationships for the ELIO definition. The fourth stage develops the model of the ontology. Finally, the last stage is focused

on the validation of the interoperability provided through different bank tests and LEAs experts.

5.2   Structure

Although researchers have written much about the potential benefits of using ontologies, the design process must take into account some constraints. The design and maintenance stages related to ontologies are high resource consumption processes [29,30]. Moreover, ontologies must incorporate five main features such as clarity, coherence, extendibility, minimal encoding bias and minimal ontology commitment [31]. As a result, useful ontologies must be small enough to have reasonable design and maintenance costs and big enough to provide substantial added value for using them. In this work, we introduce a light ontology, ELIO, in order to minimize the design and maintenance resource consumption.

Table 2. Taxonomy and object property definitions for ELIO

Taxonomy	Object Property	Range

∗ Crimes
  → CrimesAgainstPersons
  → EconomicalCrimes
  → IllegalGoods
	hasTechnique
	hasEssentialCondition
		Techniques
		EssentialConditions

∗ Techniques	–	–
∗ EssentialConditions	hasCrime hasCountry	Crimes Countries

∗ Countries
  → EuropeanCountry
  → NonEuropeanCountry
	–	–

The taxonomy and object properties present in ELIO are shown in Table 2. It has four main concepts represented as classes into the ontology structure: "Crimes", "Techniques", "Essential Conditions" and "Countries". Moreover, four object properties that connect elements among these classes are also defined: "hasTechnique", "hasEssentialCondition", "hasCrime" and "hasCountry". This knowledge representation enables LEAs interoperability through the OCS.

The designed architecture addresses two main issues: the development of ontologies and the maintenance process. ELIO design method falls on a two-layer paradigm depicted in Figure 3. From bottom to top, the first layer models the knowledge elicited from each source considered in Table 1 "Sources of knowledge". The upper layer joins knowledge from previous layer and suitable elements to obtain reasoning capabilities. In this architecture, changes are propagated from lower to upper layers and this structure eases the inclusion of new knowledge. Both benefits provide the flexibility feature to the ELIO Ontology.

The ontology developed in this work have different individuals that represent crimes, essential conditions, countries and techniques. Therefore, the main reason
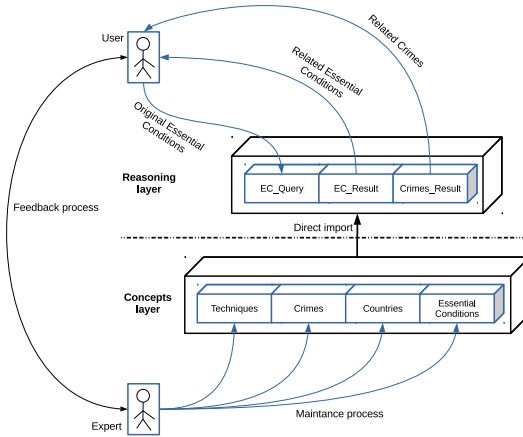
Fig. 3. ELIO architecture. Bottom layer models the knowledge acquired. The upper layer provides reasoning capabilities. In this architecture changes are propagated from lower to upper layers in order to ease the maintenance process.

for the described ontology-stack approach is to enable the detection of equivalent individuals through the modelled OCS. The interoperability is achieved in three different steps: i) modelling a special subhierarchy of essential conditions related to OCS crime instances besides the fundamental domain concepts; ii) putting these interoperability-defining subclasses in the Reasoning layer of the ontology-stack together with the logical rules; and iii) executing the reasoner against the ontology-stack. When this last step is taken, individuals in the Reasoning layer are classified into the interoperability-defining subhierarchy, according to their relation with the OCS.

5.3   Evaluation

In the literature, there are several methods specifically devised to perform an unbiased ontology evaluation. For instance, in [32] and [33] different metrics are introduced, and in [34] a comparison among different approaches is addressed. However, we leave this topic as a future work since to date we are only focused on LEAs validation. Therefore, in this Section two evaluation tests are shown as interoperability samples. The main target of ELIO is to detect the essential conditions with equivalent meaning in other countries, providing interoperability among European LEAs. The evaluation test provides the results after the execution of the reasoning algorithm over the ontology-stack introduced in the previous section to ensure that the whole essential conditions with equivalent meaning are detected.

This section shows two examples of test bank. The name of the essential conditions have been changes in order to ease the comprehension of the process, since these individuals are represented in the language of its corresponding

Table 3. Evaluation test #1

Query		
EC Individual	Object property	Crime Individual
ec-THB-CSE-G	hasCrime	childSexualExploitation
	hasCrime	traffickinginHumanBeings
	hasCountry	germany
Result		
ec-II-CSE-PR	hasCrime	illegalInmigration
	hasCrime	**childSexualExploitation**
	hasCountry	portugal
ec-THB-SP	hasCrime	**traffickinginHumanBeings**
	hasCountry	spain
ec-THB-F-FR	hasCrime	**traffickinginHumanBeings**
	hasCrime	fraud
	hasCountry	france
ec-THB-F-PR	hasCrime	**traffickinginHumanBeings**
	hasCrime	fraud
	hasCountry	portugal
ec-THB-II-PO	hasCrime	**traffickinginHumanBeings**
	hasCrime	illegalInmigration
	hasCountry	poland

country. As a result, the name pattern is "*ec-C_1-C_2-...-C_n-Country*", where C_n states that this essential condition is related to a specific crime represented for its initials and "*Country*" shows the country related to this essential condition. Table 3 shows an example when the query for an essential conditions is related to "*child sexual exploitation (CSE)*" and "*trafficking in human beings (THB)*". The results after the reasoning process are shown at the bottom of the table. All of these resultant essential conditions have at least one of the concepts present

Table 4. Evaluation test #2

Query		
EC Individual	Object property	Crime Individual
ec-CS-D-SP	hasCrime	cigarretteSmuggling
	hasCrime	drugs
	hasCountry	spain
Result		
ec-CS-D-FR	hasCrime	**cigarretteSmuggling**
	hasCrime	**drugs**
	hasCountry	france
ec-F-CS-G	hasCrime	fraud
	hasCrime	**cigarretteSmuggling**
	hasCountry	germany
ec-OR-D-SP	hasCrime	organizedRobbery
	hasCrime	**drugs**
	hasCountry	spain

in the query. Then, from a query performed for the essential conditions related to THB and CSE in Germany, ELIO answer is composed of essential conditions related to the same crimes in Portugal, Spain, France and Poland.

In addition, Table 4 shows another example of interoperability, which the query is related to "*cigarette smuggling (CS)*" and "*drugs (D)*". Consequently, the results given by ELIO have equivalent concepts in their definition, allowing this way the interoperability among European LEAs in a similar way than the previous example.

6   Conclusions

In this work we address the issue of European LEAs interoperability in the fight against transnational organized crime. In order to do so a two steps process was put into practice. This process consists first, of the design of an Organized Crime Structure (OCS) and second of the creation of a model of the OCS into a machine-readable format: and ontology. The first part entails the extraction of the contents of Europol annual reviews on serious crime in order to define a relevant structure of the field of organized crime that improves interoperability, overcoming differences among legal systems, languages and police cultures. The second step consists of an interactive knowledge acquisition process, the design of the ontology and finally the evaluation process.

Regarding the first part of this work several methodological choices lead to the selection of Europol yearly reviews as the more suitable source for the identification of both the general abstract criminal categories and the individual criminal activities to include in the OCS in order to truthfully represent the map of the situation of organized crime in the territory of the European Union. This choice allows us to overcome the problems related to the lack of a common concept organized crime in different EU countries, the mutable nature of organized crime and the different semantic and legal configuration of each crime in each legal system

As for the second part of this work we can highlight on the first place that the knowledge acquisition process performed allowed for the extraction of the information needed to identify the essential conditions in each country. Finally we argue that the ontology based on the OCS is able to improve interoperability capabilities among EU LEAs. The evaluation process is able to determine the existence of different examples in which the equivalent essential conditions of the legal system of each country are stated within the Reasoning layer.

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