# A DCAP for the Social and Solidarity Economy

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## Abstract

This article presents a work-in-progress version of a Dublin Core Application Profile (DCAP) developed to serve the Social and Solidarity Economy (SSE). Studies revealed that this community is interested in implementing both internal interoperability between their Web platforms to build a global SSE e-marketplace, and external interoperability among their Web platforms and external ones. The Dublin Core Application Profile for Social and Solidarity Economy (DCAP-SSE) serves this purpose. SSE organisations are submerged in the market economy but they have specificities not taken into account in this economy. The DCAP-SSE integrates terms from well-known metadata schemas, Resource Description Framework (RDF) vocabularies or ontologies, in order to enhance interoperability and take advantage of the benefits of the Linked Open Data ecosystem. It also integrates terms from the new essglobal RDF vocabulary which was created with the goal to respond to the SSE-specific needs. The DCAP-SSE also integrates five new Vocabulary Encoding Schemes to be used with DCAP-SSE properties. The DCAP development was based on a method for the development of application profiles (Me4MAP). We believe that this article has an educational value since it presents the idea that it is important to base DCAP developments on a method. This article shows the main results of applying such a method.

**Keywords:** Application Profile; interoperability; Metadata schemas, Vocabulary Encoding schemes, Social and Solidarity Economy.

## 1. Introduction

This article presents a work-in-progress Dublin Core Application Profile developed to serve the Social and Solidarity Economy (SSE) sector –DCAP-SSE V1.1– referred to hereafter as DCAP-SSE. Cooperatives, associations and mutualities, among others, are types of organizations that belong to this sector. The SSE is different from the economy of State and Market (Lechat, 2007) since it is created by an organised civil society. SSE organisations are interested in developing activities for the common good, with the goals of SSE organisations being neither centered in profit nor in individualistic needs. Therefore, SSE presents itself as a material and human alternative to capitalist economy (Cattani, Laville, Gaiger, & Hespanha, 2009). SSE, according to the spatio and temporal contexts, can take on other names such as the "third sector" used for example in the USA and Europe, or "non-governmental organisations" (NGO) widely used in the field of aid for development in peripheral countries.

SSE organisations work with scarce resources, therefore networking and partnerships appear as a highly relevant way of working, allowing SSE organisations to gain visibility and attract funding, or even to be able to work at scale.

These organisations have machine-to-machine communication needs that are internal or external to them, for example, to other kinds of organisations such as governmental agencies. In order to support these machine-to-machine communication needs, there is the need to provide interoperable solutions among the software platforms that support their activities. There are several approaches to interoperability. In the context of information technologies, interoperability

can be defined as the possibility of multiple systems, with different kinds of software or hardware, and different data structures and interfaces, to exchange data without previous communication, with the minimum loss of contents and functionality (NISO, 2004, p.1). The Dublin Core Metadata Initiative (DCMI) defines interoperability in its glossary as: "The ability of different types of computers, networks, operating systems, and applications to work together effectively, without prior communication, in order to exchange information in a useful and meaningful manner. There are three aspects of interoperability: semantic, structural and syntactical" (DCMI, 2011). For more information about interoperability see, for example, Institute of Electrical and Electronics Engineers (2010); Interoperable Delivery of European eGovernment Services to public Administrations Businesses and Citizens (2004); Payette, Blanchi, Lagoze, & Overly (1999).

Semantic interoperability focuses on meaningful exchanges of information, i.e., information that has the same interpretation (or very closely) by both the sender and the receiving systems. Our work is carried out under this perspective and in the context of the Semantic Web.

The Semantic Web has technologies that ``enable people to create data stores on the Web, build vocabularies, and write rules for handling data. Linked data is empowered by technologies`` that started to emerge in 1999. It is about common formats for integration and combination of data from different sources (W3C, 2012). This data is mostly what is being called metadata, in the way that it is "data about data" (DCMI, 2011) and follows well-defined rules of metadata schemas. A metadata schema is a set of ``metadata elements designed for a specific purpose, such as describing a particular type of information resource`` (NISO, 2004, pp. 4).

In order to provide "a foundation for the development of application-independent syntax specifications and constraint languages", DCMI developed the Dublin Core Abstract Model (DCAM) (Powell, Nilsson, Naeve, Baker, & Johnston, 2007) that presents the components and constructs used in DCMI metadata. One of these constructs is the Dublin Core Application Profile (DCAP) - "a generic construct for designing metadata records" (Baker & Coyle, 2009), a DCAP describes "the structure and contents of data" (Baker & Coyle, 2013). The definition of rules to build a DCAP is set in the Singapore Framework for Dublin Core Application Profiles, a DCMI Recommendation (c.f. Nilsson, Baker, & Johnston (2008)). This DCMI work has been developed under the umbrella of international standards. The use of these international standards is critical when it comes to semantic interoperability, but it is not sufficient, since a community needs to follow some rules to achieve high levels of interoperability. These rules are defined in the interoperability layers model (c.f. Nilsson, Baker, & Johnston (2009)), which allows a community to assess the "interoperability reach" of a particular implementation. The interoperability layers model defines 4 levels of interoperability that have to do with the use of: (i) metadata schemas and DCMI vocabularies, in levels 1 and 2; and (ii) DCMI standards: DCAM and DCAP, in levels 3 and 4. Level 4 is the highest level of interoperability which is achieved when a community uses the DCAP construct as a reference and binding to describe its resources. Thus, a DCAP became a very important instrument to implement interoperability.

A recent study by Curado Malta, Baptista, & Parente (2014) reveals that the SSE community is facing a global challenge. This community wants to implement interoperability between their Web platforms –to build a global SSE e-marketplace– and also among their Web platforms and external ones. After a study of the environment, its requirements, and its internal and external constraints, we came to the conclusion that there was no DCAP that could serve the SSE community. SSE organisations are submerged in the market economy but they have specificities that were not taken into account in the market economy but which are very important for SSE.

At the end of 2010 the Intercontinental Network for the promotion of Social and Solidarity Economy (RIPESS)[1] created a task force called ESSGlobal for the development of interoperability among its members' platforms, and decided to develop a DCAP.

[1] RIPESS. http://www.ripess.org (accessed on January 20, 2015).

The DCAP-SSE integrates not only terms from well-known metadata schemas, Resource Description Framework (RDF) vocabularies or ontologies (namely dcterms, foaf, vcard, schema.org and good relations), in order to enhance interoperability and take advantage of the benefits of Linked Open Data ecosystem (LOD), but also terms from the essglobal RDF vocabulary. This new vocabulary was created to respond exactly to the SSE specific needs—e.g., a pre-requisite of the SSE is the open cost which is a breakdown of all inputs, such as taxes and raw materials, and labour costs that make up the product or service's final cost. The DCAP-SSE also integrates five new Vocabulary Encoding Schemes created by the DCAP-SSE development-group to be used with DCAP-SSE properties.

This article proceeds as follows: Section 2 presents the methodology used to develop the DCAP-SSE; section 3 presents the DCAP-SSE: the functional requirements, the domain model and the Description Set Profile, and some other technical information we consider relevant. The last section presents conclusions and future work.

## 2. Methodology

A DCAP development can be a complex task since it happens in a completely open environment. In addition to that, this kind of development is often framed in multi-cultural-organizational-language environments. This work is no exception. In fact, the ESSGLobal development-team integrates persons with different profiles: 7 SSE experts, 3 data modelers and 1 Semantic Web expert: the SSE experts belong to different organisations of the RIPESS network with top organisations of SSE in Brazil, Canada, France, Italy, Luxemburg, Spain and USA. Two data modelers were members of EITA[2], a Brazilian SSE cooperative; the researcher leading the development-team was from the Algoritmi Research Center in Portugal,[3] a data modeler and the Semantic Web expert.

The SSE organisations participating in the DCAP-SSE development differ in organization-type, location, culture and in the language they speak. To find a common ground of understanding in such an environment becomes a huge challenge. We think that the existence of methods for the development of a DCAP may help to address this challenge. The DCAP-SSE development work was framed in a PhD research project (Curado Malta & Baptista, 2013a, 2013b; Curado Malta, 2014) that resulted in the definition of a method for the development of metadata application profiles (Me4MAP). This project was based on a design science research methodology, with the framework defined by Hevner & Chatterjee (2010). The DCAP-SSE development work was the experimental situation defined by Hevner & Chatterjee (2010) to test the artifact in development (Me4MAP). The development of DCAP-SSE was informed by the development of Me4MAP and vice versa. The focus of this article is the DCAP-SSE. A fuller explanation of Me4MAP is in preparation.

According to Me4MAP, a DCAP development should follow the Singapore Stages. The name of the stages are based in the seminal document *The Singapore framework for Dublin Core Application Profiles* (c.f. Nilsson et al. (2008)). This framework defines three mandatory Singapore Components: Functional Requirements; Domain Model and Description Set Profile, and two optional components: Usage Guidelines and Syntax Guidelines. This framework does not define a sequence of activities, but in fact the Singapore Components have a logic order of development and every Component builds upon the previous one. A method organizes the activities in a sequence and Me4MAP does the same. Unlike other methods, each activity results in a deliverable which are the Singapore Components already referred.

The DCAP-SSE development was carried out as follows:

- In the first Stage we developed the Functional Requirements. This activity included the sub-activities of: (i) definition of the *vision* of the project; (ii) definition of the

[2] EITA. http://www.eita.org.br (accessed July 2, 2015).
[3] Algoritmi Research Center. http://algoritmi.uminho.pt (accessed July 2, 2015).

*application domain*; (iii) elicitation of the *high-level requirements*; (iv) development of the *use-case model*, and (v) the elicitation of the *functional requirements*.

- In the second Stage we developed the *domain model*. This activity included the sub-activities (i) definition of the *environmental scan*, and (ii) definition of the *domain model*;
- In the third Stage, we developed the Description Set. This activity included the sub-activities of:
  i. development of Pre-Description Set profile including sub-activities of defining the:
     a) Detailed Domain Model;
     b) Vocabulary Alignment; and
     c) Constraints Matrix;
  ii. encoding of the Description Set Profile.

The next section shows the DCAP-SSE Singapore Components and some of the deliverables that led to the definition of these Components.

## 3. Dublin Core Application Profile for the Social and Solidarity Economy

The DCAP-SSE development project's wiki page[4] includes DCAP-SSE's technical information.

As in any other projects, it is very important to set boundaries in order to effectively identify the issues the project aims to address. To accomplish this task, the DCAP-SSE team defined a Vision Statement as follows:

"ESSglobal is an initiative of some RIPESS members with the following objectives:

- Increase the international visibility of the activities and products of solidarity economy;
- Pool the methods and tools of mapping projects that already exist and that are being developed;
- Develop transversal projects of human and economic cooperation among the participants of the working group;
- Cooperate with other initiatives (existing or being created) that specialize in information systems, in the geo-referencing of SSE actors, and in networking.

The DCAP-SSE covers the following dimensions:

- Commerce;
- Public visibility;
- Research and statistics;
- Network building;
- Public policies;
- Education.

The dimensions of "Education" and "Public policies" are not present in this first version of the DCAP-SSE."

### 3.1. Functional Requirements

As already mentioned in the methodology section, the Me4MAP suggests that the Functional Requirements should be developed based on all activities of the first Stage, especially on the identified uses cases.

The Functional requirements defined for DCAP-SSE are to:

[4] Project Wiki. http://purl.org/essglobal/wiki/ (accessed on April 4, 2015).

- enable the creation and sharing of consistent metadata;
- support the search by any or all items: "SSEInitiative", "Network", "Product", "Sale Options" and "Product-Input": these functional requirements meet the needs of Use Cases 1, 2 and 3 which are described in the Project Wiki;[5]
- support the search for any property of each element mentioned in the previous paragraph and also "Cost Composition" of any Product-Input: these functional requirements meet the needs of the previously referenced Use Cases 1, 2 and 3 on the Project Wiki.

### 3.2. Domain Model

Figure 1 presents DCAP-SSE domain model as an Object Role Model (ORM) diagram.

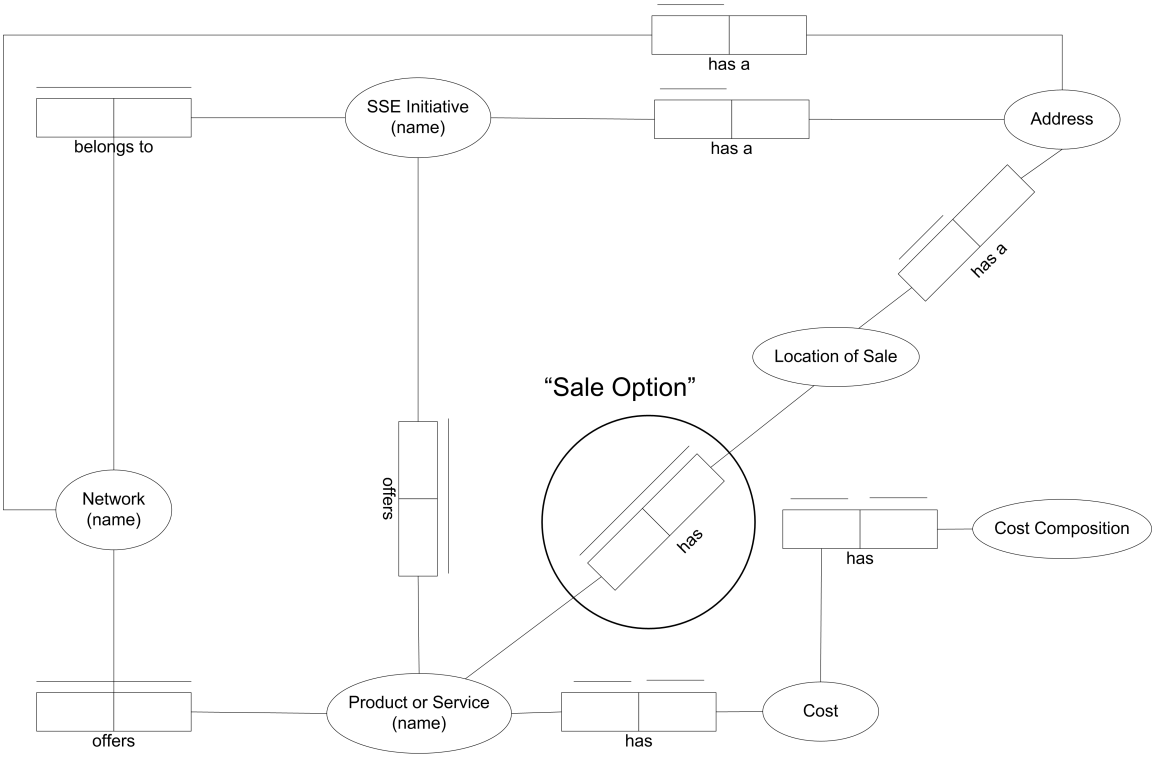


FIG 1. DCAP-SSE Domain Model

This domain model represents eight entities: SSE Initiative, Network, Product or Service, Cost, Cost Composition, Location of Sale, Sale Option and Address; and the relations between them. The next section provides more details about the classes and relations.

### 3.3. Description Set Profile

The Description Set Profile (DSP) of DCAP-SSE can be accessed online.[6] The DCAP-SSE integrates terms from well-known metadata schemas, Resource Description Framework (RDF) vocabularies or ontologies in order to enhance interoperability and take advantage of the benefits of Linked Open Data (LOD) ecosystem - see Table 1.

Figure 2 in appendices to this article, presents the Unified Modeling Language (UML) diagram showing the data model of the relations between the DCAP-SSE terms. This model shows the information we want to gather, the definition of: (i) the organisations and its networks; (ii) the products or services sold by the organisations or by the networks; (iii) the several components of the open cost of the products or services; and (iv) the location of sale of the products or services.

[5] Wiki: Use Cases. http://www.maltas.org/wiki-essglobal/doku.php?id=use.
[6] DSP. http://purl.org/essglobal/dsp-xml (accessed on 04 April, 2015).

TABLE 1: Metadata schemas used in the DCAP-SSE

| Title | Namespace URI | Prefix |
|---|---|---|
| DC TERMS | http://purl.org/dc/terms/ | dcterms |
| The friend of a friend | http://xmlns.com/foaf/0.1/ | foaf |
| Good Relations | http://purl.org/goodrelations/v1# | gr |
| VCARD | http://www.w3.org/2006/vcard/ns/ | v |
| Schema.org | http://schema.org | schema |
| Social and Solidarity Economy | http://purl.org/essglobal/vocab/ | essglobal |

DCAP-SSE has the following classes:

- `SSEInitiative`: an organization, practice, network, or other initiative that is recognized as belonging within the SSE;
- `Network`: a network of individuals and/or organisations that participate in the SSE;
- `ProductOrService`. the good offered by an `SSEInitiative` or `Network`. It may be material good or provision of service;
- `LocationOfSale`: a place where the goods or services of an SSE initiative are provided. It can be self-owned shops, but also SSE partner places where products or services are available among those from other initiatives;
- `Address`: the physical address of a `LocationOfSale`, of a `SSEInitiative` or of a `Network`;
- `SaleOption`: a product or service sold at a given price, under specific properties, in a given `LocationOfSale`. The delivery costs are included in this class;
- `Cost`: the final cost for a particular product or service produced by an `SSEInitiative` or `network`, including all costs components. The price will be this cost added to delivery costs and sales margin;
- `CostComposition`: a breakdown of all inputs (such as taxes and raw materials) and labour costs that make up the product or service's final cost;
- `Input`: a product, service, or activity that goes into making the final product or service;
- `Labour`: work done for specific tasks related to the provision of goods or services offered by the `SSEInitiative`. Generally it can be human, animal or machine labour, but ESSglobal considers human labour only;
- `OtherCosts`: other costs which impact on the final cost of a product or service provided by an `SSEInitiative` other than `Input` or `Labour`, like taxes, depreciation of machinery, funds, etc.

Details about the: i) properties related to each class, and the properties that relate classes; ii) cardinality of each property; and iii) constrains of each property can be found in the Constraints Matrix deliverable in the Project Wiki.[7] This matrix is based on the table presented in the Guidelines for DCAP by Baker & Coyle (2009) with some adjustments and improvements. An excerpt of this matrix is presented in Figure. 3, in appendices to this article.

### 3.4. ESSGlobal RDF Vocabulary and Vocabulary Encoding Schemes created

The ESSGlobal development-team did not find terms in the metadata community that could describe some of the SSE community specificities. SSE organisations, despite being submerged in the market economy, need to describe their resources taking into account dimensions such as: (i) the description of specific characteristics of the SSE organisations; (ii) the description of relations and networks that exist among SSE organisations; (iii) the description of the product or service's open cost, i.e. the breakdown of all inputs (such as taxes and raw materials) and labour

[7] Constraints Matrix. http://purl.org/essglobal/wiki/ (accessed on April 4, 2015).

costs that make up the product's or the service's final cost. In SSE, these costs are included and differentiated (as open cost) in the final price of the products or services.

The essglobal RDF vocabulary was created in order to fill these gaps. This vocabulary is available online[8], it was registered in the Linked Open Vocabularies (LOV) platform.[9].

The essglobal RDF vocabulary has:

- 11 classes: 4 of these classes are sub-classes of well-known RDF vocabularies classes;
- 29 properties: 9 are object properties and the remaining 20, datatype properties.

Five vocabulary encoding schemes (VES) were created to be used with some of the DCAP-SSE properties (links accessed on 04 April, 2015):

- Economic Activities/Sectors[10]
- Macro-themes[11]
- Qualifiers[12]
- Type of Labour[13]
- Legal form[14]

## 4. Conclusions and future work

The DCAP-SSE explicated here was developed based on a method for the development of DCAP (Me4MAP). A fuller explanation of Me4MAP is in preparation to be published in the future. We believe that this article has an educational value since it presents the idea that it is important to base DCAP developments on a method and shows the main results of applying such a method.

We think that the primarily use of SSE metadata will be to aid the discovery of SSE goods or services and networks, and for calculating statistical data (e.g. types of organisations, gender distributions of workers, etc). We predict that, in the first years of deployment, this data will be mostly about describing organisations (numbers employed, objectives, mission, address, membership in networks) and in a near future, it will also be about the goods or services offered. An example of application of the available SSE metadata could be the development of Apps for smartphones that can present users with the location and characteristics of nearby SSE organisations.

As future work, we will follow three tracks: a Research track, a Marketing & Technical support track and a Development Track:

- Research Track: the DCAP-SSE version presented in this article is a work-in-progress version since there are still steps to accomplish: i) a laboratory validation with samples from different SSE Web platforms; ii) a revision of DCAP-SSE after the laboratory validation; iii) inclusion of new dimensions, and new organisations in the development team, in order to enrich the DCAP-SSE expressivity.
- Marketing & Technical support Track: the DCAP-SSE development team is aware of the need to define and implement a dissemination plan for the SSE global community: there is the need to find ways to explain the potential of this new tool in a community that works with so few resources. On the other hand, SSE organisations that are willing to enter the LOD ecosystem will need technical support in order to understand how to use the DCAP-SSE. In order to achieve this we will need to develop manuals and use cases.

[8] RDF vocabulary: http://purl.org/essglobal/vocab/ (accessed on 04 April, 2015).
[9] LOV: http://lov.okfn.org/dataset/lov/vocabs/essglobal (accessed on 04 April, 2015).
[10] Economic Activities/Sectors: http://purl.org/essglobal/standard/activities
[11] Macro-themes: http://purl.org/essglobal/standard/themes.
[12] Qualifiers: http://purl.org/essglobal/standard/qualifiers.
[13] Type of Labour: http://purl.org/essglobal/standard/type-of-labour.
[14] Legal form: http://purl.org/essglobal/standard/legal-form.

- Development Track: there is the need to reflect on User Interface developments or ways to present the SSE metadata within an application framework for the SSE community.

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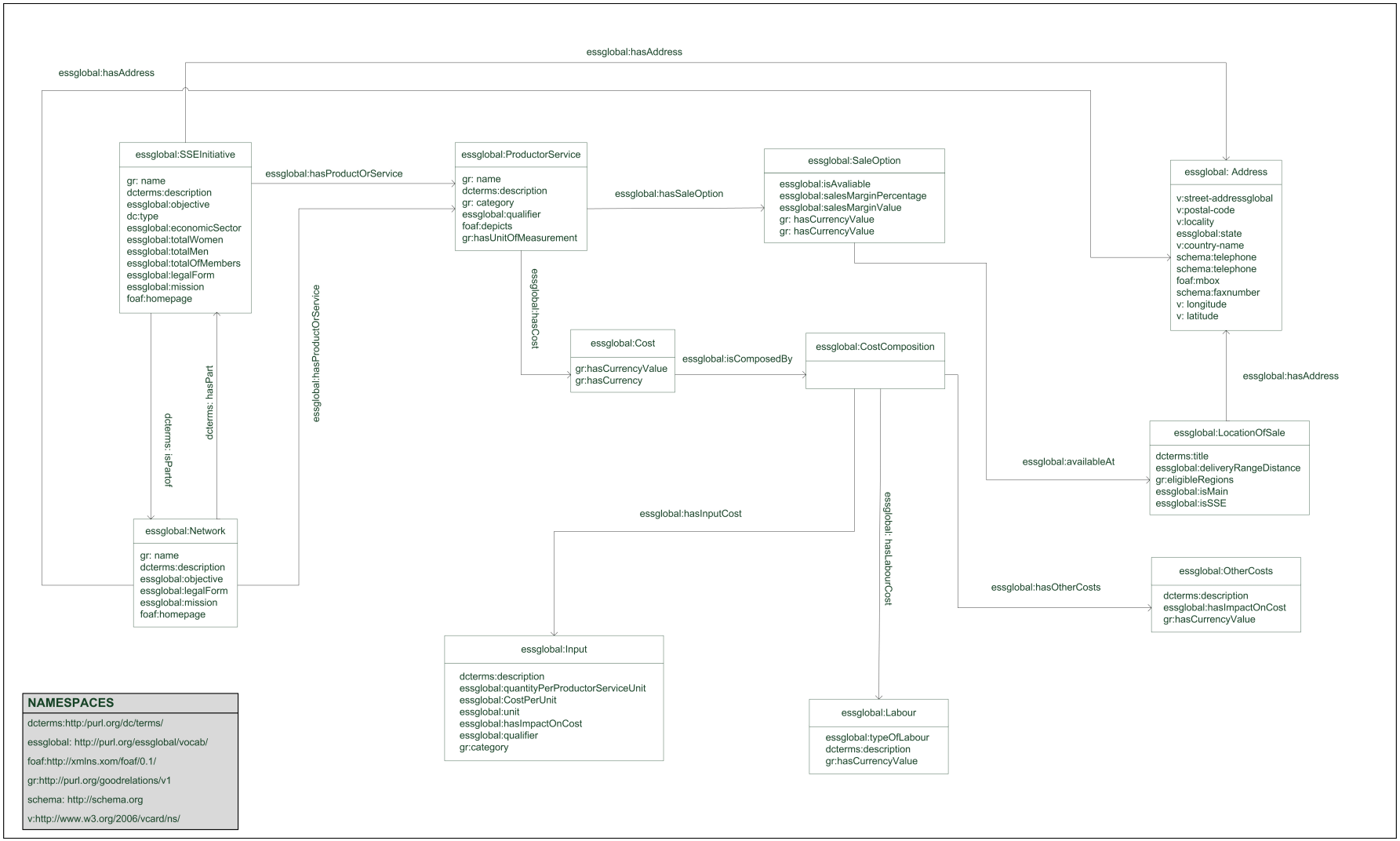


FIG 2. DCAP-SSE terms relations

| **Definition of Description Templates** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Description Template:** | **SSE initiative** | **Property:** | **essglobal:SSEInitiative** | | **Usage:** | **An organization, practice, network, or other initiative that is recognized as belonging within the social solidarity economy.** | | | | | |
| **Label** | **Property** | **Range** | **Value String** | **SES URI** | **Value URI** | **VES URI** | **Related description** | **Min** | **Max** | **Type** | **Usage** |
| Name | gr:name | literal | YES | no | n/a | n/a | n/a | 1 | 1 | n/a | The name of the SSE initiative in its original language |
| Description | dcterms:description | literal | YES | no | n/a | n/a | n/a | 0 | 1 | n/a | A description of the SSE initiative |
| Objective | essglobal:objective | literal | YES | no | n/a | n/a | n/a | 0 | 1 | n/a | Actionable and measurable steps the initiative is taking to carry out its mission. |
| Mission | essglobal:mission | literal | YES | no | n/a | n/a | n/a | 0 | 1 | n/a | The initiative's vision, values, and principles. |
| Type | dc:type | literal | YES | no | n/a | n/a | n/a | 0 | infinity | n/a | |
| Economic-Sector | essglobal:economicSector | non-literal | no | no | YES | http://purl.org/essglobal/standard/activities | n/a | 0 | infinity | n/a | The economic sector of the SSE Initiative. ESSGlobal has established a VES form this term. |
| Total of Women | essglobal:totalWomen | literal | YES | no | n/a | n/a | n/a | 0 | 1 | n/a | The number of women that work in the SSE Initiative. |
| Total of Men | essglobal:totalMen | literal | YES | no | n/a | n/a | n/a | 0 | 1 | n/a | The number of men that work in the SSE Initiative. |
| Total of Members | essglobal:totalOfMembers | literal | YES | no | n/a | n/a | n/a | 0 | 1 | n/a | The total number of members that work in the SSE Initiative. |
| Legal Form | essglobal:legalForm | non-literal | no | no | YES | http://purl.org/essglobal/standard/legal-form | n/a | 0 | 1 | n/a | |
| URL | foaf:homepage | literal | YES | no | n/a | n/a | n/a | 0 | 1 | n/a | The initiative's homepage |
| Has Product or Service | essglobal:hasProductOrService | non-literal | YES | no | no | no | YES | 0 | infinity | n/a | The good offered by the SSE initiative. |
| has address | essglobal:hasAddress | non-literal | YES | no | no | no | YES | 0 | 1 | n/a | The address of the SSE initiative |
| Is part of a Network | dcterms:isPartOf | non-literal | YES | no | no | no | YES | 0 | infinity | n/a | A network of individuals and/or organizations that the SSE Initiative belongs to. |
| | | | | | | | | | | | |
| **Description Template:** | **Network** | **Property:** | **essglobal:Network** | | **Usage:** | **A network of individuals and/or organizations that participate in the SSE.** | | | | | |
| **Label** | **Property** | **Range** | **Value String** | **SES URI** | **Value URI** | **VES URI** | **Related description** | **Min** | **Max** | **Type** | **Usage** |
| Name | gr:name | literal | YES | no | n/a | n/a | n/a | 1 | 1 | n/a | Name of the network |
| Description | dcterms:description | literal | YES | no | n/a | n/a | n/a | 0 | 1 | n/a | A description of the network |
| Objective | essglobal:objective | literal | YES | no | n/a | n/a | n/a | 0 | 1 | n/a | Actionable and measurable steps the initiative is taking to carry out its mission. |
| Legal Form | essglobal:legalForm | non-literal | no | no | YES | http://purl.org/essglobal/standard/legal-form | n/a | 0 | 1 | n/a | ESSGlobal has established a VES for this property. |
| Mission | essglobal:mission | literal | YES | no | n/a | n/a | n/a | 0 | 1 | n/a | The Network's vision, values, and principles. |

FIG 3. Extract of DCAP-SSE Constrains Matrix