Standardising Public Policy Documentation to Foster Collaboration Across Government Agencies

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Abstract. Public policies documents convey strategic directions and framework of actions of government in a particular sector. For most societal challenges, there is a need for government entities at the same and different levels to coordinate their policies and collaborate on the implementations of policies. However, this coordination and collaboration efforts are seriously hampered by the lack of a central repository for public policy documents from which policy makers and researchers can access related policies on a particular topic, industry or group of stakeholders. To address this challenge, this paper describes the development of Vocabulary to underpin the implementation of a shared public policy repository in Europe. The Core Public Policy Vocabulary (CPPV) is developed as a semantic interoperability resource for government organizations for consistent description and documentation of public policies to enable efficient discovery, cross-referencing and analysis of policy documents. We describe our approach, conceptual model, elements of the vocabulary, its implementation and concrete scenarios for the use of the vocabulary.

Keywords: Core Public Policy Vocabulary (CPPV) · Inter-agency collaboration · Standardisation · Open policy · Policy repository · e-Government

1 Introduction

Service Delivery and Policy Networks are one of the most common Governance Networks in the public sector in which entities within government and outside government work together to tackle complex societal challenges [1]. Collaboration in public policy making is pivotal to coherence of government programs in general. Policy coherence entails systematic promotion of mutually reinforcing policy actions across government departments and agencies creating synergies towards achieving the agreed objectives [2]. In the context of Sustainable Development, integrated policy making and coherence aims to foster synergies across economic, social and environmental policy areas; identifying trade-offs and reconcile domestic and international

objectives; and addressing the spill-overs of domestic policies on other countries and on future generations (*ibid*).

There are three main approaches towards assessing the coherence of public policies. These include: (1) Analytical approaches: Modelling of cause-and-effect relations; (2) Participatory approaches: Involving stakeholders; and (3) Knowledge management: collection and processing of data[1]. The knowledge management dimension requires some form of standardization in collecting the relevant data on policies to be stored in the knowledge base. Standardisation here entails specifying some minimum agreed information to be provided by different parties (i.e. government agencies) responsible for producing and publishing public policies. For instance, the European Commission's Interoperability Solutions for Public Administrations (ISA) provides a number of similar standards - Core vocabularies about organizations, person, public services, locations, public organizations etc.; to facilitate semantic interoperability among public administrations across the European Union [3]. These vocabularies are data models which capture the fundamental characteristic of an entity in a context-neutral fashion thus enabling public administration to use these models as basis for information exchange, data integration and publishing of open data or information[2].

The development of the vocabulary – Core Public Policy Vocabulary (CPPV) presented in this article was motivated by the lack of a public repository or knowledge base of open public policies and the unavailability of existing standards in the form of ontologies, schema or data models that could be adapted to underpin the development of such repository. To address this problem, we have developed a conceptual model and a vocabulary to implement the model as a basis for a public policy repository or knowledge base.

This rest of the paper is structured as follows: Sects. 2 describes some of the basic concepts underpinning CPPV vocabulary. The methodology employed for the development of the vocabulary is presented in Sect. 3 while the details of the vocabulary are provided in Sect. 4. Section 5 discusses the application scenario of the vocabulary followed by some final discussions in Sect. 6.

2   Concepts

This section briefly explains some core concepts underpinning the CPPV vocabulary. It describes the concept of public policies in Sect. 2.1 and the notion of vocabularies and ontologies in Sect. 2.2.

2.1   Public Policies

A *Public Policy* is a commitment made by a government (or inter-governmental) entity to accomplish a single or set of objectives. It could also be described as "*a principled guide to action taken by the administrative executive branches of the state with regard*

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[1] http://www.liaise-kit.eu/ia-method/methods-analyse-coherence-policies.

[2] https://ec.europa.eu/isa2/solutions/core-vocabularies_en.

to a class of issues in a manner consistent with law and institutional customs"[3].
A policy might be detailed using laws or other formal documents to discuss the
institutional settings e.g. executing organization, and rewards/fines system [4].
A Public policy is could also as the aggregation of actions, legal acts, governing
measures, duties, sequences of operations and resource allocation precedence that are
completed, in the 'public's' name [5].

Examples of policies include regulatory policies, redistributive policies, fiscal
policies and monetary policies [6]. Regulatory policies allow the government to exert
control over the conduct of certain activities. The most obvious examples of regulation
techniques include civil and criminal penalties for certain behaviors. Redistributive
policies are used for managing the economy as a whole. The techniques of control
involve fiscal (tax) and monetary (supply of money policies. Fiscal techniques employ
tax rates and government spending to affect total or aggregate demand. Each particular
approach to taxing or spending can have a different impact on the overall economy, so
political entrepreneurs often propose or initiate policies with the goal of achieving
specific impacts. Monetary policies attempt to regulate the economy by changing the
rate of growth of the money supply or manipulating interest rates.

Public policies documents are usually published on government agencies websites
responsible for their development and implementation. In exceptional cases (e.g. the
UK government[4]), policy documents are accessible through one central point. Even
when this is the case, cross-analysis and linking of these policies is not possible.

2.2   Vocabularies and Public Policies

Vocabularies are represents the definitions of concepts and their relationships in a
certain domain of interest. Practically, vocabularies represent the base component for
the semantic web inferencing framework [7]. Vocabularies also enable semantic inte-
gration and interoperation and understanding of the domain [8]. Ontologies are more
complex form of vocabularies which are described formal explicit specification of a
shared conceptualization [9].

Ontologies are employed to perform following: organizing and structuring infor-
mation, reasoning and problem solving, semantic indexing and search, semantic inte-
gration and interoperation and understanding of the domain [8]. Ontologies like
vocabularies do not only describe the data model, it also supports the specification of
concrete exemplars (also called individuals) of such models.

There have been past efforts in describing public policies using other methods of
formalism associated with the subject of policy modelling. For instance in the
OCOPOMO (Open Collaboration Policy Modelling) project, the goal was to engage
stakeholders in policy making [10]. Public policies such as renewable energy policy of the
Kosice region in Slovakia, housing policy of the city of London or the distribution of
structural funds in the Campania region in Italy were analysed and modelled.
OCOPOMO provided so-called Consistent Conceptual Description for these policy cases.

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[3] https://www.jstor.org/topic/public-policy/.

[4] https://www.gov.uk/government/policies.

The OCOPOMO framework also supported semi-automatic transformation of conceptual policy descriptions in the CCD into formal policy models. In a second example the Open Preservation Data project [11], designed a policy vocabulary to control the digital preservation process and as enabling preservation systems to collaborate more effectively. Thirdly, some standardization efforts in the United States on publishing strategy related documents and performance plans of government agencies have produced the Strategy Markup Language (StratML) [12]. StratML was designed to enable the publishing of these documents in open and machine readable format.

However, so far, none of these efforts have resulted in a scalable public policy standard that could be adopted to underpin (pan European) Public Policy repository.

3 Methodology

This section describes our overall approach in the development of the Core Public Policy Vocabulary. There are popular alternatives to developing vocabularies. The first is to adopt a lightweight version of ontology development approaches. The second approach is to adopt the more general conceptual modelling process. We adopted the latter approach due to the importance we gave the underpinning conceptual model for the vocabulary.

Conceptual modelling (CM) is the elicitation and the representation of the general knowledge that an information system operating in a specific domain needs to know [13, 14]. In particular, conceptual modelling aims at representing static (e.g., objects, entities) and dynamic phenomena (e.g., events and processes) in a particular domain [15]. Conceptual modelling encompasses four elements [15]:

CM grammar [16] (or CM notation [17]) that provides a set of constructs and rules showing how to combine the constructs in order to model the real world domain [15]. The IS literature includes a vast variety of conceptual modelling grammars including data oriented, process oriented and object-oriented ones, [13, 15, 17–20].

CM method (or modelling technique [17, 21] that prescribes how to map the real phenomena of the domain into a model of the domain [15]. A rather limited number of CM methods exist in the literature [15, 18].

CM script (or conceptual schema [13, 14, 17, 18, 22] or conceptual model [17, 18] is the output of the CM method and is constructed using a CM grammar [15]. It is usually one (or more) diagrams [18] depicting the domain's concepts. A great variety of conceptual scripts have been proposed in the literature [13, 15, 18, 21, 23].

CM context, which is the setting in which conceptual modelling occurs and scripts are used.

Guide by the above Conceptual modelling framework, we started by developing concrete scenarios and general use cases for the vocabulary. Following this we analysed over 20 well documented public policy documents across different sectors and from different public administration cultures in Europe. These documents serve as primary sources of requirements for what could constitute core elements in describing the public policies (as shown in Fig. 1).
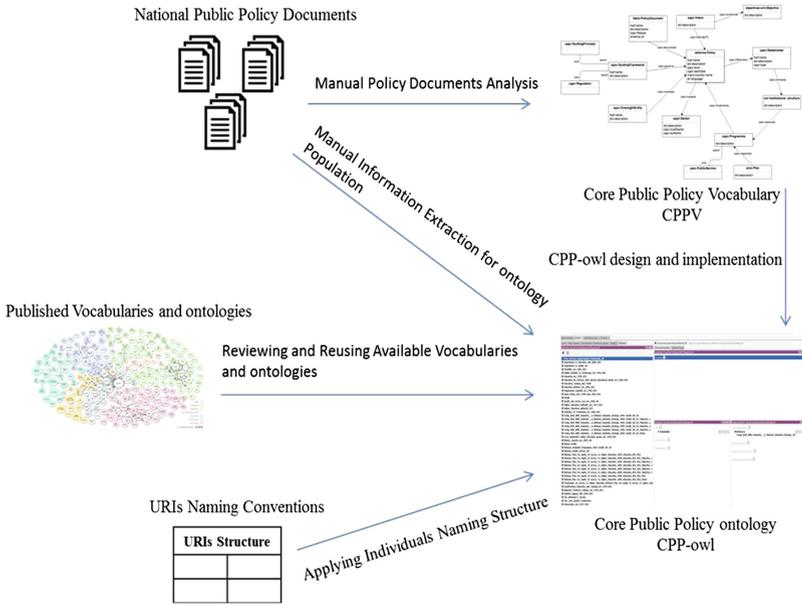
Fig. 1. The Core Public Policy Vocabulary modeling methodology

A minimalist orientation was adopted in identifying these core elements in line with the guiding principles for the European Commission's Core Vocabulary[5] as agreements are easier when the standards are simple enough to enable exchange and concomitantly allow for possible extensions by individual collaborating government entities using the standards.

4   Core Public Policy Vocabulary

This section provides some details about the elements of the CPPV vocabulary. Section 4.1 describes the conceptual model while

4.1   Conceptual Model

The Core Public Policy Vocabulary (CPPV) contains the following classes and properties to model elements public policies resulting from the process described above. Elements were included in the vocabulary after detailed analysis of their necessity in being part of the core or minimal set. Subsequently, the Core Public Policy Ontology was manually populated (CPP-owl)[6] by extracting and mapping information from

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[5] https://joinup.ec.europa.eu/site/core_vocabularies/Core_Vocabularies_user_handbook/ISA%20Hanbook%20for%20using%20Core%20Vocabularies.pdf.

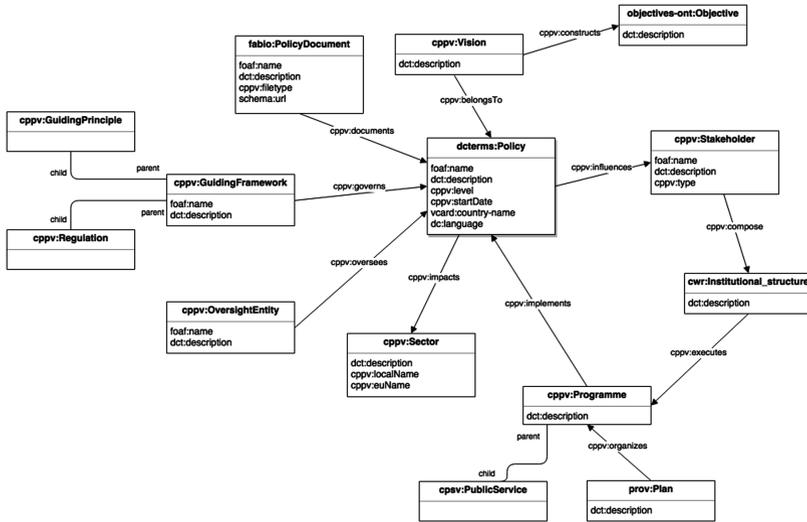[6] http://vmogi01.deri.ie/egovcppv/.

Fig. 2. Core Public Policy Vocabulary (CPPV) conceptual model

sample public policies as shown in Fig. 2. A detailed description of the CPPV elements is listed in Tables 1 (the main classes) and 2 (properties). The definitions of these elements are provided in respective tables.

Policy coordination and coherence can be analysed and effected through a number of relationships such as impacts which specified which sectors are impacted by a policy, implements which indicates which programmes are linked to specific policies or governs which specifies a legislation or higher level framework that binds a set of policies. All these properties with a supporting Uniform Resource Identifier (URI) strategy provide strong mechanism for linking in a policy ecosystem (Table 2).

4.2 Vocabulary Implementation

The above vocabulary was implemented in number of ways. First, we created an ontology based on this vocabulary in Protégé (one of the most popular open source ontology editor and management tool) so that basic analysis and reasoning could be performed on exemplar policies. By capturing the policies in Protégé, a linked data of public policy could be generated and published as open data on the government open data portals. Figure 3 below the screen shot of the implementation,

In our second implementation, the vocabulary was on the employed for publishing our sample policies as open policies on the popular Comprehensive Knowledge Archive Network (CKAN)[7] platform developed by the Open Foundation. CKAN is the most popular open data platform available. CKAN in our instance represents an open policy repository providing one central point of access to the public and policy makers.

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[7] https://ckan.org/this.

Table 1. CPPV classes i.e. concepts

Class	Description	URI
cppv:GuidingFramework	The Parent Class for the Guiding Principle and the Regulation	http://www.egov.deri.ie/cppv.owl#GuidingFramework
cppv:GuidingPrinciple	The foundation of every organization. They define what is truly important for its success	http://www.egov.deri.ie/cppv.owl#GuidingPrinciple
cwr:institutional_structure	Explicit and implicit institutional rules and policies designed to provide a structure where various work roles and responsibilities are delegated and coordinated. source: (cwr)	http://www.fao.org/aims/aos/cwr.owl#institutional_structure
objectives-ont:Objectives	Things policy actions set out or are intended to attain or accomplish. Top level class for Goals and Objectives. source:(objectives-ont)	http://www.daml.org/experiment/ontology/objectives-ont#Objectives
cppv:OversightEntity	A distinct or independent body charged with supervision and observation of policy implementation	http://www.egov.deri.ie/cppv.owl#OversightEntity
terms2:PeriodOfTime	An interval of time that is named or defined by its start and end dates. source:(dublin core)	http://dublincore.org/documents/2012/06/14/dcmi-terms/?v=terms#PeriodOfTime
prov:Plan	A detailed proposal for doing or achieving something. A plan is an entity that represents a set of actions or steps intended by one or more agents to achieve some goals. source:(prov)	http://www.w3.org/ns/prov#Plan
cppv:Poilcy	A combination of law, rules and guidelines that determine or control results, management and information usage – that designs the role of information in a community	http://www.egov.deri.ie/cppv.owl#Policy
fabio:PolicyDocument	A document embodying a policy that descibes and defines how something should be done. source:(fabio)	http://purl.org/spar/fabio/PolicyDocument
cppv:Programme	A planned series of future events or performances. Structures for implementing and executing policies	http://www.egov.deri.ie/cppv.owl#Programme

(*continued*)

Table 1. (*continued*)

Class	Description	URI
cpsv:PublicService	This class represents the service itself. A public service is the capacity to carry out a procedure and exists whether it is used or not. It is a set of deeds and acts performed by or on behalf of a public agency for the benefit of a citizen, a business or another public agency. source:(cpsv)	http://purl.org/vocab/cpsv#PublicService
cppv:Regulation	The system of rules which a particular country or community recognizes as regulating the actions of its members and which it may enforce by the imposition of penalties	http://www.egov.deri.ie/cppv.owl#Regulation
cppv:Sector	A distinct part, especially of society or of a nation's economy that is impacts or impacted by the public policy	http://www.egov.deri.ie/cppv.owl#Sector
cppv:Stakeholder	All key parties influenced or affected by the implementation of a policy	http://www.egov.deri.ie/cppv.owl#Stakeholder
cppv:Vision	An organisation's road map, indicating both what it wants to become and guiding transformational initiatives by setting a defined direction for growth or achievement	http://www.egov.deri.ie/cppv.owl#Vision

Table 2. CPPV object properties i.e. relations

| Object property	Domain	Range	Is inverse of
belongsTo	Vision	Policy	hasVision
compose	Stakeholder	institutional_structure	composedOf
constructs	Vision	Objective	constructedBy
documents	PolicyDocument	Policy	documentedby
executes	institutional_structure	Programme	executedBy
governs	GuidingFramework	Policy	governedBy
impacts	Policy	Sector	isImpactedBy
implements	Programme	Policy	implementedBy
influences	Policy	Stakeholder	influencedBy
organizes	Plan	Programme	organizedBy
oversees	OversightEntity	Policy	overseenBy
relatedTo	Thing	Thing	relatedTo
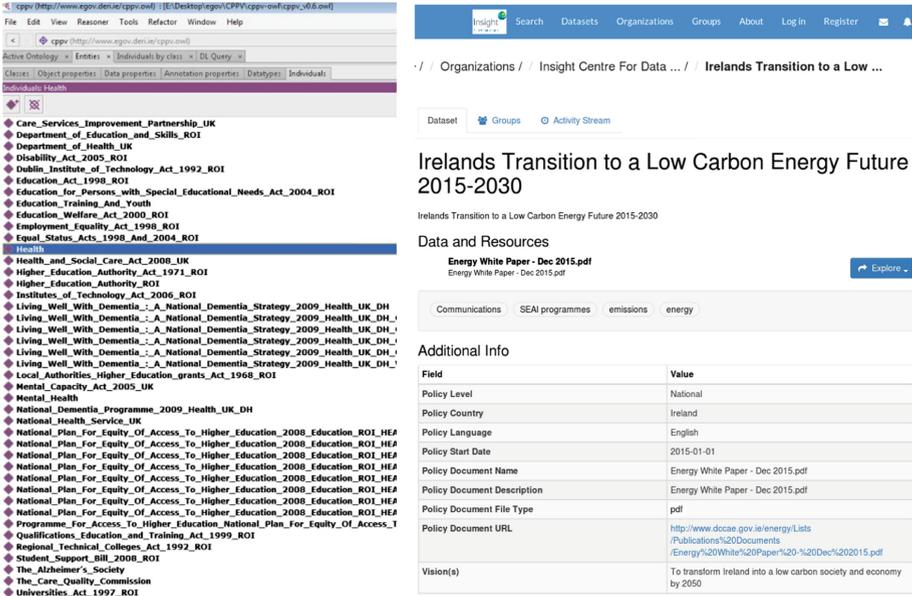
Fig. 3. Core Public Policy Vocabulary implementations in Protégé and CKAN

In addition to the vocabulary, the use of standard code lists and entity identifiers are required to fully link up the published policies.

5   Applications

This section describes in more details how the vocabulary could be exploited to enable collaboration among government entities in the implementation of public policies. Following this, we present a few other application scenarios of the CPPV vocabulary and discuss how it could be formally adopted.

5.1   The Collaboration Scenario

Let's assume the availability of the above CKAN based Open Policy Repository in a Public Administration jurisdiction. In addition, we could assume that all public authorities are mandated to publish the policies on the Open Policy Platform. Supposing the Environment department would like to design a policy to address the increasing level of air pollution in a city produced by cars. One of the policy makers in the Environment searches for "air pollution" on the policy repository to identifier other policies that may be addressing issues related to air pollution. He discovers that the Trade and Transport ministries are two other departments interested on the issue. The reference from the Trade department referred to levels of emissions permitted from imported cars and the Transport department reference was linked to the road worthiness assessment.

The policy officer from the environment investigates the programmes associated with respective policies and sets up meetings to better understand how the new policy to be design could leverage the existing programs. The officer also wishes to know how the environment department could participate in pollution related programs of these other departments.

5.2 Other Application Scenarios

Here we highlight two other application scenarios for the CPPV vocabulary.

Scenario 2: Semantic Policy Search Engine: Researchers and Business users of a CPPV ontology based search engine to browse the public policies or run complex queries, to discover opportunities in a market. Example: Firm X is specialized in the energy sector; they would like to extend their business to Country Y. To get a better understanding of the market they need to review Country Y's energy policies and related policies using a search engine such as the semantic policy search engine.

Scenario 3: "Policy learning" - During the policy making or policy update processes, governments may review policies from the Open Public Policy platform to find best practices or certain policy aspects to adopt. Example: Government Y is developing a new Health policy and would want to review different Health polices implemented in the European Union, query for certain aspects of the Health policies to improve their policy decisions.

5.3 Formal Adoption of the Core Public Policy Vocabulary

Finally, we briefly highlight the vision for the adoption of the vocabulary. Currently, the vocabulary is being reviewed by experts involved in public sector information modelling practices in Ireland, Scotland and UK, semantic interoperability and standards in Europe for staged adoption. After the adoption by a these governments, the follow-up steps entails submitting the vocabulary to the European Commission's ISA programme as a candidate Core Vocabulary.

6 Conclusion

Our work was motivated the lack of the of central repository for government policies in Europe and the underpinning semantic data model or vocabulary to facilitate the inter-linking and exchange of public policies in the European Public Administration Ecosystem. The unavailability of such infrastructure makes the collaboration among public agencies and development of coherent public policies difficult. In addressing this challenge, we have developed a public policy ontology guided by the principles driving the ISA's Core Vocabulary initiatives. Our Core Public Policy Vocabulary complements existing core vocabularies and reuses elements of these vocabularies.

We are currently in the second stage of the third-party country expert review process of the vocabulary. We intend to develop many uses cases to demonstrate policy collaboration opportunities afforded by the CPPV. In addition, we plan to provide

reference implementation using other technologies such as Semantic Media Wiki or Wiki Data[8]. In the near future, we intend to propose the CPPV vocab as a candidate ISA Core Vocabulary.

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