INCLUDING QUALIFICATIONS IN THE LEARNING OPPORTUNITIES AND QUALIFICATIONS IN EUROPE PORTAL AND IN THE ESCO PORTAL

QUALIFICATIONS METADATA SCHEMA SPECIFICATIONS

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Document History

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<td>1.1.0</td>
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<td>Minor update</td>
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Abstract

The Qualification Metadata Schema (QMS) is an application profile used to describe qualifications and aimed at supporting linked data publishing of qualifications across Europe.

The QMS is intended to facilitate the exchange of qualification information between different stakeholders across Europe and the Learning Opportunities and Qualifications in Europe (LOQ) and ESCO portals. The schema enables the decentralized publishing of information on qualifications.

This document defines the schema and provides examples for its use.

Status of this document

This document describes the version 1.1.0 of the QMS, published the 21/08/17. It needs to be read in parallel with the “Overview of the technical requirements of the call” document which is part of the Invitation to apply for a grant.

This document can be used as reference material. Nevertheless, the document may be updated, or replaced by other documents in the future.

This document was published by the European Commission – DG EMPL as technical specifications of the QMS. If you have any comments regarding this document, please send them to the ESCO-Secretariat (EMPL-ESCO-SECRETARIAT@ec.europa.eu).
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1. INTRODUCTION

This section is non-normative.

The QMS is an application profile to describe qualifications. The QMS is intended to facilitate the exchange of qualification information between different stakeholders across Europe and the LOQ and ESCO portals. The schema enables the decentralized publishing of information on qualifications.

The QMS is an RDF\(^1\) vocabulary with an RDF schema. Additionally, there is an XML\(^2\) schema available to support the encoding of qualification information in XML. The QMS also defines controlled vocabularies as fixed value lists for some properties in the schema. Both the RDF vocabulary and the XSD that you can use to encode your data are available in the Invitation to apply for a grant EACEA 31/2016 folder.

The QMS is applicable in many contexts. It can be applied to encode, publish and exchange qualification metadata in many technologies, including:

- RDF accessible via SPARQL\(^3\) endpoints.
- RDF embedded in HTML\(^4\) pages.
- RDF serialized as RDF/XML\(^5\) or Turtle\(^6\).
- XML.

---

\(^1\) [https://www.w3.org/RDF/](https://www.w3.org/RDF/)
\(^2\) [https://www.w3.org/XML/](https://www.w3.org/XML/)
\(^3\) [https://www.w3.org/TR/rdf-sparql-protocol/](https://www.w3.org/TR/rdf-sparql-protocol/)
\(^4\) [https://www.w3.org/html/](https://www.w3.org/html/)
\(^5\) [https://www.w3.org/TR/rdf-syntax-grammar/](https://www.w3.org/TR/rdf-syntax-grammar/)
\(^6\) [https://www.w3.org/TR/turtle/](https://www.w3.org/TR/turtle/)
2. CONFORMANCE

All guidelines, diagrams, examples, and notes in this specification are non-normative. This is mentioned at the beginning of each section, otherwise, the section can be regarded as normative.

The reader of this specifications should interpret the key words MUST, MUST NOT, REQUIRED, SHOULD, SHOULD NOT, RECOMMENDED, MAY, and OPTIONAL as described in RFC2119\(^7\).

This document needs to be read in parallel with the following table:

**Indicative elements of a common format for the electronic publication of information on qualifications\(^8\)**

<table>
<thead>
<tr>
<th>DATA</th>
<th>Required / Optional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title of the qualification</td>
<td>Required</td>
</tr>
<tr>
<td>Field(^9)</td>
<td>Required</td>
</tr>
<tr>
<td>Country/Region (code)</td>
<td>Required</td>
</tr>
<tr>
<td>EQF Level</td>
<td>Required</td>
</tr>
<tr>
<td>Description of the qualification(^10)</td>
<td></td>
</tr>
<tr>
<td>Either Knowledge</td>
<td>Required</td>
</tr>
<tr>
<td>Skills</td>
<td>Required</td>
</tr>
<tr>
<td>Responsibility and autonomy</td>
<td>Required</td>
</tr>
<tr>
<td>Or Open text field describing what the learner is expected to know, understand and able to do</td>
<td>Required</td>
</tr>
<tr>
<td>Awarding body or competent authority(^11)</td>
<td>Required</td>
</tr>
<tr>
<td>Credit points/ notional workload needed to achieve the learning outcomes</td>
<td>Optional</td>
</tr>
<tr>
<td>Internal quality assurance processes</td>
<td>Optional</td>
</tr>
<tr>
<td>External quality assurance/regulatory body</td>
<td>Optional</td>
</tr>
<tr>
<td>Further information on the qualification</td>
<td>Optional</td>
</tr>
<tr>
<td>Source of information</td>
<td>Optional</td>
</tr>
</tbody>
</table>

---


\(^9\) ISCED FoET2013

\(^10\) This description shall consist of open text fields, with no prescribed use of standard terminology and no obligation for the Member States to translate the description into other EU languages.

\(^11\) The minimum required information on the awarding body or the competent authority should facilitate to find information about it, which would include its name, or if applicable the name of the group of awarding bodies or competent authorities, completed with a URL or contact information.
The QMS has been developed with respect to this table.

It models and defines the classes, properties and their ranges to capture all the information presented in the table, both optional and required information, as structured data. For classes that record optional information, the properties are also marked as required or optional in case you decide to use those classes to provide the optional data they represent.

For example, the entry requirements are an optional information to provide for the stakeholders. The QMS uses the class EntryRequirement to record this information. Therefore, if you decide to provide and exchange this information as structured data, you must use this class and its properties as listed in the specifications. For more information about this example, please consult the part of the document that related to the EntryRequirement class.

A data interchange, however it occurs, is compliant with the QMS if:

- it uses terms (i.e. the classes and properties) of the QMS in a way that is consistent with the semantics following the definition in this specification.
- it does not use terms from other vocabularies instead of the ones defined in this vocabulary that could reasonably be used (use of such terms in addition to the QMS is however permitted).

A compliant data interchange:

- MAY include terms of other vocabularies.
- MAY use only a subset of the terms in the qualification metadata schema.

The QMS is technology-neutral. A publisher can use any of its terms to encode and publish information about qualifications in any technology, but RDF and XML are preferred.
3. NAMESPACEs

This section is non-normative.

The URI for this vocabulary is http://data.europa.eu/esco/qms#

The QMS reuses terms and classes from existing specifications wherever possible, and therefore defines a minimal set of classes and properties of its own. The new classes and properties introduced by the schema are part of the ESCO ontology and are therefore defined in the ESCO namespace. Classes and properties specified in the next sections have been taken from the following namespaces:

- rdfs: http://www.w3.org/2000/01/rdf-schema#
- skos: http://www.w3.org/2004/skos/core#
- esco: http://data.europa.eu/esco/model#
- dcterms: http://purl.org/dc/terms/
- xsd: http://www.w3.org/2001/XMLSchema#
- iso-thes: http://purl.org/iso25964/skos-thes#
- adms: http://www.w3.org/ns/adms#
- prov: http://www.w3.org/ns/prov#
- dcat: http://www.w3.org/ns/dcat#
- foaf: http://xmlns.com/foaf/0.1/
- org: http://www.w3.org/ns/org#
- rov: http://www.w3.org/ns/regorg#
- owl:http://www.w3.org/2002/07/owl#
4. THE QUALIFICATION METADATA SCHEMA – AN OVERVIEW

This section is non-normative.

The key class in the schema is esco:Qualification, to represent a single qualification. A qualification is a formal outcome of an assessment and validation process, which is obtained when a competent body determines that an individual has achieved learning outcomes to given standards.\(^\text{12}\)

The QMS distinguishes following other classes:

- the esco:AwardingActivity class, to represent an activity related to the awarding of a qualification.
- the esco:AwardingBody class, a particular subclass of org:Organization to indicate institutions, organizations or companies issuing qualifications (certificates, diplomas or titles).
- the esco:AssociationObject class, to represent a relationship from a ‘qualification’ to another semantic asset. This allows specifying metadata about the association itself.
- the esco:AssociationType, a subclass of skos:Concept to identify the semantics of an esco:AssociationObject relationship.
- the esco:Recognition class, to specify a formal recognition of a qualification or awarding body.
- the esco:Accreditation class, to specify accreditation information of a qualification or awarding body.
- the :EntryRequirement class, to represent an entry requirement of a qualification.

The QMS also uses existing classes from other standardized and ontologies:

- the adms:Identifier class, to capture (alternative) identifiers.
- the foaf:Agent class, to identify the different provenance agents in the QMS. E.g. the owner and publisher of a qualification, organizations quality assuring, regulating or accrediting qualifications, an awarding body, ... If the agent is an organization, the schema recommends using the (registered) Organization Ontology\(^\text{13}\)\(^\text{14}\) to specify more detailed information about the organization.
- the foaf:Document class, to represent public web documents that one can navigate in a Web browser or download as a file distribution.
- the skos:Concept class, the generic class of classification codes in the controlled vocabularies used by the QMS. This class is also recommended to represent nodes in any other established framework and/or classification system that a qualification might be linked to.
- the dcterms:Standard class, to represent an established framework, standard or classification system a qualification can be linked to.
- the NodeLiteral class, to specify a literal in a specific language and with a certain datatype.


\(^\text{13}\)Dave Reynolds, Epimorphics Ltd. The organization ontology. 16 January 2014. W3C Recommendation. URL: http://www.w3.org/TR/vocab-ovorg/

\(^\text{14}\)Registered organization Vocabulary. 01 August 2013. W3C Working Group Note. URL: http://www.w3.org/TR/vocab-regorg/
Figure 1 - UML model of the qualification metadata schema
5. USAGE AND EXAMPLES

This section is non-normative.

The QMS is flexible, it can adapt to the existing situation in different Member States as well as to an international context.

This section explains how to use the qualification metadata schema to represent a qualification and its related entities. Examples are serialized in Turtle.

How to work with Qualifications?
The key class is esco:Qualification, to represent a single qualification. A qualification is a formal outcome of an assessment and validation process which is obtained when a competent body determines that an individual has achieved learning outcomes to given standards.

Remark: The full list of metadata properties is listed in Qualification.

An example of a qualification described with the QMS:

0 @prefix ex: <http://www.example.com/>
1 ex:Qualification
2   a esco:Qualification ;
3       adms:identifier _:bnode_id1 ; ## unique and persistent identifier
4       esco:referenceLanguage "en"^^xsd:language ;
5       skos:prefLabel "Master in communication science"@en ;## title of the qualification
6       skos:definition _:bnode_id2 ; ## abstract description of the qualification
7       dcterms:description _:bnode_id3 ; ## full learning outcome description of the qualification
8       esco:hasISCED-FCode <http://data.europa.eu/escodata/iscof/0612> ;## field (thematic area)
9       esco:hasISCED-FCode <http://data.europa.eu/escodata/iscof/0613> ;## field (thematic area)
10      esco:hasAssociation _:bnode_id4 ; ## nqf level
11      esco:hasAssociation _:bnode_id5 ; ## eqf level
12      esco:hasAssociation _:bnode_id6 ; ## learning outcome
13      esco:waysToAcquire <http://data.europa.eu/escodata/ways-to-acquire#formal-education> ;
14      esco:hasAwardingActivity _:bnode_id7 ;## awarding activity that specifies the awarding body
15      esco:hasAwardingActivity _:bnode_id8 ;## awarding activity that specifies the awarding country
16      foaf:homepage <http://www.organizationA.nl/Qualifications/9807537> ;
19      esco:hasRecognition _:bnode_id9 ; ## recognition information
20      esco:hasAccreditation _:bnode_id10 ; ## accreditation information
21      esco:hasEntryRequirement _:bnode_id11 ;
22      esco:hasEntryRequirement _:bnode_id12 ;
23      esco:additionalNote _:bnode_id13 ; ## additional note about qualification
24      dcterms:rightsHolder ex:OrganizationA ;## owner
25      dcterms:publisher ex:OrganizationA . ## publisher

Line 3 points to a unique and persistent identifier of the qualification. A qualification can have one or more additional identifiers that identify the qualification in a unique way. See How to work with Identifiers? for more information.
In line 4, the reference language specifies the (default) language in which the information about the qualification is available. This implies that all labels and free-text metadata fields – such as the title, definition and description of a qualification in line 5, 6 and 7 - should at least be provided in the reference language. See How to work with NodelLiterals? and Multilingual Aspects for more information.

In lines 8 and 9, the ISCED FoET\textsuperscript{15} 2013 code indicates the thematic area of a qualification. ESCO\textsuperscript{16} organizes a copy of this classification in a controlled vocabulary and represents ISCED FoET codes as SKOS\textsuperscript{17} concepts.

Line 10 refers to an AssociationObject to associate the qualification to its NQF\textsuperscript{18} level. In the same way, qualifications can be related to other semantic assets, like the EQF\textsuperscript{19} level of the qualification (line 11), the learning outcomes of a qualification identified by ESCO skills, competences and knowledge (line 12) or the related occupations or occupational fields of a qualification. See How to work with AssociationObjects? for more information.

Line 13 states that the qualification can be acquired by validation of formal education\textsuperscript{20}. The different ways of education and/or learning to acquire a qualification are encoded as skos:Concepts in a controlled vocabulary defined by the QMS (see Controlled vocabularies to be used).

Lines 14 and 15 refer to an activity related to the awarding of the qualification. See How to work with Awarding Activities? for more information.

Line 16 refers to a Document resource, to indicate the homepage of a qualification. Additionally, any other supplementary documents can be linked to a qualification (line 17 and 18). See How to work with Documents? for more information.

Line 19 refers to a Recognition resource to specify information about the formal recognition of the qualification. See How to work with Recognitions? for more information.

Line 20 refers to an Accreditation resource to specify accreditation information. See How to work with Accreditations? for more information.

Lines 21 and 22 refer to entry requirements for the qualification. See How to work with EntryRequirements? for more information.

Line 23 refers to an additional note about the qualification. See How to work with NodeLiterals? for more information. This field is introduced to support the free text fields specified in the EQF Data model. The field can be used to record any further information about the qualification.

Lines 24 and 25 refer to the owner and publisher of the qualification. The publisher can be another organization than the owner, although typically they are the same. See How to work with Agents? for more information.

\textsuperscript{15}http://www.uis.unesco.org/Education/Pages/international-standard-classification-of-education.aspx

\textsuperscript{16}https://ec.europa.eu/esco/portal/home

\textsuperscript{17}https://www.w3.org/2004/02/skos/intro


\textsuperscript{20}Learning that occurs in an organized and structured environment (such as in an education or training institution or on the job) and is explicitly designated as learning (in terms of objectives, time or resources). Formal learning is intentional from the learner’s point of view. It typically leads to certification.URL: http://www.cedefop.europa.eu/en/events-and-projects/projects/validation-non-formal-and-informal-learning/european-inventory/european-inventory-glossary#F
**How to work with Awarding Activities?**
A qualification can be awarded by different organisations in different countries and/or regions. All those awarding activities can take place at different time periods, now or in the past.

The QMS uses the class `esco:AwardingActivity` to represent any activity related to the awarding of a Qualification. It is used to specify metadata such as the awarding body, the country or region where the qualification is awarded and optionally the awarding period. A qualification can be related to multiple awarding activities.

Example:
```sparql
@prefix ex: <http://www.example.com/>.

_:bnode_id7 a esco:AwardingActivity;
    prov:used ex:Qualification ;
    prov:atLocation <http://data.europa.eu/esco/nuts/NL> ;

_:bnode_id8 a esco:AwardingActivity;
    prov:used ex:Qualification ;
    prov:wasAssociatedWith ex:OrganizationB .

_:bnode_id13 a esco:AwardingActivity;
    prov:used ex:Qualification ;
    prov:wasAssociatedWith ex:OrganizationC;
    prov:wasStartedAtTime "2002-01-01T00:00:00"^^xsd:dateTime;
    prov:wasEndedAtTime "2003-12-31T00:00:00"^^xsd:dateTime .
```

**How to work with Recognitions?**
Qualifications and awarding bodies can be formally recognised in one or more countries and/or regions at different points in time.

The QMS uses the class `esco:Recognition` to specify information about the formal recognition of a qualification or awarding body, such as the country and/or region where a qualification is recognised and optionally the date of formal recognition. A qualification can have multiple recognitions.

Example:
```sparql
@prefix ex: <http://www.example.com/>.

_:bnode_id9 a esco:Recognition;
    prov:hadPrimarySource ex:Qualification ;
    prov:atLocation <http://data.europa.eu/esco/nuts/NL> ;
    dcterms:issued "2002-01-01T00:00:00"^^xsd:dateTime .
```
**How to work with Accreditations?**
Qualifications and awarding bodies can be quality assured, regulated or accredited. Accreditations can expire or need a review.

The QMS uses the class *esco:Accreditation* to specify accreditation information of a qualification or awarding body, such as the agent or authority primarily responsible for the accreditation, the issue-, the expiry- and/or review date of the accreditation. Additionally, a homepage or any other public accessible web document with more detailed information about the accreditation, the assessment or related quality assurance processes can be specified.

Example:

```xml
0 @prefix ex: <http://www.example.com/>
1  _:bnode_id10
2  a esco:Accreditation ;
3  prov:hadPrimarySource ex:Qualification ;
4  prov:wasAttributedTo ex:OrganizationD ; ## organization quality assuring, regulating or accrediting the qualification
5  dcterms:issued "2002-01-01T00:00:00"^^xsd:dateTime ; ## approval date
6  prov:invalidatedAtTime "2003-12-31T00:00:00"^^xsd:dateTime . ## expiry date
```

**How to work with Agents?**
The QMS uses the *foaf:Agent* class to identify agents, such as:

- the publisher, the owner or the provenance agent of a qualification (e.g. an academic institution, an international company or a national authority);
- awarding bodies.
- organizations quality assuring, regulating or accrediting qualifications.

To know the minimal set of properties to provide with an Agent or Awarding Body, see Agent and AwardingBody. If the agent is a (registered) organization, the use of the (registered) Organization Ontology is recommended to specify more detailed information.

Example of an awarding body as a subclass of Agent.

```xml
0 @prefix ex: <http://www.example.com/>
1  ex:OrganizationB
2  a esco:AwardingBody ;
3  adms:identifier _:bnode_id_org_b ;
4  dcterms:type <http://data.europa.eu/esco/agent-type#academic-institution> ;
5  foaf:name "Organization B"@en ;
6  foaf:homepage <http://www.organizationB.nl/index.html> ;
7  foaf:mbox <mailto:info@organisationB.nl> ;
```

Line 2 introduces the awarding body. Line 3 specifies a unique and persistent identifier of the organisation. See How to work with Identifiers? for more information.
Line 4 refers to an SKOS Concept that represents the type of organization. See Controlled vocabularies to be used for more information.

The name, homepage and email are specified at lines 5, 6 and 7.

Line 8 refers to a NUTS code and specifies the country or region where the main site of the awarding body is located. See Controlled vocabularies to be used for more information.

**How to work with Documents?**
The QMS uses the class `foaf:Document` to represent any public accessible web document with more detailed information about a qualification, organisation or accreditation. This allows specifying metadata on the Document.

The document can be a web page that can be navigated (e.g. the homepage of a qualification or organisation) or a downloadable file (e.g. a supplementary document of a qualification). Documents can be used to provide information about a specific topic of a qualification such as internal or external quality assurance processes, detailed entry requirements, information about professional regulations and certificates, awarding activities or any other further information about the qualification.

Example:
```
0 @prefix ex:<http://www.example.com/>
1 <http://www.organizationA.nl/Qualifications/9807537>
2   a foaf:Document ;
4 <http://www.organizationA.nl/Qualifications/9807537/doc1.pdf>
5   a foaf:Document ;
7   dcterms:title “Regulated professions and certificates”@en ;
```

Line 1 is the URI of the document that represents the homepage of the qualification. This has to be the HTTP URL of the homepage.

Line 3 specifies the language of the homepage by using the controlled vocabulary of ESCO. See Multilingual Aspects and Controlled vocabularies to be used for more information.

Line 4 specifies a supplementary document with more information about professional regulations and certificates with respect to the qualification. The URI of the document is the HTTP URL that gives access to the document (e.g. download URL).

The topic of the document is described in lines 7 and 8. Line 7 specifies the title of the document and line 8 specifies the information topic that the document is about. The different information topics are encoded as SKOS concepts in a controlled vocabulary. See Controlled vocabularies to be used for more information.
How to work with AssociationObjects?
The QMS defines the class esco:AssociationObject to relate a qualification to another semantic asset. An AssociationObject links a qualification to a node from another established framework or classification system.

For example:

- a qualification level from an existing framework (e.g. EQF or any national or regional qualification framework).
- a related occupation or occupational field from a regional, national or international standard (e.g. ESCO, ROME\(^{21}\), ISCO\(^{22}\)…).
- a learning outcome expressed as an ESCO skill, competence or knowledge.

The schema defines a dedicated property to link a qualification to a field of education node in the ISCED FoET classification. See Qualification for more information.

Example to associate a qualification with a national qualification framework level:

```
0 @prefix ex: <http://www.example.com/>
1 _:bnode_id4
2 a esco:AssociationObject ;
3 dcterms:type <http://data.europa.eu/esco/association-type#qf-level> ;
4 esco:targetFramework _:bnode_idy ;
5 esco:isAssociationFor ex:Qualification ;
6 esco:target <http://example.com/refX/NQF/5> .
7 _:bnode_idy
8 a dcterms:Standard ;
9 skos:prefLabel “National Qualification Framework X”@en ;
10 skos:altLabel “NQF X”@en.
11
12 <http://example.com/refX/NQF/5>
13 a skos:Concept ;
14 skos:prefLabel “Level 5”@en ;
15 skos:notation “5”.
```

Line 3 tells us that the association is about a “Qualification Framework level” association used to assign a qualification framework level to a qualification. The relations between qualifications and other semantic assets are what we call ‘typed’ relations. The different types of associations and their semantics in the qualification metadata schema are identified and described by SKOS concepts. Those “tagging” concepts are part of a taxonomy managed by the QMS. See Association Types for more information.

In line 4 the esco:targetFramework-property specifies the National Qualification Framework to which the qualification is linked to. It refers to the resource that identifies and describes the national qualification framework at line 7.

The QMS includes a list of known and recommended frameworks (see Alignment Frameworks). For those frameworks, the predefined URI’s, as specified in the list, must be used to identify the framework. In case the framework is unknown and not included in this list, it must be encoded as a resource of type “dcterms:Standard” (line 8) with at least a preferred label (line 9) and optionally an alternative label

\(^{21}\) http://emploi.spf75.org/IMG/xls_code_rome_v3.xls

\(^{22}\) http://www.ilo.org/public/english/bureau/stat/isco/
It is also recommended to assign a unique and persistent URI to this resource and so to refer to the framework in a consistent way.

In line 6 the esco:target-property refers to a resource that identifies and describes the level within the national qualification framework at line 12. The NQF level is encoded as an SKOS Concept. This is a recommended way of working: denote the target node as an SKOS concept (line 13) with at least a preferred label (line 14) and eventually a code (line 15). It is also recommended to assign a unique and persistent URI to the SKOS concept to refer to the target node (e.g. the NQF level) in a consistent way.

If such a controlled vocabulary is not available, you can still use the metadata property esco:target-Notation or esco:targetName to specify a code or term that identifies the semantic asset. For example, to specify the national qualification framework level 5 this could be:

```
_:bnode_id4 esco:targetNotation "5" .
```

In the same way, we associate the qualification with the European Qualification Framework level.

```
0 _:bnode_id5
1 a esco:AssociationObject ;
2 dcterms:type <http://data.europa.eu/esco/association-type#qf-level> ;
4 esco:isAssociationFor ex:Qualification ;
```

In line 3 the European Qualification Framework is specified as the target framework by the predefined URI as specified in the list of known frameworks (see Alignment Frameworks).

Line 5 specifies the EQF level as a reference to an SKOS Concept. The EQF levels are encoded as SKOS concepts. See Controlled vocabularies to be used.

Now we add a learning outcome to the qualification, expressed as a relation to an ESCO skill, competence or knowledge:

```
0 _:bnode_id6
1 a esco:AssociationObject ;
2 dcterms:type <http://data.europa.eu/esco/association-type#learning-outcome> ;
4 esco:isAssociationFor ex:Qualification ;
```

In line 3 the ESCO skills, competences and knowledge classification is specified as target framework by the predefined URI as specified in the list of known frameworks (see Alignment Frameworks). In line 5 the learning outcome is expressed as a reference to a skill concept from the ESCO taxonomy.

All properties of an AssociationObject are listed in the section AssociationObject.
How to work with Identifiers?

Identifiers are needed to identify and link resources in a unique and persistent way. (see also Identifying Resources)

A resource identifier consists of:

- a string identifier, unique and persistent within the scope of the issuing system.
- a unique identifier of the publishing system that issued the string identifier for that particular resource.

The combination of both, the string identifier and the unique identifier of the issuing system, make the resource identifier globally unique.

ESCO identifiers

The QMS uses the class `adms:Identifier` to represent the full identifier of a Qualification or Organization. The class is defined by ADMS.

An example of a unique and persistent identifier that will be issued by the Qualification Datasets Register (QDR) to each individual qualification:

```
0 @prefix ex:<http://www.example.com/>
1  _:bnode_id1
2   a  adms:Identifier  ;
4   adms:schemaAgency "ESCO"  ;
```

In line 3, we use the `skos:notation`-property to provide the actual identifier “9807537” as a string. We datatype it with a URI of the QDR identifier schema `<http://data.europa.eu/esco/datatype/qdr-id>`. The identifier schema is uniquely related to the publication system that issued the identifier. It is the namespace in which the string identifier is unique and persistent.

The full qualification identifier is then composed of the qualification identifier “9807537” and its namespace identifier `<http://data.europa.eu/esco/datatype/qdr-id>`. The combination of both makes the identifier globally unique.

Line 4 provides an optional name of the agency that manages the identifier schema.

Line 5 provides an optional date that the identifier was issued.

Identifiers published by data providers

Publishers of qualifications must assign identifiers to each individual qualification. The identifiers must be unique and persistent within the scope of their publishing system. The QDR will assign a unique namespace to each publishing system.

An example of a unique and persistent identifier issued by a qualification provider:

```
0@prefix ex:<http://www.example.com/>
1  _:bnode_id1
2   a  adms:Identifier  ;
3   skos:notation "00000001" .
```
Line 3 specifies the unique and persistent string identifier “00000001” issued by the publishing system of the qualification provider.

In case the publishing system does not already make use and specify a known and unique identifier schema, the ESCO harvesting system will assign one and add it to the published identifier:

```
0@prefix ex:<http://www.example.com/>
1  _:bnode_id1
2  a adms:Identifier ;
3  skos:notation "00000001" ;
```

Line 4, specifies the string identifier with a datatype URI <http://data.europa.eu/esco/datatype/{prefix-publishing-system}-id> assigned either by the publishing system or by the QDR. The datatype URI uniquely identifies the issuing system where the identifier originates from. It is the namespace in which the identifier is unique and persistent.

**Alternative Identifiers**

A qualification can have one or more *additional* identifiers, to uniquely identify the qualification. For example, a unique code issued and managed by an agency. An identifier register can be organized on any level: on the international, national, regional or even on the institutional or private level.

It is necessary that the agency managing the identifier register ensures the uniqueness and persistence of the identifiers. Otherwise, it can’t be used to uniquely identify a qualification.

An example of identifying a qualification with an alternative unique code:

```
0 @prefix ex:<http://www.example.com/>
1  _:bnode_id8
2  a adms:Identifier ;
3  skos:notation "HE07X1"^^ex:CrohoCode ;
4  adms:schemaAgency "DUO (Dutch office of education)" ;
```

Line 3, specifies the unique code “HE07X1” with the datatype URI <http://www.example.com/CrohoCode> that uniquely identifies the CROHO coding system.
How to work with EntryRequirements?
A qualification might have requirements to enter the programme that leads to the qualification or to access the examination or certification process. For example, prior (professional) experience, prior acquired qualifications, skills...

The QMS structures the entry requirements of a qualification into some abstract categories such as work experience, pre-assessment and qualification (see Entry Requirement Types). The necessity of the entry requirement is expressed with terms like ‘required’ or ‘recommended’ (see Entry Requirement Levels).

An example of a qualification that requires either some work experience or a certain qualification to enter the programme.

0 @prefix ex: <http://www.example.com/>
1 _:bnode_id11
2   a esco:EntryRequirement ;
3   dcterms:type <http://data.europa.eu/esco/entryrequirement-category#work-experience> ;

5 _:bnode_id12
6   a esco:EntryRequirement ;
7   dcterms:type <http://data.europa.eu/esco/entryrequirement-category#qualification> ;

How to work with NodeLiterals?
The QMS uses the class esco:NodeLiteral to specify literals that can have both a datatype and a language tag.

It is used to support larger free text metadata fields, such as the learning outcome description or a historical note of a qualification. Those fields can either contain plain text or a valid XHTML fragment. An XHTML fragment allows a publisher to provide some simple basic formatting of a large text.

An example of two NodeLiterals, one containing plain text and one containing an XHTML fragment:

0 @prefix ex: <http://www.example.com/>
1 _:bnode_id2
2   esco:language "en"^^xsd:language ;
3   esco:nodeLiteral "abstract description of the qualification as plain text" .
4 _:bnode_id3
5   esco:language "en"^^xsd:language ;
6   esco:nodeLiteral ''<div>XHTML fragment with full description of the learning outcomes of the qualification</div>''^^rdf:XMLLiteral .

Lines 2 and 5 specify the language of the free text. Lines 3 and 6 provide the actual free text value. In line 3 it is plain text. In case it is an XHTML fragment (line 6) the datatype rdf:XMLLiteral must be specified.

A NodeLiteral allows specifying additional metadata such as the topic that an additional note is about. In the QMS, any further information about a qualification can be specified in additional notes. The

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23 http://www.w3schools.com/html/html_xhtml.asp
different information topics are encoded as SKOS concepts in a controlled vocabulary. See Controlled vocabularies to be used for more information.

An example of an additional note about the qualification:

```
0 _:bnode_id13
1     esco:language "en"^^xsd:language ;
2     esco:nodeliteral "additional note about the qualification" ;
3     dcterms:subject <http://data.europa.eu/esco/qualification-topics#entry-requirements> .
```

Line 2 specifies an additional note about the entry requirements (specified at line 3) of the qualification.
6. THE QUALIFICATION METADATA SCHEMA - SPECIFICATIONS

I. Classes

<table>
<thead>
<tr>
<th>Class name</th>
<th>Usage note for the schema</th>
<th>URI</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualification</td>
<td>A qualification is a formal outcome of an assessment and validation process, which is obtained when a competent body determines that an individual has achieved learning outcomes to given standards.</td>
<td>esco:Qualification</td>
<td>Qualifications and How to work with Qualifications?</td>
</tr>
<tr>
<td>Agent</td>
<td>An agent is a for example, a person, a group, an organization or an authority. This class defines the provenance agents in the QMS (e.g. the owner, the publisher or the awarding body of a qualification). If the agent is an organization, we recommend using the (Registered) Organization Ontology.</td>
<td>foaf:Agent</td>
<td>Agent and How to work with Agents?</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><a href="http://www.w3.org/TR/vocab-org/">http://www.w3.org/TR/vocab-org/</a>.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><a href="http://www.w3.org/TR/vocab-regorg/">http://www.w3.org/TR/vocab-regorg/</a></td>
</tr>
<tr>
<td>AwardingBody</td>
<td>An awarding body is an institution, organization, company or competent authority that is recognised (official or otherwise) for issuing qualifications (certificates, diplomas or titles) and formally recognising the learning outcomes of an individual, following an assessment and validation procedure.</td>
<td>esco:AwardingBody</td>
<td>Awarding Body and How to work with Agents?</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><a href="http://www.w3.org/TR/vocab-org/">http://www.w3.org/TR/vocab-org/</a>.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><a href="http://www.w3.org/TR/vocab-regorg/">http://www.w3.org/TR/vocab-regorg/</a></td>
</tr>
<tr>
<td>Qualification Metadata Schema specifications</td>
<td>AwardingActivity</td>
<td>Recognition</td>
<td>Accreditation</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>------------------</td>
<td>-------------</td>
<td>---------------</td>
</tr>
<tr>
<td>An awarding activity represents an activity related to the awarding of a qualification. It is used to specify an awarding body, a country or region where the qualification is awarded and optionally an awarding period.</td>
<td>esco:AwardingActivity</td>
<td>esco:Recognition</td>
<td>esco:Accreditation</td>
</tr>
<tr>
<td>Recognition is used to specify information about the recognition of a qualification or awarding body. For example, the region, the country or the authority that formally recognises the qualification.</td>
<td>esco:Recognition</td>
<td>Recognition and How to work with Recognitions?</td>
<td></td>
</tr>
<tr>
<td>An accreditation is used to specify quality assurance, regulation or accreditation information of a qualification or awarding body. For example, the agent that was primarily responsible for the accreditation, the issue-, review- and/or expiry date of the accreditation.</td>
<td>esco:Accreditation</td>
<td>Accreditation and How to work with Accreditations?</td>
<td></td>
</tr>
<tr>
<td>The generic class for entry requirements of a qualification. For example, a requirement to enter the programme that leads to a qualification, or to access the examination or certification process, such as a prior professional experience or a specific qualification.</td>
<td>esco:EntryRequirement</td>
<td>EntryRequirement and How to work with EntryRequirements?</td>
<td></td>
</tr>
<tr>
<td>Any document (intended for human consumption) that contains further information about a Qualification, an Agent or an Accreditation. For example, a home page of a qualification, or a web page about a Diploma or Certificate Supplement.</td>
<td>foaf:Document</td>
<td>Document and How to work with Documents?</td>
<td><a href="http://xmlns.com/foaf/spec/#term_Document">http://xmlns.com/foaf/spec/#term_Document</a></td>
</tr>
<tr>
<td>Class</td>
<td>Description</td>
<td>URI</td>
<td>Related Documentation</td>
</tr>
<tr>
<td>-----------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------------------------------</td>
<td>---------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><code>AssociationObject</code></td>
<td>The generic class to describe an association from a resource to a node in another established framework. It is used in the QMS to relate a qualification to another semantic asset. For example, to relate a qualification to a qualification framework level, an ESCO skill or occupation.</td>
<td>esco:AssociationObject</td>
<td>AssociationObject and How to work with AssociationObjects?</td>
</tr>
<tr>
<td><code>AssociationType</code></td>
<td>The class to represent the semantics of an association from a qualification to another semantic asset. The QMS defines a controlled vocabulary with all Association Types.</td>
<td>esco:AssociationType</td>
<td>AssociationObject and How to work with AssociationObjects?</td>
</tr>
</tbody>
</table>
| `Identifier`          | An identifier in a particular context. This consists of: ▪ the string that is the identifier (required); ▪ the identifier scheme (optional); ▪ the version of the identifier scheme (optional); ▪ the agency that manages the identifier scheme (optional). | adms:Identifier              | Identifying Resources
Identifier and How to work with Identifiers? http://www.w3.org/TR/vocab-adms/#identifier |
| `Concept`             | The generic class of classification codes in controlled vocabularies used by the QMS. The recommended class to represent nodes in any other established framework. | skos:Concept                 | Concept http://www.w3.org/TR/skos-reference/#concepts                                   |
| `NodeLiteral`         | The class used to specify Literals with both a datatype and a language tag.                                                                                                                                   | esco:NodeLiteral             | NodeLiteral and How to work with NodeLiterals?                                           |
## II. Properties per class

### Qualification
The class of qualifications.

Characteristics of a qualification:

- General information such as the title, abstract description, the field (thematic area) and learning outcome description of the qualification.
- Other information such as ECTS credit points, volume of learning, ways to acquire and entry requirements.
  - A qualification can have one or more awarding activities that specify the awarding body and/or location where the qualification is awarded.
  - A qualification can have related documents (such as the homepage or a supplementary document) or additional notes to record any further information about the qualification.
  - A qualification can be related to an accreditation to record information about an external quality assuring or regulating body.

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24 IETF. BCP 47. Tags for Identifying Languages. [http://www/rfc-editor.org/rfc/bcp/bcp47.txt](http://www.rfc-editor.org/rfc/bcp/bcp47.txt)
Associations to other semantic assets to express:
- The national or regional qualification framework level
- The European Qualification Framework level
- Learning outcomes as relations to ESCO skills, competences and knowledge
- Relations to occupations or occupational fields

<table>
<thead>
<tr>
<th>Property</th>
<th>URI</th>
<th>Range</th>
<th>Usage note</th>
<th>Card.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identifier</td>
<td>adms:identifier</td>
<td>adms:Identifier</td>
<td>This property refers to an (alternative) identifier of a qualification like a national code or any other unique code issued by some agency and/or system. This can be on any level: an international, national, regional, private or institutional level (e.g. the unique and persistent identifier of the qualification within the publishing system). (See Identifying Resources and How to work with Identifiers?)</td>
<td>1..n</td>
</tr>
<tr>
<td>Reference language</td>
<td>esco:referenceLanguage</td>
<td>rdfs:Literal typed as xsd:language</td>
<td>The ISO 639-1 code(^{25}) of the language (2-char language code) in which information about the qualification is published. This language will be used as the default reference language for the qualification.</td>
<td>0..n</td>
</tr>
<tr>
<td>Title</td>
<td>skos:prefLabel</td>
<td>rdfs:Literal</td>
<td>The exact and official title of the qualification, in a given language. This property can be repeated for parallel language versions of the title. There can be no more than one title per language. It is mandatory to mention the title at least in the reference language if specified. See Multilingual Aspects for more information.</td>
<td>1..n</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Alternative label</th>
<th>skos:altLabel</th>
<th>rdfs:Literal</th>
<th>An alternative name of the qualification (e.g. synonym, acronym).</th>
<th>O..n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition</td>
<td>skos:definition</td>
<td>esco:NodeLiteral</td>
<td>Short and abstract description about the qualification. This property contains a free-text and can be repeated for parallel language versions of the definition. There can be no more than one definition per language. It is mandatory to mention the definition at least in the reference language if specified. See NodeLiteral and How to work with NodeLiterals?</td>
<td>O..n</td>
</tr>
<tr>
<td>Learning outcome description (required)</td>
<td>dcterms:description</td>
<td>esco:NodeLiteral</td>
<td>The full learning outcome description of the qualification. This property contains a free-text and can be repeated for parallel language versions of the learning outcome description. There can be no more than one learning outcome description per language. It is mandatory to mention the description at least in the reference language if specified. See NodeLiteral and How to work with NodeLiterals?</td>
<td>1..n</td>
</tr>
<tr>
<td>Field (required)</td>
<td>esco:hasISCED-FCode</td>
<td>skos:Concept</td>
<td>This property relates the qualification to the ISCED FoET 2013 classification code (Field of Education and Training Code). It indicates the thematic area of the qualification. See Controlled vocabularies to be used.</td>
<td>1..n</td>
</tr>
<tr>
<td>EQF level</td>
<td>esco:hasAssociation</td>
<td>esco:AssociationObject tagged with:</td>
<td>This property relates the qualification to the level as specified by the European Qualification Framework. See AssociationObject.</td>
<td>0..1</td>
</tr>
<tr>
<td>------------</td>
<td>---------------------</td>
<td>-------------------------------------</td>
<td>-----------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>(required)</td>
<td></td>
<td>the skos:Concept</td>
<td><a href="http://data.europa.eu/esco/association-type#qf-level">http://data.europa.eu/esco/association-type#qf-level</a></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>the EQF framework identifier</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>the appropriate EQF code</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(non-applicable for qualifications which are not part of national qualifications framework)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NQF Level</th>
<th>esco:hasAssociation</th>
<th>esco:AssociationObject tagged with:</th>
<th>This property relates the qualification to the National or Regional Qualification Framework level. See AssociationObject.</th>
<th>0..n</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>the skos:Concept</td>
<td><a href="http://data.europa.eu/esco/association-type#qf-level">http://data.europa.eu/esco/association-type#qf-level</a></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>the qualification framework identifier</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>the level within the framework</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Property</td>
<td>URI</td>
<td>Type</td>
<td>Description</td>
<td>Range</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>----------------------------------</td>
<td>-----------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>ECTS credit points</td>
<td>esco:hasECTSCreditPoints</td>
<td>rdfs:Literal typed as xsd:decimal</td>
<td>This property contains the credit points assigned to the qualification, following in the ECTS credit system.</td>
<td>0..1</td>
</tr>
<tr>
<td>Volume of learning</td>
<td>esco:volumeOfLearning</td>
<td>rdfs:Literal typed as xsd:duration</td>
<td>This property contains an indication of how many hours of learning efforts are needed, i.e. notional learning hours.</td>
<td>0..1</td>
</tr>
<tr>
<td>Is partial qualification</td>
<td>esco:isPartialQualification</td>
<td>xsd:boolean</td>
<td>Indicates whether a qualification is a full qualification or part of another qualification. In the latter, the qualification is only obtained as a formal outcome of a “broader” qualification of which it is part. The default value is ‘false’.</td>
<td>0..1</td>
</tr>
<tr>
<td>Ways to acquire</td>
<td>esco:waysToAcquire</td>
<td>skos:Concept</td>
<td>This property indicates whether the qualification can be acquired by validation of a formal, non-formal and/or informal learning processes. The different ways are encoded as skos:Concepts in a controlled vocabulary defined by the QMS (see Controlled vocabularies to be used)</td>
<td>0..n</td>
</tr>
<tr>
<td>Entry requirement</td>
<td>esco:hasEntryRequirement</td>
<td>esco:EntryRequirement</td>
<td>This property refers to an entry requirement of the qualification.</td>
<td>0..n</td>
</tr>
<tr>
<td>Expiry period</td>
<td>esco:expiryPeriod</td>
<td>xsd:duration</td>
<td>The validity period of a qualification.</td>
<td>0..n</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Learning outcome</strong></th>
<th>esco:hasAssociation</th>
<th>esco:AssociationObject tagged with:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>• the skos:Concept <a href="http://data.europa.eu/esco/association-type#learning-outcome">http://data.europa.eu/esco/association-type#learning-outcome</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• the ESCO skill classification identifier</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• the related ESCO skill uri</td>
</tr>
<tr>
<td>0..n</td>
<td></td>
<td>Expresses a learning outcome of the qualification as a relation to a skill, competence or knowledge from a known framework or standard classification. The recommended framework is ESCO. See AssociationObject</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Related occupation</strong></th>
<th>esco:hasAssociation</th>
<th>esco:AssociationObject tagged with:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>• a description describing the relation or a skos:Concept identifying the meaning of the relation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• the used occupation framework/classification identifier</td>
</tr>
<tr>
<td></td>
<td></td>
<td>the related occupation or the occupational field as a code or text value</td>
</tr>
<tr>
<td>0..n</td>
<td></td>
<td>Relates the qualification to an occupation or occupational field from a known framework or standard classification. The recommended framework is ESCO. See AssociationObject</td>
</tr>
<tr>
<td><strong>Recognition</strong></td>
<td>esco:hasRecognition</td>
<td>esco:Recognition</td>
</tr>
<tr>
<td>-----------------</td>
<td>------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td><strong>Awarding activity</strong> (Required to specify the awarding body/competent authority and the Country/Region 27)</td>
<td>esco:hasAwardingActivity</td>
<td>esco:AwardingActivity</td>
</tr>
<tr>
<td><strong>Accreditation</strong></td>
<td>esco:hasAccreditation</td>
<td>esco:Accreditation</td>
</tr>
<tr>
<td><strong>Homepage</strong></td>
<td>foaf:homepage</td>
<td>foaf:Document</td>
</tr>
<tr>
<td><strong>Landing page</strong></td>
<td>dcat:landingPage</td>
<td>foaf:Document</td>
</tr>
</tbody>
</table>

27 It is required to specify the awarding body and the country/region where the qualification is awarded. The recommended way to publish this information is to use the ‘Awarding activity’ property. If specificities in your case do not allow you to use this property, two alternatives exist to record this information. Either in a descriptive way by an ‘Additional note’ property or by referring to a public accessible web document via a ‘Supplementary document’ property.
| Supplementary document | esco:supplementaryDoc | foaf:Document | A public web document containing additional documenta-
tion about the qualification, such as a diploma or certif-
icate supplement. It can be any document containing fur-
ther information about the qualification. The document
can be a web page that can be navigated or a down-
loadable file.

See Document and How to work with Documents? | 0..n |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Release/publication date</td>
<td>dcterms:issued</td>
<td>rdfs:Literal typed as xsd:dateTime</td>
<td>Date of formal publication. The date the qualification was published and the metadata about the qualification was made available</td>
<td>1..1</td>
</tr>
<tr>
<td>Update/modification date</td>
<td>dcterms:modified</td>
<td>rdfs:Literal typed as xsd:dateTime</td>
<td>Date when the qualification was last updated since it was published.</td>
<td>1..1</td>
</tr>
</tbody>
</table>
| Change note | skos:changeNote | esco:NodeLiteral | A property to record information about fine grained changes of the qualification.

This property contains a free-text and can be repeated for parallel language versions of the change note. See NodeLiteral and How to work with NodeLiterals? | 0..1 |
| History note | skos:historyNote | esco:NodeLiteral | A property to record information about major lifecycle changes of the qualification (e.g. past state/use/meaning of a qualification).

This property contains a free-text and can be repeated for parallel language versions of the history note. See NodeLiteral and How to work with NodeLiterals? | 0..1 |
<table>
<thead>
<tr>
<th>Property</th>
<th>URI</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional note</td>
<td>esco:additionalNote</td>
<td>esco:NodeLiteral optionally tagged with the appropriate topic that the note is about (see Qualification Documentation Topics). A property to record any further information about a qualification. This property contains a free-text and can be repeated for parallel language versions of the additional note. See NodeLiteral and How to work with NodeLiterals?</td>
</tr>
<tr>
<td>Status</td>
<td>iso-thes:status</td>
<td>rdfs:Literal typed as xsd:string. The publication status of a qualification, e.g. released, obsolete, ... It MUST take one of the predefined values as specified in the section Controlled vocabularies to be used.</td>
</tr>
<tr>
<td>Replaces</td>
<td>dcterms:replaces</td>
<td>esco:Qualification. A related qualification that was replaced, displaced or superseded by this qualification. The learning outcomes of a qualification might change overtime and therefore result in another qualification replacing the old one.</td>
</tr>
<tr>
<td>Replaced by</td>
<td>dcterms:isReplacedBy</td>
<td>esco:Qualification. In case a qualification is deprecated, this property refers to the qualification that replaces, displaces or supersedes the first qualification.</td>
</tr>
<tr>
<td>Owner</td>
<td>dcterms:rightsHolder</td>
<td>foaf:Agent. Refers to the owner of the qualification. The organization owning rights over the qualification. For example, an awarding body, a national or regional authority or an international organization.</td>
</tr>
<tr>
<td>Provenance Agent</td>
<td>dcterms:creator</td>
<td>foaf:Agent. Organisation primarily responsible for establishing defining and managing the qualification and its curricula.</td>
</tr>
<tr>
<td>Publisher</td>
<td>dcterms:publisher</td>
<td>foaf:Agent. Refers to the agent responsible for making the information about the qualification available.</td>
</tr>
</tbody>
</table>

Table 2
**EntryRequirement**
The generic class for entry requirements of a qualification.

The QMS structures the entry requirements of a qualification into abstract categories such as work experience, pre-assessment and qualification. The necessity of the entry requirement is expressed with terms like ‘required’ or ‘recommended’.

<table>
<thead>
<tr>
<th>Property</th>
<th>URI</th>
<th>Range</th>
<th>Usage Note</th>
<th>Card.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Category (required)</strong></td>
<td>dcterms:type</td>
<td>skos:Concept</td>
<td>This property is used to point to the specific type or category of entry requirement. The different categories are encoded as skos:Concepts in a controlled vocabulary defined by the QMS (see Controlled vocabularies to be used)</td>
<td>1..1</td>
</tr>
<tr>
<td><strong>Requirement level (required)</strong></td>
<td>esco:requirement-Level</td>
<td>skos:Concept</td>
<td>This property refers to the necessity of the entry requirement. The allowed values for this property are encoded as skos:Concepts in a controlled vocabulary defined by the QMS (see Controlled vocabularies to be used).</td>
<td>1..1</td>
</tr>
</tbody>
</table>

**Table 3**

**Agent**
An agent (e.g. a person, a group, an organization, software or a physical artefact), represented by the class foaf:Agent.

If the agent is a (registered) organization, the use of the (registered) Organization Ontology is recommended to specify more detailed information. See:

- http://xmlns.com/foaf/spec/#term_Agent
- http://www.w3.org/TR/vocab-org/
- http://www.w3.org/TR/vocab-regorg/

The table list the minimal set of properties to provide for an agent:
<table>
<thead>
<tr>
<th>Property</th>
<th>URI</th>
<th>Range</th>
<th>Usage Note</th>
<th>Card.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identifier (required)</td>
<td>adms:identi-</td>
<td>adms:Identi-</td>
<td>This property refers to an (alternative) identifier that uniquely identifies the agent (e.g. the unique and persistent identifier within the publishing system, a legal organisation number, a VAT(^{28}) identification number) (see Identifying Resources and How to work with Identifiers?)</td>
<td>1..n</td>
</tr>
<tr>
<td></td>
<td>fier</td>
<td>fier</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preferred name (required)</td>
<td>foaf:name</td>
<td>rdfs:Literal</td>
<td>The official or formal name of the agent. (e.g. the registered organisation name) This property can be repeated for different versions of the name (e.g. the name in different languages).</td>
<td>1..n</td>
</tr>
<tr>
<td>Alternative name</td>
<td>skos:altLabel</td>
<td>rdfs:Literal</td>
<td>An alternative name of the agent, such as a short name or an abbreviation.</td>
<td>0..n</td>
</tr>
<tr>
<td>type</td>
<td>dcterms:type</td>
<td>skos:Concept</td>
<td>This property is used to point to the specific type of agent. The type of agent is a skos:Concept from a controlled vocabulary (see Controlled vocabularies to be used).</td>
<td>0..n</td>
</tr>
<tr>
<td>home page</td>
<td>foaf:home-</td>
<td>foaf:Docu-</td>
<td>The homepage of the agent.</td>
<td>0..n</td>
</tr>
<tr>
<td>e-mail</td>
<td>foaf:mbox</td>
<td>rdfs:Resource</td>
<td>The mailbox of the agent, identified using the mailto: URI scheme (see RFC 2368(^{29}))</td>
<td>0..n</td>
</tr>
</tbody>
</table>

| 28 VAT, Value-added Tax ID  |
| 29 https://www.ietf.org/rfc/rfc2368.txt |
**AwardingBody**
The class of registered awarding bodies.

An AwardingBody is a subclass of org:Organization. See Agent for its list of properties. Additional properties that should be provided are listed in the table below:

<table>
<thead>
<tr>
<th>Property</th>
<th>URI</th>
<th>Range</th>
<th>Usage Note</th>
<th>Card.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site location</td>
<td>dcterms:spatial</td>
<td>skos:Concept</td>
<td>The main site location of the awarding body. The location is a skos:Concept from a controlled vocabulary (see Controlled vocabularies to be used).</td>
<td>0..1</td>
</tr>
</tbody>
</table>

*Table 5*
**AwardingActivity**  
The class of awarding activities. An awarding activity specifies information about an activity related to the awarding of a qualification.

A qualification can have multiple awarding activities. An awarding activity is used to:

- specify the awarding body of a qualification.
- specify the country or region where the qualification is awarded with or without respect to a certain awarding body.
- specify awarding periods.

<table>
<thead>
<tr>
<th>Property</th>
<th>URI</th>
<th>Range</th>
<th>Usage Note</th>
<th>Card.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awarded qualification (required)</td>
<td>prov:used</td>
<td>esco:Qualification</td>
<td>The qualification this awarding activity applies to.</td>
<td>1..1</td>
</tr>
<tr>
<td>Awarding body</td>
<td>prov:wasAssociatedWith</td>
<td>esco:AwardingBody</td>
<td>The awarding body related to this awarding activity.</td>
<td>0..n³⁰</td>
</tr>
<tr>
<td>Country/Region code (Awarding area)</td>
<td>prov:atLocation</td>
<td>skos:Concept</td>
<td>The country or region where the qualification is awarded. The country is a skos:Concept that represents the location as specified in Controlled vocabularies to be used</td>
<td>0..1</td>
</tr>
<tr>
<td>Start date</td>
<td>prov:startedAtTime</td>
<td>rdfs:Literal typed as xsd:dateTime</td>
<td>The date since when the qualification is awarded. If not specified it is undefined (“not known”)</td>
<td>0..1</td>
</tr>
<tr>
<td>End date</td>
<td>prov:endedAtTime</td>
<td>rdfs:Literal typed as xsd:dateTime</td>
<td>The date until when the qualification was awarded. If not specified it is undefined (“not known”)</td>
<td>0..1</td>
</tr>
</tbody>
</table>

³⁰ Only in cases of co-awarding/co-graduation, where a qualification is issued to an individual by 2 or more organisations, the cardinality is greater than 1

Table 6
Recognition
The class of recognitions.

A recognition entity specifies information related to the formal recognition of a qualification and/or awarding body. Qualifications and awarding bodies can be related to multiple recognition entities.

A recognition entity is used to model a national or regional authority that formally recognises a qualification and/or a certain awarding body. It can be used to:

- specify the country or region where a qualification is formally recognised.
- specify the country or region where an awarding body is formally recognised.
- specify the country or region where an awarding body is formally recognised with respect to a specific qualification.

<table>
<thead>
<tr>
<th>Property</th>
<th>URI</th>
<th>Range</th>
<th>Usage Note</th>
<th>Card.</th>
</tr>
</thead>
<tbody>
<tr>
<td>recognised qualification</td>
<td>prov:hadPrimarySource</td>
<td>esco:Qualification</td>
<td>The qualification that was recognised.</td>
<td>0..1</td>
</tr>
<tr>
<td>recognised awarding body</td>
<td>prov:hadPrimarySource</td>
<td>esco:AwardingBody</td>
<td>The awarding body that was recognised.</td>
<td>0..1</td>
</tr>
<tr>
<td>Recognising country or region</td>
<td>prov:atLocation</td>
<td>skos:Concept</td>
<td>The country or region where the qualification and/or awarding body is formally recognised. The country is a skos:Concept that represents the location as specified in Controlled vocabularies to be used</td>
<td>0..1</td>
</tr>
<tr>
<td>Recognising agent</td>
<td>prov:wasAttributedTo</td>
<td>foaf:Agent</td>
<td>The organisation that formally recognised the qualification and/or awarding body.</td>
<td>0..1</td>
</tr>
<tr>
<td>Issue date</td>
<td>dcterms:issued</td>
<td>rdfs:Literal typed as xsd:dateTime</td>
<td>The date at which the qualification and/or awarding body was formally recognised. If not specified it is undefined (“not known”)</td>
<td>0..1</td>
</tr>
</tbody>
</table>
**End date**
prov:invalidatedAtTime rdfs:Literal typed as xsd:dateTime
The date at which the qualification and/or awarding body was formally not recognised anymore.
If not specified it is undefined (“not known”)

<table>
<thead>
<tr>
<th>Property</th>
<th>URI</th>
<th>Range</th>
<th>Usage Note</th>
<th>Card.</th>
</tr>
</thead>
<tbody>
<tr>
<td>accredited qualification</td>
<td>prov:hadPrimarySource</td>
<td>esco:Qualification</td>
<td>The qualification that was accredited.</td>
<td>0..1</td>
</tr>
<tr>
<td>accredited awarding body</td>
<td>prov:hadPrimarySource</td>
<td>esco:AwardingBody</td>
<td>The awarding body that was accredited.</td>
<td>0..1</td>
</tr>
<tr>
<td>Accrediting agent</td>
<td>prov:wasAttributedTo</td>
<td>foaf:Agent</td>
<td>The organisation that was formally responsible for the accreditation and quality assurance of the qualification and/or awarding body.</td>
<td>1..1</td>
</tr>
</tbody>
</table>

**Accreditation**
The class of accreditations.

An accreditation entity specifies information related to the accreditation, quality assurance and regulation of a qualification and/or awarding body, such as:
- the agent that was primarily responsible for the accreditation.
- the date the accreditation was formally approved.
- a review date or expiry date.
- related documents with additional information about the accreditation or used standards and procedures in the assessment and quality assurance of the qualification.

A qualification can be related to multiple accreditation entities. An accreditation entity can be used to:
- specify the accreditation of a qualification.
- specify the accreditation of an awarding body.
- specify the accreditation of an awarding body with respect to a specific qualification.
<table>
<thead>
<tr>
<th><strong>Issue date</strong></th>
<th>dcterms:issued</th>
<th>rdfs:Literal typed as xsd:dateTime</th>
<th>The date when the accreditation was formally approved/issued. If not specified it is undefined (“not known”)</th>
<th>0..1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Review date</strong></td>
<td>esco:reviewedAtTime</td>
<td>rdfs:Literal typed as xsd:dateTime</td>
<td>The date when the accreditation has to be reviewed. If not specified it is undefined (“not known”)</td>
<td>0..1</td>
</tr>
<tr>
<td><strong>Expiry date</strong></td>
<td>prov:invalidatedAtTime</td>
<td>rdfs:Literal typed as xsd:dateTime</td>
<td>The date when the accreditation expires or was expired. If not specified it is undefined (“not known”)</td>
<td>0..1</td>
</tr>
<tr>
<td><strong>Homepage</strong></td>
<td>foaf:homepage</td>
<td>foaf:Document</td>
<td>The homepage (a public web document) of an accreditation. There can be only one accreditation that has a particular homepage</td>
<td>0..n</td>
</tr>
<tr>
<td><strong>Landing page</strong></td>
<td>dcat:landingPage</td>
<td>foaf:Document</td>
<td>A web page that can be navigated to in a web browser to gain access to the accreditation and/or additional information about the accreditation. An accreditation might not have a personal homepage but instead a landing page.</td>
<td>0..n</td>
</tr>
<tr>
<td><strong>Supplementary Document</strong></td>
<td>esco:supplementaryDoc</td>
<td>foaf:Document</td>
<td>A public web document containing supplementary documentation about the accreditation (e.g. applied standards and procedures in the assessment and quality assurance of the qualification). This can be a web page that can be navigated to or a downloadable file.</td>
<td>0..n</td>
</tr>
<tr>
<td>Subject</td>
<td>dcterms:subject</td>
<td>skos:Concept</td>
<td>This property points to the subject of accreditation. It is used to specify more information about what was accredited (e.g. the content and curricula of a qualification, the learning programmes implementing this qualification…)</td>
<td>0..n</td>
</tr>
</tbody>
</table>

Table 8
Document
Any public accessible web document that provides more information about a qualification, an agent or an accreditation such as the homepage or landing page of a qualification. Represented by the class foaf:Document.

Documents are used to specify any further information about a qualification, an agent or an accreditation. They can provide additional information about:

- entry requirements.
- ways to acquire.
- professional regulations and certificates.
- way of assessment.
- learning outcomes.
- pathways and relations to other qualifications.
- continuity in studies and career.
- labour market needs and employment opportunities.
- important history and lifecycle events.
- accreditation and used standards in quality assurance process.
- awarding activities (i.e. awarding bodies, country/region...)

The document can be a web page that can be navigated to or a downloadable file. The URI of the document must be its HTTP URL.

The table lists optional properties to provide for documents:

<table>
<thead>
<tr>
<th>Property</th>
<th>URI</th>
<th>Range</th>
<th>Usage Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title</td>
<td>dcterms:title</td>
<td>rdfs:Literal</td>
<td>The name of the document.</td>
</tr>
<tr>
<td>Language</td>
<td>dcterms:language</td>
<td>skos:Concept</td>
<td>The language of the document.</td>
</tr>
<tr>
<td>Subject</td>
<td>dcterms:subject</td>
<td>skos:Concept</td>
<td>This property is used to point to the topic that is described in the document. The information topic specifies what kind of information is provided in the supplement document of a qualification.</td>
</tr>
</tbody>
</table>

Card. 0..n
The different topics are encoded as skos:Concepts in a controlled vocabulary defined by the QMS (see Controlled vocabularies to be used).

**Table 9**

**AssociationObject**

The generic class of extended directed associative relationships from a resource to a semantic asset.

This class relates a qualification to a node from another established framework or classification system. This allows to specify metadata on the association.

<table>
<thead>
<tr>
<th>Property</th>
<th>URI</th>
<th>Range</th>
<th>Usage Note</th>
<th>Card.</th>
</tr>
</thead>
<tbody>
<tr>
<td>has association type</td>
<td>dctersms:type</td>
<td>skos:Concept</td>
<td>Refers to a “tagging concept” to identify and describe the semantics of the association, i.e. the category of alignment. The QMS defines the controlled vocabulary that MUST be used to identify the associations between qualifications and other semantic assets (see Association Types).</td>
<td>0...1</td>
</tr>
<tr>
<td>description</td>
<td>dctersms:description</td>
<td>rdfs:Literal</td>
<td>Free-text to describe the semantics of the association. This property should be used if there is no appropriate association type available. This property can be repeated for parallel language versions of the description.</td>
<td>0..n</td>
</tr>
<tr>
<td>date issued</td>
<td>dctersms:issued</td>
<td>rdfs:Literal typed as xsd:dateTime</td>
<td>Date of the formal issuing of the association.</td>
<td>0..1</td>
</tr>
<tr>
<td>is association for</td>
<td>esco:isAssociationFor</td>
<td>rdfs:Resource</td>
<td>The resource being described (the resource the association starts from e.g. a qualification).</td>
<td>1..1</td>
</tr>
<tr>
<td>(required)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>target framework</td>
<td>esco:target-Framework</td>
<td>dct:Standard</td>
<td>Refers to the framework associated with the resource being described. It is the framework that describes the target resource (e.g. ESCO classification system, national qualification framework system...). It is recommended that the target framework is denoted by a known resource (e.g. a skos:ConceptScheme, a adms:Asset, a dcat:Dataset, see Alignment Frameworks)</td>
<td>1..1</td>
</tr>
<tr>
<td>(required)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Target Framework Version</td>
<td>owl:version-Info</td>
<td>rdfs:Literal</td>
<td>A version number or other designation of the target framework.</td>
<td>0..1</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-----------------</td>
<td>-------------</td>
<td>---------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Target Resource</td>
<td>esco:target</td>
<td>rdfs:Resource</td>
<td>The associated resource. Refers to a node in another established framework (e.g. a skill or occupation from the ESCO classification, a skill, occupation or occupational field from the national classification system, the qualification level according to the national qualification framework…). It is recommended that the target resource is denoted by a skos:Concept.</td>
<td>0..1</td>
</tr>
<tr>
<td>Target Description</td>
<td>esco:targetDescription</td>
<td>rdfs:Literal</td>
<td>A free-text description of a node in another established framework. This property can be repeated for parallel language versions of the target description. This property can be used if there is no URI resource available that represents the node in the target framework.</td>
<td>0..n</td>
</tr>
<tr>
<td>Target Notation</td>
<td>esco:targetNotation</td>
<td>rdfs:Literal</td>
<td>String of characters used to uniquely identify the node in the targeted framework. A notation is different from a lexical label in the sense that a notation cannot be recognised as a word (or sequence of words) in any natural language. Additionally, the notation can have a datatype specified identifying the coding schema/system.</td>
<td>0..n</td>
</tr>
<tr>
<td>Target Name/Value</td>
<td>esco:targetName</td>
<td>rdfs:Literal</td>
<td>The name or value of a node in another established framework. This property can be repeated for parallel language versions of the target name. This property can be used if there is no URI resource available that represents the node in the target framework.</td>
<td>0..n</td>
</tr>
<tr>
<td>Target URL</td>
<td>esco:targetURL</td>
<td>rdfs:Literal typed as xsd:anyURI</td>
<td>The URL of a node in another established framework. This property can be used if there is no URI resource available that represents the node in the target framework.</td>
<td>0..1</td>
</tr>
</tbody>
</table>

Table 10
**Identifier**
An (alternative) identifier of a qualification or organization. Represented by the class adms:Identifier.

See [http://www.w3.org/TR/vocab-adms/#identifier](http://www.w3.org/TR/vocab-adms/#identifier)

<table>
<thead>
<tr>
<th>Property</th>
<th>URI</th>
<th>Range</th>
<th>Usage Note</th>
<th>Card</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identifier (required)</td>
<td>skos:notation</td>
<td>rdfs:Literal</td>
<td>Content string which is the identifier</td>
<td>1..1</td>
</tr>
<tr>
<td>identifier scheme</td>
<td></td>
<td>rdfs:Datatype</td>
<td>Identifier for the identifier schema. The content string provided by skos:notation should be datatyped with the identifier scheme.</td>
<td>0..1</td>
</tr>
<tr>
<td>identifier scheme agency</td>
<td>dcterms:creator</td>
<td>foaf:Agent</td>
<td>Agency that manages the identifier scheme</td>
<td>0..1</td>
</tr>
<tr>
<td>identifier scheme agency name</td>
<td>adms:schemaAgency</td>
<td>rdfs:Literal</td>
<td>Name of the agency that manages the identifier scheme</td>
<td>0..1</td>
</tr>
<tr>
<td>Issued date</td>
<td>dcterms:issued</td>
<td>xsd:dateTime</td>
<td>The date on which the identifier was issued</td>
<td>0..1</td>
</tr>
</tbody>
</table>

*Table 11*
**AssociationType**
The class of association types used in the QMS.

The relations from a qualification to other semantic assets (resources from other semantic frameworks and or classification systems) are “typed relations”.31 The different association types and their semantics in the qualification metadata schema are SKOS Concepts (see Concept). The “tagging” concepts are part of a taxonomy managed by the QMS (see Association Types).

**Concept**
The generic class of classification codes in the controlled vocabularies (e.g. a taxonomy, a code list) used by the QMS. It is also the recommended class to represent nodes in other established frameworks qualifications are linked to.

Many properties used in the QMS represent coded values from controlled term lists rather than free text descriptions. In the QMS such codes are represented by URI references in the usual RDF fashion. The qualification metadata scheme uses SKOS32 to represent such URI sets as a controlled vocabulary. The individual nodes or code values in such a vocabulary are represented using skos:Concept and the overall set of admissible values using skos:ConceptScheme or skos:Collection. (see Controlled vocabularies).

<table>
<thead>
<tr>
<th>Property</th>
<th>URI</th>
<th>Range</th>
<th>Usage Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>preferred label (required)</td>
<td>skos:prefLabel</td>
<td>rdfs:Literal</td>
<td>Preferred or formal name of the concept, in a given language. This property can be repeated for parallel language versions of the preferred label. A concept has no more than one preferred label per language.</td>
</tr>
<tr>
<td>description</td>
<td>dcterms:description</td>
<td>rdfs:Literal</td>
<td>Description of the concept This property can be repeated for parallel language versions of the description. A concept has no more than one description per language.</td>
</tr>
</tbody>
</table>

31 A relation between the content item represented by this element's owning content element, and another content item
32 SKOS. Simple Knowledge Organization System. [http://www.w3.org/2004/02/skos/](http://www.w3.org/2004/02/skos/)
A notation is different from a lexical label in the sense that a notation cannot be recognised as a word (or sequence of words) in any natural language. Additionally, the notation can have a datatype specified identifying the coding schema/system.

| notation/code | skos:notation | rdfs:Literal | String of characters used to uniquely identify the concept (a unique code). A notation is different from a lexical label in the sense that a notation cannot be recognised as a word (or sequence of words) in any natural language. Additionally, the notation can have a datatype specified identifying the coding schema/system. | 0..n |

**Table 12**

**Standard**
A Standard represents another established framework, standard or classification system to which a qualification can be linked. Represented by the class dcterms:Standard.

Qualifications can be linked to other frameworks, standards and/or classifications (see also AssociationObject and Alignment Frameworks).

<table>
<thead>
<tr>
<th>Property</th>
<th>URI</th>
<th>Range</th>
<th>Usage Note</th>
<th>Card</th>
</tr>
</thead>
<tbody>
<tr>
<td>preferred label</td>
<td>skos:prefLabel</td>
<td>rdfs:Literal</td>
<td>Preferred or formal name of the framework and/or classification system, in a given language. This property can be repeated for parallel language versions of the preferred label. A concept has no more than one preferred label per language.</td>
<td>1..n</td>
</tr>
<tr>
<td>(required)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>alternative label</td>
<td>skos:altLabel</td>
<td>rdfs:Literal</td>
<td>Alternative label of the framework and/or classification system, in a given language (e.g. shortname)</td>
<td>0..n</td>
</tr>
</tbody>
</table>

**Table 13**
**NodeLiteral**
The class used to specify Literals that can have both a datatype and a language tag.

Free text metadata fields, such as the description and a historical note of a qualification can have a plain text or a XHTML fragment as literal value. By using a NodeLiteral both the datatype of the literal as the language can be specified.

<table>
<thead>
<tr>
<th>Property</th>
<th>URI</th>
<th>Range</th>
<th>Usage Note</th>
<th>Card</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language</td>
<td>esco:language</td>
<td>rdfs:Literal typed as xsd:language</td>
<td>The ISO 639-1 code(^{33}) of the language (2-char language code) associated with the provided literal. (See Multilingual Aspects for more information about language)</td>
<td>0..1</td>
</tr>
<tr>
<td>Literal</td>
<td>esco:nodeLiteral</td>
<td>rdfs:Literal with an optional datatype</td>
<td>The literal value. In case it is plain text, no datatype must be specified. In case of an XHTML fragment the datatype rdf:XMLLiteral must be specified</td>
<td>1..1</td>
</tr>
<tr>
<td>Subject</td>
<td>dcterms:subject</td>
<td>skos:Concept</td>
<td>This property is used to point to the information topic that an additional note is about. The different topics are encoded as skos:Concepts in a controlled vocabulary defined by the QMS (see Qualification Documentation Topics).</td>
<td>0..n</td>
</tr>
</tbody>
</table>

III. Controlled vocabularies

To improve semantic interoperability and to support multilingual purposes, the QMS links to other established frameworks and classification systems. The schema also defines its own reusable “controlled vocabularies” (i.e. code lists, taxonomies, name authority lists, value lists…) that must be used as a “value vocabulary” for certain properties in the schema.

Controlled vocabularies to be used

The table lists a number of properties and the controlled vocabularies that must be used for these properties:

<table>
<thead>
<tr>
<th>Property URI</th>
<th>Used for Class</th>
<th>Vocabulary name/description</th>
<th>Vocabulary URI</th>
<th>Usage note</th>
</tr>
</thead>
<tbody>
<tr>
<td>esco:target</td>
<td>AssociationObject</td>
<td>The European Qualification Framework (EQF) levels published as recommendation by the EU Publication office. ESCO organizes a copy of the EQF level codes in the concept schema</td>
<td><a href="http://data.europa.eu/esco/concept-scheme/eqf">http://data.europa.eu/esco/concept-scheme/eqf</a></td>
<td>To identify an EQF level when linking a qualification to the EQF framework.</td>
</tr>
</tbody>
</table>

\(^{34}\) International Standard Classification of Education: Fields of Education and Training 2013
<table>
<thead>
<tr>
<th>Property</th>
<th>Domain/Type</th>
<th>Definition</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>esco:target</code></td>
<td>AssociationObject</td>
<td>ESCO skill, competence and knowledge classification</td>
<td>To identify a skill, competence or knowledge when linking a qualification to the ESCO classification to express a learning outcome.</td>
</tr>
<tr>
<td><code>esco:target</code></td>
<td>AssociationObject</td>
<td>ESCO occupation classification</td>
<td>To identify a occupation when linking a qualification to the ESCO occupation classification.</td>
</tr>
<tr>
<td><code>dcterms:language</code></td>
<td>Document</td>
<td>MDR Languages Named Authority List</td>
<td>To identify the language of a Document</td>
</tr>
<tr>
<td><code>prov:atLocation</code></td>
<td>AwardingActivity</td>
<td>NUTS</td>
<td>To identify the country/region where a qualification is awarded.</td>
</tr>
<tr>
<td><code>prov:atLocation</code></td>
<td>Recognition</td>
<td>NUTS</td>
<td>To identify the country/region where a qualification is formally recognised.</td>
</tr>
<tr>
<td><code>dcterms:spatial</code></td>
<td>Organization</td>
<td>NUTS</td>
<td>To identify the country/region where the main site of an organization is located</td>
</tr>
</tbody>
</table>

---


<table>
<thead>
<tr>
<th>dcterms:type</th>
<th>EntryRequirement</th>
<th>QMS Entry Requirement Category Vocabulary (see Entry Requirements Types)</th>
<th><a href="http://data.europa.eu/esco/concept-scheme/entryrequirement-category">http://data.europa.eu/esco/concept-scheme/entryrequirement-category</a></th>
<th>To identify the type or category of an entry requirement.</th>
</tr>
</thead>
<tbody>
<tr>
<td>esco:requirement-Level</td>
<td>EntryRequirement</td>
<td>QMS Entry Requirement Level Vocabulary (see Entry Requirement Levels)</td>
<td><a href="http://data.europa.eu/esco/concept-scheme/entryrequirement-level">http://data.europa.eu/esco/concept-scheme/entryrequirement-level</a></td>
<td>To identify the necessity of an entry requirement.</td>
</tr>
<tr>
<td>dcterms:type</td>
<td>AssociationObject</td>
<td>QMS Association Type Vocabulary (see Association Types)</td>
<td><a href="http://data.europa.eu/esco/concept-scheme/association-type">http://data.europa.eu/esco/concept-scheme/association-type</a></td>
<td>To identify and describe the semantics of the association to another semantic asset.</td>
</tr>
<tr>
<td>dcterms:type</td>
<td>Agent</td>
<td>QMS Organization Type Vocabulary (see Organization Types)</td>
<td><a href="http://data.europa.eu/esco/concept-scheme/agent-type">http://data.europa.eu/esco/concept-scheme/agent-type</a></td>
<td>To identify the type of organisation (e.g. a company, a local, regional- or national authority, an academic institution...)</td>
</tr>
<tr>
<td>esco:waysToAcquire</td>
<td>Qualification</td>
<td>QMS Ways To Acquire Vocabulary (see Ways To Acquire a Qualification)</td>
<td><a href="http://data.europa.eu/esco/concept-scheme/ways-to-acquire">http://data.europa.eu/esco/concept-scheme/ways-to-acquire</a></td>
<td>To identify an education type or learning process alternative needed to acquire a qualification</td>
</tr>
<tr>
<td>dcterms:subject</td>
<td>Document</td>
<td>QMS Qualification Documentation Topics Vocabulary (see Qualification Documentation Topics)</td>
<td><a href="http://data.europa.eu/esco/concept-scheme/qualification-topics">http://data.europa.eu/esco/concept-scheme/qualification-topics</a></td>
<td>To identify which information topic about a qualification is described in a document</td>
</tr>
<tr>
<td>dcterms:subject</td>
<td>NodeLiteral</td>
<td>QMS Qualification Documentation Topics Vocabulary (see Qualification Documentation Topics)</td>
<td><a href="http://data.europa.eu/esco/concept-scheme/qualification-topics">http://data.europa.eu/esco/concept-scheme/qualification-topics</a></td>
<td>To identify which information topic about a qualification is described in an additional note</td>
</tr>
<tr>
<td>esco:targetFramework</td>
<td>AssociationObject</td>
<td>QMS Semantic Framework Named Authority List. (see Alignment Frameworks)</td>
<td>List of known semantic frameworks used to associate qualifications with in the QMS</td>
<td>To identify another semantic asset to which a qualification is linked. The list of recommended semantic assets is included in the QMS specification.</td>
</tr>
<tr>
<td>----------------------</td>
<td>-------------------</td>
<td>-----------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Datatype of skos:notation</strong></td>
<td>Identifier</td>
<td>QMS Identifier Schema Named Authority List. (see Identifier schemas)</td>
<td>List of known and/or registered identifier schema’s used to assign unique ids/codes to qualifications</td>
<td>To identify the schema and/or publishing system a qualification identifier originates from in order to make the identifier globally unique. The string identifier of a qualification is provided using skos:notation datatyped with the identifier scheme.</td>
</tr>
</tbody>
</table>
Association Types
The relations from qualifications to other semantic assets (from other semantic frameworks and or classification systems) are “typed relations”. The different association types and their semantics in the QMS are identified and described by SKOS concepts. The “tagging” concepts are part of a taxonomy managed by the schema. This taxonomy can be extended to support other association types, as the result of business decisions.

<table>
<thead>
<tr>
<th>Concept URI</th>
<th>Description</th>
<th>Usage Note</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="http://data.europa.eu/esco/association-type#learning-outcome">http://data.europa.eu/esco/association-type#learning-outcome</a></td>
<td>has learning outcome</td>
<td>To associate a qualification with a skill, knowledge or competence. Recommended frameworks are listed in Alignment Frameworks.</td>
</tr>
<tr>
<td><a href="http://data.europa.eu/esco/association-type#qf-level">http://data.europa.eu/esco/association-type#qf-level</a></td>
<td>has qualification framework level</td>
<td>To associate a qualification with a Qualification Framework level. Recommended frameworks are listed in Alignment Frameworks.</td>
</tr>
<tr>
<td><a href="http://data.europa.eu/esco/association-type#related-occupation">http://data.europa.eu/esco/association-type#related-occupation</a></td>
<td>has related occupation/ occupational field</td>
<td>To associate a qualification with an occupation or occupational field from a known occupational framework/classification</td>
</tr>
</tbody>
</table>

Table 16

Ways To Acquire a Qualification
Controlled vocabulary that lists different ways of education and/or learning to acquire a qualification. This vocabulary is used to specify the way to acquire a qualification.

<table>
<thead>
<tr>
<th>Concept URI</th>
<th>Usage Note</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="http://data.europa.eu/esco/ways-to-acquire#formal-education">http://data.europa.eu/esco/ways-to-acquire#formal-education</a></td>
<td>Qualification can be acquired by validation of formal education.</td>
</tr>
<tr>
<td><a href="http://data.europa.eu/esco/ways-to-acquire#non-formal-education">http://data.europa.eu/esco/ways-to-acquire#non-formal-education</a></td>
<td>Qualification can be acquired by validation of non-formal education.</td>
</tr>
<tr>
<td><a href="http://data.europa.eu/esco/ways-to-acquire#informal-learning">http://data.europa.eu/esco/ways-to-acquire#informal-learning</a></td>
<td>Qualification can be acquired by validation of informal learning process.</td>
</tr>
</tbody>
</table>

Table 17
Qualification Documentation Topics
Controlled vocabulary that lists the different information topics about a qualification that can be described in additional documents attached to a qualification. This vocabulary is used to tag a document or an additional note with the information topic it is describing.

<table>
<thead>
<tr>
<th>Concept URI</th>
<th>Usage Note</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="http://data.europa.eu/esco/qualification-topics#entry-requirements">http://data.europa.eu/esco/qualification-topics#entry-requirements</a></td>
<td>To specify it is about the requirements to enter the programme that leads to the qualification.</td>
</tr>
<tr>
<td><a href="http://data.europa.eu/esco/qualification-topics#pathways">http://data.europa.eu/esco/qualification-topics#pathways</a></td>
<td>To specify it is about pathways to gain the qualification and the continuation in the context of lifelong learning. Learning processes can be formal, non-formal or informal.</td>
</tr>
<tr>
<td><a href="http://data.europa.eu/esco/qualification-topics#regulations-and-certificates">http://data.europa.eu/esco/qualification-topics#regulations-and-certificates</a></td>
<td>To specify it is about regulated professions and certificates.</td>
</tr>
<tr>
<td><a href="http://data.europa.eu/esco/qualification-topics#learning-outcomes">http://data.europa.eu/esco/qualification-topics#learning-outcomes</a></td>
<td>To specify it is about the learning outcomes of a qualification.</td>
</tr>
<tr>
<td><a href="http://data.europa.eu/esco/qualification-topics#labour-market-and-employment">http://data.europa.eu/esco/qualification-topics#labour-market-and-employment</a></td>
<td>To specify it is about labour market needs and employment opportunities.</td>
</tr>
<tr>
<td><a href="http://data.europa.eu/esco/qualification-topics#history-and-lifecycle">http://data.europa.eu/esco/qualification-topics#history-and-lifecycle</a></td>
<td>To specify it is about the history and important lifecycle events. A qualification might change over time.</td>
</tr>
<tr>
<td><a href="http://data.europa.eu/esco/qualification-topics#assessment">http://data.europa.eu/esco/qualification-topics#assessment</a></td>
<td>To specify it is about the way of assessment.</td>
</tr>
<tr>
<td><a href="http://data.europa.eu/esco/qualification-topics#accreditation-and-quality-assurance">http://data.europa.eu/esco/qualification-topics#accreditation-and-quality-assurance</a></td>
<td>To specify it is about accreditation and quality assurance.</td>
</tr>
<tr>
<td><a href="http://data.europa.eu/esco/qualification-topics#ways-to-acquire">http://data.europa.eu/esco/qualification-topics#ways-to-acquire</a></td>
<td>To specify it is about the way to acquire the qualification (i.e. by validation of a formal, non-formal and/or informal learning processes).</td>
</tr>
<tr>
<td><a href="http://data.europa.eu/esco/qualification-topics#awarding-activity">http://data.europa.eu/esco/qualification-topics#awarding-activity</a></td>
<td>To specify it is about awarding activities of the qualification such as the awarding bodies and/or the location where the qualification is awarded</td>
</tr>
</tbody>
</table>
**Table 18**

**Entry Requirement Types**
A qualification might have requirements to enter the programme that leads to the qualification, or to access the examination or certification process. For example, prior life or work experience, prior acquired qualifications, skills...

The QMS structures the entry requirements of a qualification into some broader and abstract categories such as work experience, pre-assessment and qualification. The different entry requirement categories are SKOS concepts. The concepts are part of a taxonomy managed by the schema. This taxonomy can be extended to support other categories, as the result of business decisions.

<table>
<thead>
<tr>
<th>Concept URI</th>
<th>Usage Note</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="http://data.europa.eu/esco/entryrequirement-category#work-experience">http://data.europa.eu/esco/entryrequirement-category#work-experience</a></td>
<td>Category that relates an entry requirement to prior work experience.</td>
</tr>
<tr>
<td><a href="http://data.europa.eu/esco/entryrequirement-category#qualification">http://data.europa.eu/esco/entryrequirement-category#qualification</a></td>
<td>Category that relates an entry requirement to prior acquired qualification(s).</td>
</tr>
<tr>
<td><a href="http://data.europa.eu/esco/entryrequirement-category#pre-assessment">http://data.europa.eu/esco/entryrequirement-category#pre-assessment</a></td>
<td>Category that relates an entry requirement to pre-assessments.</td>
</tr>
<tr>
<td><a href="http://data.europa.eu/esco/entryrequirement-category#skills">http://data.europa.eu/esco/entryrequirement-category#skills</a></td>
<td>Category that relates an entry requirement to skills, competences and knowledge.</td>
</tr>
</tbody>
</table>

**Table 19**
**Entry Requirement Levels**

The requirement level is expressed with terms like ‘required’, or ‘recommended’. The different terms used to express the necessity of the entry requirement are SKOS concepts. The concepts are part of a taxonomy managed by the schema.

<table>
<thead>
<tr>
<th>Concept URI</th>
<th>Usage Note</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="http://data.europa.eu/escos/entryrequirement-level#required">http://data.europa.eu/escos/entryrequirement-level#required</a></td>
<td>The entry requirement is mandatory</td>
</tr>
<tr>
<td><a href="http://data.europa.eu/escos/entryrequirement-level#recommended">http://data.europa.eu/escos/entryrequirement-level#recommended</a></td>
<td>The entry requirement is recommended</td>
</tr>
<tr>
<td><a href="http://data.europa.eu/escos/entryrequirement-level#might-be-required">http://data.europa.eu/escos/entryrequirement-level#might-be-required</a></td>
<td>The entry requirement might be mandatory depending on other values</td>
</tr>
</tbody>
</table>

*Table 20*

**Organization Types**

Controlled vocabulary to identify the type of an organization.

<table>
<thead>
<tr>
<th>Concept URI</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="http://data.europa.eu/escos/agent-type#regional-authority">http://data.europa.eu/escos/agent-type#regional-authority</a></td>
<td>A regional authority</td>
</tr>
<tr>
<td><a href="http://data.europa.eu/escos/agent-type#national-authority">http://data.europa.eu/escos/agent-type#national-authority</a></td>
<td>A national authority</td>
</tr>
<tr>
<td><a href="http://data.europa.eu/escos/agent-type#international-authority">http://data.europa.eu/escos/agent-type#international-authority</a></td>
<td>An international authority</td>
</tr>
<tr>
<td><a href="http://data.europa.eu/escos/agent-type#academic-institution">http://data.europa.eu/escos/agent-type#academic-institution</a></td>
<td>An academic institution (e.g. a university)</td>
</tr>
<tr>
<td><a href="http://data.europa.eu/escos/agent-type#government-agency">http://data.europa.eu/escos/agent-type#government-agency</a></td>
<td>A government agency</td>
</tr>
<tr>
<td><a href="http://data.europa.eu/escos/agent-type#company">http://data.europa.eu/escos/agent-type#company</a></td>
<td>A company</td>
</tr>
<tr>
<td><a href="http://data.europa.eu/escos/agent-type#education-training-provider">http://data.europa.eu/escos/agent-type#education-training-provider</a></td>
<td>An education and training provider</td>
</tr>
</tbody>
</table>
Alignment Frameworks
Qualifications relate to other semantic assets. Qualifications can be linked to other frameworks, standards and/or classifications. For example, the different (national) qualification frameworks from which a qualification might have a qualification framework level assigned to or the ESCO skill, competence and knowledge classification to express the learning outcomes of a qualification.

The table below lists the known frameworks and/or classifications. The list is not complete and will extend dynamically. Some of the frameworks will be captured during the announcement and publication of qualification datasets in the QDR.

<table>
<thead>
<tr>
<th>Framework description</th>
<th>Framework URI</th>
<th>Usage note</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESCO skill, competence and knowledge classification</td>
<td><a href="http://data.europa.eu/esco/concept-scheme/skills">http://data.europa.eu/esco/concept-scheme/skills</a></td>
<td>The ESCO classification is recommended when associating qualifications with skills, competences and knowledge to express the learning outcomes.</td>
</tr>
<tr>
<td>ESCO occupation classification</td>
<td><a href="http://data.europa.eu/esco/concept-scheme/occupations">http://data.europa.eu/esco/concept-scheme/occupations</a></td>
<td>The ESCO classification is recommended when associating qualifications with occupations.</td>
</tr>
<tr>
<td>The European Qualification Framework (EQF)</td>
<td><a href="http://data.europa.eu/esco/concept-scheme/eqf">http://data.europa.eu/esco/concept-scheme/eqf</a></td>
<td>The European Qualification Framework is used to specify the EQF level of a qualification</td>
</tr>
<tr>
<td>National or Regional Qualification Frameworks</td>
<td></td>
<td>The used qualification framework when associating a qualification with a</td>
</tr>
<tr>
<td>National or Regional Occupation Classification Systems</td>
<td>national or regional qualification framework level.</td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------------------</td>
<td>---------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The used occupation classification system when associating a qualification with an occupation/occupational field, if relevant.</td>
<td></td>
</tr>
</tbody>
</table>

*Table 22*
**Identifier schemas**

Name authority list of known Identifier Schemas and Schema Agencies.

Publishers of qualifications must assign a unique and persistent identifier to each individual qualification within the scope of their publishing system. This list names and identifies the different publishing systems and/or coding systems issuing unique and persistent qualification identifiers. The list is used to identify the system or agent a qualification identifier originates from. It is the namespace or the schema in which the identifier is unique and persistent (see Identifying Resources and How to work with Identifiers?)

This list is not complete and will extend dynamically. The different identifier schemas will be captured during the announcement and publication of qualification datasets in the QDR.

<table>
<thead>
<tr>
<th>Identifier Schema/Namespace Prefix</th>
<th>Identifier Schema/Namespace Uri</th>
<th>Usage note</th>
</tr>
</thead>
<tbody>
<tr>
<td>qdr</td>
<td><a href="http://data.europa.eu/esco/datatype/qdr-id">http://data.europa.eu/esco/datatype/qdr-id</a></td>
<td>The QDR will harvest and manage the different qualification datasets published across Europe, it will also assign and manage a unique identifier for each individual qualification.</td>
</tr>
</tbody>
</table>

*Table 23*
IV. Multilingual Aspects

Multilingual aspects concern all properties that use strings with human-readable text. The string values are always one of these two types:

- The string is free text. For example, descriptions and labels. Such text may be translated into several languages.
- The string is an appellation of a ‘named entity’. For example, names of organisations or persons. These names may have parallel versions in other languages but those versions don’t need to be literal translations.

The property can always be repeated, with translations in the case of free text and with parallel versions in case of named entities. For free text, the language tag is mandatory. For named entities, the language tag is optional and should only be provided if the parallel version of the name is strictly associated with a particular language. For example, the name ‘European Union’ has parallel versions in all official languages of the union, while a name like ‘W3C’ is not associated with a particular language and has no parallel versions.

In the qualification metadata schema, a foaf:Document represents a public web document that contains information about a qualification or agent (e.g. the home page and supplement pages of a qualification). It is identified by a URL, i.e. the “browsable weblink” of the document. Multilingual links can be met through a content negotiation mechanism, that serves different content based on the Accept-Languages indicated by the browser. With such a mechanism, the link to the home page or supplement page can resolve to different language versions of the web document with more information about the resource. However if the document represents a specific language version, a language property on the foaf:Document entity should indicate this.
V. Identifying Resources

What is a Resource?
A resource is anything that has an identity and that you can describe. Main resources in QMS are Qualifications and Organisations.

What is a Property?
A property is a specific aspect, characteristic, attribute or relation to describe a resource.

What is a resource identifier and why do you need it?
In order to talk about resources, describe and link them to other resources in the distributed web of data, one must be able to uniquely identify resources. Different sources can talk and publish data about the same resource and link to other known resources. How do we know they are talking about the same resource? By looking at the identifier.

All resources must have identifiers. A resource identifier must be unique and persistent, meaning the identifier will always refer to the same resource and cannot be reused to identify other resources. Systems that integrate published data will use those resource identifiers to refer to the published resources.

What is an Identifier Schema?
An identifier schema is the schema, registry or system that issues and manages identifiers. It’s a compilation of unique identifiers, with information on each resource that’s being identified, and registered by the organization that maintains them. The registry follows a syntax specification for the identifiers (typically a formal standard) and the agency provides a means to register identifiers.

The purpose of an identifier schema is to manage a given collection of identifiers. Assigned identifiers within a particular identifier schema should be unique within the scope of that schema. When assigning an identifier to a resource, the managing system must ensure the identifier is not issued twice within the scope of that schema. How this is organised and how the identifiers and the assignment of those identifiers are managed, depends on the agency that is responsible for maintaining the identifier schema.

The global uniqueness of a resource identifier according to a known and specified Identifier Schema is defined by two parts:

- the content string that represents the actual identifier code;
- the Identifier Schema itself.

Example:
- ISBN code system: the content string that represents the ISBN code is unique within the scope of the ISBN code system. The unique identifier of the resource (i.e. a book) consists of two parts:
  - identifier of the ISBN code system;
  - the content string that represents the actual ISBN code.
- VAT identification number system for organizations: the unique identifier of a resource (i.e. an organization) consists of two parts:
  - identifier of the VAT identification system;
  - the content string representing the actual VAT identification number.

An Identifier Schema can be organised and managed on any level:
- On a global level, e.g. Digital Object Identifier (DOI), ISBN...
- On a national or regional level, e.g. the Dutch CROHO system (Central Register of Higher Education Programmes), legal organisation identifiers registered with and managed by national or regional authorities…
• On a local or internal level of an organisation, e.g. the database and/or publishing system of an organisation.

... 

How to identify resources in a unique and persistent way?
Different strategies are possible:
• Uniform Resource Identifiers (URI’s).
• Identifiers according to a known Identifier Schema.
• Make use of a NAL, a controlled vocabulary to name particular entities in a consistent way.

Which resources must be identified in the qualification metadata schema?
The main resources identified in the QMS are “Qualifications”, “Organisations”, “Documents”, “Concepts” and “Standards”:
• A Standard is another framework or classification system a qualification can be linked to (e.g. EQF, ESCO, a national qualification framework). It is recommended to assign a unique and persistent URI to each Standard in order to refer to the framework in a unique and consistent way.
• A Concept is uniquely identified by its URI and optionally a unique code as published within the controlled vocabulary where the concept is organised.
• A Document in the QMS is a public accessible web document identified by its HTTP URL.
• Qualifications and Organizations must be identified in a unique and persistent way.

The other resources, such as an accreditation, an awarding activity, an association object or an entry requirement can be seen as records of structured metadata about a qualification or an awarding body including one or more properties and their associated values. The QMS does not require persistent identifiers for those resources.

How to identify Qualifications?
To identify qualifications in a global unique and persistent way the qualification metadata schema applies the strategy of identifiers according to a known and specified identifier schema.

Publishers of qualifications must assign identifiers to each individual qualification. The identifiers must be unique and persistent within the scope of their publishing system. (see How to work with Identifiers?)

Each publisher of qualification identifiers will have a unique identifier schema assigned. The identifier schema identifies the issuing system where the identifier originates from. It is the namespace in which the identifier is unique and persistent.

The full qualification identifier is then composed of the qualification identifier and its identifier schema. The combination of both makes the identifier globally unique.

In case the publishing system does not already make use and specify a known and unique identifier schema, the ESCO harvesting system will assign one and add it to the published identifier.

Additionally, publishing systems can provide secondary identifiers. These are other alternative qualification identifiers issued and managed by other known coding systems or schema agencies:
• Qualifications could have a unique code registered and managed on a national or regional level, e.g. the Dutch CROHO system;

If the qualifications are published with a unique and persistent URI, then the URI will serve to uniquely identify and refer to the qualification. In this case the qualification identifier itself is still required and will be used as an alternative identifier of the qualification.
How to identify Organizations?
To identify organisations in a global unique and persistent way the same strategy as for qualifications applies.

Publishers of qualifications must issue identifiers to each individual agent or organisation that is included in their qualification metadata. The identifiers must be unique and persistent within the scope of their publishing system.
VI. Implementation and Deployment Issues

Publishing Linked Data

As the QMS is intended to be used in a Linked Data \(^{38}\) environment, publishers should consider the recommendations in the W3C Notes “Best Practice Recipes for Publishing RDF Vocabularies”\(^{39}\), “Best Practices for Publishing Linked Data”\(^{40}\) and the ISA report “10 Rules for Persistent URIs”\(^{41}\).

Publishers should also consider it best practice to assign URIs to all instances of the classes described in section Classes.

Exchange of data

While the QMS concentrates on the specification of the data format to be used for exchange of information about qualifications, in practical situations the communicating partners will need to identify the exchange mechanisms and protocols that they will use.

Various approaches may be deployed:

- harvesting: an aggregator initiates a connection to the data store at the data provider’s site to pull metadata from the provider’s qualifications.
- file transfer: an aggregator pulls a file with qualification metadata from the data provider, or the data provider uploads such a file to the aggregator. Such a file is prepared by the data provider as a (partial) export from its qualifications.
- online maintenance: the data provider maintains the metadata of its qualifications at the aggregator’s site using an online user interface that allows to upload, modify and delete qualification metadata.

Various technical specifications can support such mechanisms, such as SPARQL, the Atom Publishing Protocol, the Atom Syndication Format, Annotated HTML, and others.

The European Commission will provide a central platform to announce, exchange and publish qualification datasets. The qualification dataset register (QDR) will harvest and manage the different qualification datasets published across Europe.

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\(^{38}\) W3C Linked Data. [http://www.w3.org/standards/semanticweb/data](http://www.w3.org/standards/semanticweb/data)

\(^{39}\) W3C. Best Practice Recipes for Publishing RDF Vocabularies. [http://www.w3.org/TR/swbp-vocab-pub/](http://www.w3.org/TR/swbp-vocab-pub/)


7. UPDATING OF THE SCHEMA

The schema presented in this document is the first release of the QMS (Version 1.0.0).

The Commission can offer technical IT visits to interested countries, following their invitation, to assess their technical maturity level and pertinent steps needed to implement a national qualifications database and to exchange the recorded qualification information according to the QMS with the European qualifications portals.

These visits can provide technical consultancy as well as advice to appointed staff.

Following the visits and the first applications of the QMS in practice, future version releases, including backwards-compatible fixes, or minor releases, introducing backwards-compatible additions or improvements, might be published.

Foreseen releases might include:

- Changes to the control vocabularies lists.
- Extension of the relations between a qualification and an occupation/occupational field.
- Relations between qualifications.

The latest version of the QMS specifications is also online at: https://ec.europa.eu/esco/portal/escopedia/1. Introduction

All releases of the QMS will be supported by the Qualification Datasets Register.
## ANNEX I: LIST OF ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>AB</td>
<td>Awarding Body</td>
</tr>
<tr>
<td>ADMS</td>
<td>Asset Description Metadata Schema</td>
</tr>
<tr>
<td>CROHO</td>
<td>Centraal Register Opleidingen Hoger Onderwijs</td>
</tr>
<tr>
<td>DC</td>
<td>Dublin Core, a small set of vocabulary terms to describe web and physical resources</td>
</tr>
<tr>
<td>DOI</td>
<td>Digital Object Identifier</td>
</tr>
<tr>
<td>ECTS</td>
<td>European Credit Transfer and Accumulation System</td>
</tr>
<tr>
<td>ESCO</td>
<td>European Skills, Competences, Qualifications and Occupations</td>
</tr>
<tr>
<td>EQF</td>
<td>European Qualification Framework</td>
</tr>
<tr>
<td>FoET</td>
<td>Fields of Education and Training</td>
</tr>
<tr>
<td>HTML</td>
<td>Hyper Text Markup Language</td>
</tr>
<tr>
<td>ISA</td>
<td>Interoperability Solutions for European Public Administrations</td>
</tr>
<tr>
<td>ISCED</td>
<td>International Standard Classification of Education</td>
</tr>
<tr>
<td>ISBN</td>
<td>International Standard Book Number</td>
</tr>
<tr>
<td>ISO</td>
<td>International Organization for Standardization</td>
</tr>
<tr>
<td>LOD</td>
<td>Linked Open Data</td>
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<tr>
<td>LOQ</td>
<td>Learning Opportunities and Qualifications in Europe</td>
</tr>
<tr>
<td>NAL</td>
<td>Name Authority List</td>
</tr>
<tr>
<td>NUTS</td>
<td>The Nomenclature of Territorial Units for Statistics</td>
</tr>
<tr>
<td>NQD</td>
<td>National Qualification Database</td>
</tr>
<tr>
<td>NQF</td>
<td>National Qualification Framework</td>
</tr>
<tr>
<td>OWL</td>
<td>Web Ontology Language</td>
</tr>
<tr>
<td>QDR</td>
<td>Qualification Datasets Register</td>
</tr>
<tr>
<td>QMS</td>
<td>Qualification Metadata Schema</td>
</tr>
<tr>
<td>RDF</td>
<td>Resource Description Framework</td>
</tr>
<tr>
<td>SKOS</td>
<td>Simple Knowledge Organization System</td>
</tr>
<tr>
<td>SPARQL</td>
<td>Protocol and RDF Query Language</td>
</tr>
<tr>
<td>URI</td>
<td>Uniform Resource Identifier</td>
</tr>
<tr>
<td>URL</td>
<td>Uniform Resource Locator</td>
</tr>
<tr>
<td>UML</td>
<td>Unified Modeling Language</td>
</tr>
<tr>
<td>W3C</td>
<td>World Wide Web Consortium: develops protocols and guidelines for the web</td>
</tr>
<tr>
<td>XML</td>
<td>eXtensible Markup Language</td>
</tr>
<tr>
<td>XHTML</td>
<td>Extensible Hypertext Markup Language</td>
</tr>
<tr>
<td>XSD</td>
<td>XML Schema Definition</td>
</tr>
</tbody>
</table>
ANNEX 2: LIST OF REFERENCES

[ECTS]
European Credit Transfer System.
http://ec.europa.eu/education/ects/ects_en.htm

[ESCO]
ESCO
https://ec.europa.eu/eso/portal/home

[EQF]
European Qualification Framework

[FORMAL EDUCATION]
Learning that occurs in an organized and structured environment (such as in an education or training institution or on the job) and is explicitly designated as learning (in terms of objectives, time or resources). Formal learning is intentional from the learner’s point of view. It typically leads to certification.

[HTML]
Hyper Text Markup Language
https://www.w3.org/html/

[INDICATIVE ELEMENTS OF A COMMON FORMAT FOR THE ELECTRONIC PUBLICATION OF INFORMATION ON QUALIFICATIONS]

[IETF – BCP 47]
Tags for Identifying Languages.
http://www.rfc-editor.org/rfc/bcp/bcp47.txt
[ISCO]
International Standard Classification of Occupations

[ISO 939]
Codes for the Representation of Names of Languages.

[ISCED F-2013]
Fields of Education and Trainings.
http://www.uis.unesco.org/Education/Pages/international-standard-classification-of-education.aspx

[JOINUP – PERSISTENT URI]
European Commission. Joinup. 10 Rules for Persistent URIs.

[NQF]
National Qualification Framework

[NUTS]
Nomenclature of territorial units for statistics classification
http://ec.europa.eu/eurostat/web/nuts

[ORG-ONTOLOGY]
http://www.w3.org/TR/vocab-org/

[RDF]
Resource Description Framework
https://www.w3.org/RDF/

[RDF SYNTAX]
Resource Description Framework SYNTAX
https://www.w3.org/TR/rdf-syntax-grammar/

[REGISTERED ORGANIZATION VOCABULARY]
Registered organization Vocabulary. 01 August 2013. W3C Working Group Note. URL:
http://www.w3.org/TR/vocab-regorg/

[RFC2119]

[RFC 2368]
The mailto URL scheme - IETF
https://www.ietf.org/rfc/rfc2368.txt

[ROME]
Répertoire Opérationnel des Métiers et des Emplois
http://emploi.spf75.org/IMG/xls_code_rome_v3.xls

[SPARQL]
Protocol and RDF Query Language
https://www.w3.org/TR/rdf-sparql-protocol/

[SKOS]
Simple Knowledge Organization System
https://www.w3.org/2004/02/skos/intro

[TURTLE]
Turtle
https://www.w3.org/TR/turtle/
W3C Linked Data
http://www.w3.org/standards/semanticweb/data

Best Practice Recipes for Publishing RDF Vocabularies
http://www.w3.org/TR/swbp-vocab-pub/

Best Practices for Publishing Linked Data
https://dvcs.w3.org/hg/gld/raw-file/default/bp/index.html

eXtensible Markup Language
https://www.w3.org/XML/