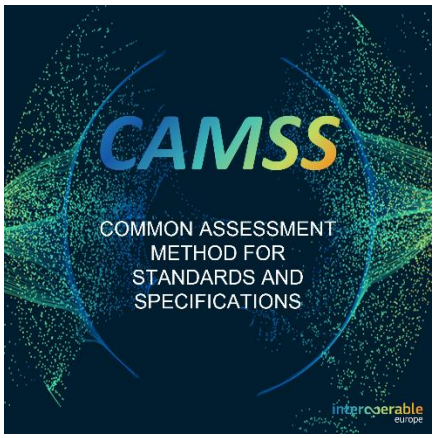

ASSESSMENT SUMMARY v1.0.0

Basic Formal Ontology (BFO)[1]

International Organization for Standardization (ISO)[2]

[1] BFO: https://www.iso.org/standard/74572.html

[2] ISO: https://www.iso.org/home.html

Change Control

Modification	Details
Version 1.0.0	
Initial version	

TABLE OF CONTENT

1. INTRODUCTION

The present document is a summary of the assessment of the **BFO** carried out by CAMSS using the CAMSS Assessment EIF scenario[3]. The purpose of this scenario is to assess the compliance of a standard or specification with the European Interoperability Framework (EIF)[4].

2. ASSESSMENT SUMMARY

The **Basic Formal Ontology (BFO)** is a small, upper level ontology that is designed to be used in supporting information retrieval, analysis and integration in scientific and other domains. BFO is a genuine upper ontology, which means that does not contain any domain-specific vocabulary, even though BFO is widely used in scientific domains which would properly fall within the coverage domains of the special sciences. BFO is used by more than 550 ontology-driven endeavours throughout the world.

In the context of the BFO at EU level, the specification is the core element of the Elementary Multiperspective Material Ontology[5] (EMMO), developed by the European Materials Modelling Council[6], and it is within this project that BFO shows its domain agnostic properties since the EMMO reaches far beyond the BFO original scope.

The specification has been developed by the International Organization for Standardization (ISO), which is an international community concerned with developing international standards.

2.1. EIF Interoperability Principles

Interoperability principles are fundamental behavioural aspects that drive interoperability actions. They are relevant to the process of establishing interoperable European public services. They describe the context in which European public services are designed and implemented.

***The specification does not support the principles setting context for EU actions on interoperability*:**

- **Subsidiarity and proportionality**
  There is no Member State that includes the BFO in their national catalogue with their National Interoperability Framework (NIF) in alignment with the three categories 1. Conceptual model for integrated public services provision, 2. interoperability layers, and 3. interoperability principles.

The specification fully supports the principles setting context for EU actions on interoperability:

- **Openness**
  The specification supports the five points of the 5-star deployment scheme for Open data[7] since:

[3]CAMSS Assessment EIF Scenario: https://ec.europa.eu/eusurvey/runner/CAMSSAssessmentEIFScenario6

[4] ISA2 programme: https://ec.europa.eu/isa2/eif_en

[5] EMMO: https://emmo-repo.github.io/

[6] EMMC: https://emmc.eu/

[7] Tim Berners 5-star deployment scheme for Open data: https://5stardata.info/en/#

1) BFO enables the publication of data on the web under an open licence (OWL),
2) BFO makes data available in structured way (OWL),
3) BFO can be used to serialised data in an open format, such as TTL,
4) BFO relies on URIs to denote things,
5) BFO enables linking data in the context of other ontologies

The development process has been carried out by ISO. Standards are developed by groups of experts called technical committees. These experts are put forward by ISO's national members. If a user interested in getting involved, they ought to contact their national standards body[8]. Companies and individuals are not eligible to join ISO as members.

BFO is publicly available for free as an ISO Publicly Available Specification (PAS) and also in the BFO GitHub[9], and It is licensed on a royalty-free basis for its implementation or study.

- **Transparency**

The specification covers the need for a top-level ontology designed to support information system interoperability expressed by ontology users in these and other areas. In this sense the specification can promote the visibility of administrations on the specific fields where they are operating, since users will be able to browse through them following the specific categories.

- **Reusability**

The ambition and scope of BFO is to provide a useful upper-level ontology that can be extended to any jurisdiction or domain-specific applications, providing a versatile data model adaptable to multiple business domains.

- **Technological neutrality and data portability**

BFO is independent of any specification and does not rely on any technology or platform. Moreover, the BFO can be adapted and expanded to the specific needs of organisations, allowing for partial implementations and customisations depending on the requirements of the particular context where it is intended to be applied.

***The specification partially supports the principles related to generic user needs and expectations*:**

- **User-centricity**

The purpose of BFO is not related to the reuse of information. Therefore, this criterion is not applicable to the specification.

[8] ISO Technical commitees: https://www.iso.org/get-involved.html

[9] BFO on Github: https://github.com/BFO-ontology

- **Inclusion and accessibility**

  The purpose of BFO is not related to e-accessibility. Therefore, this criterion is considered not applicable to this specification.

- **Security**

  The purpose of BFO is not related to the provision of means for restriction of access to information/data. Therefore, this criterion is considered not applicable to this specification.

- **Privacy**

  The purpose of BFO is not related to the protection of personal data managed by Public Administrations since the specification does not provide any privacy considerations.

- **Multilingualism**

  BFO foresees the support for multiple languages but currently only Portuguese[10] is available alongside English.

The specification fully supports the foundation principles for cooperation among public administrations:

- **Administrative Simplification**

  BFO is not used in European institutions but BFO contributes to improve interoperability and portability of data, as EMMO does in the material processing domain.
  Although no evidence of BFO facilitating digital service delivery channels were found, the specification could enable the migration of services and data across various platforms, making it an efficient and flexible solution for digital services.

- **Preservation of information**

  The main purpose of BFO is related to the provision of a hierarchy of categories to be used in multiple fields to classify and organise data. This core element of BFO is what gives it the possibility to be developed into an ontology dedicated to long term preservation of data.

- **Assessment of effectiveness and efficiency**

  BFO is a core element of multitude of existing implementations that address the effectiveness of the criterion.

[10] Portuguese version of BFO: https://mba.eci.ufmg.br/legal/bfo-pt

2.2. EIF Interoperability Layers

The interoperability model which is applicable to all digital public services includes:

- Four layers of interoperability: legal, organisational, semantic and technical;
- A cross-cutting component of the four layers, 'integrated public service governance';
- A background layer, 'interoperability governance'.

The Specification partially supports the implementation of digital public services complying with the EIF interoperability model:

- **Interoperability governance**

  BFO is already associated to the EIRA ABB Ontology in the EIRA Library Of Interoperability Specifications[11] (ELIS). Although BFO is not included in any catalogue, neither at national nor European level, the EU-based EMMO project adopted the specification as reference top level ontology.

- **Legal Interoperability**

  BFO is not a European Standard nor have been adopted as such within the EU.

- **Organisational interoperability**

  Basic Formal Ontology (BFO) consists in thirty-eight classes, designed to support information integration, retrieval, and analysis across all domains of scientific investigation, presently employed (according to the available data on the specification page) in over 350 ontology projects around the world. BFO is a genuine top-level ontology, containing no terms particular to material domains, such as physics, medicine, or psychology.
  The specification is used by the European Materials Modelling Council (EMMC) in order to organise the top level ontology that leads to a better integration of business processes related to material processing.

- **Semantic Interoperability**

  While the BFO is an upper level ontology that is designed for use in supporting information retrieval, analysis and integration in scientific and other domains currently there is no widespread sharing of data among users due to the wide variety of applications and no communities have been created that share data based on the BFO structure. BFO is the core element of the Elementary Multiperspective Material Ontology (EMMO) used to organise the top level ontology that leads to a better integration of business processes related to material processing.

[11] EIRA Library of Interoperability Specifications (ELIS): https://joinup.ec.europa.eu/collection/common-assessment-method-standards-and-specifications-camss/solution/elis/release/v610

3. Assessment Results

This section presents an overview of the results of the CAMSS assessments for **BFO**. The CAMSS "Strength" indicator measures the reliability of the assessment by calculating the number of answered (applicable) criteria. On the other hand, the number of favourable answers and the number of unfavourable ones are used to calculate the "Automated Score" per category and an "Overall Score".

Category	Automated Score	Assessment Strength	Compliance Level
Principle setting the context for EU actions on interoperability	20/100 (20%)	100%	Ad-hoc
Core interoperability principles	1060/1700 (86%)	88%	Seamless
Principles related to generic user needs and expectations	920/1200 (77%)	41%	Sustainable
Foundation principles for cooperation among public administrations	420/500) (84%)	100%	Seamless
Interoperability layers*	740/1000 (74%)	100%	Sustainable
Overall Score	2660/3600 (74%)[12]	80%	

**The technical interoperability layer is covered by the criteria corresponding to the core interoperability principle ''Openness''.*

With a 80% of assessment strength, this assessment can be considered representative of the specification compliance with the EIF principles and recommendations.

The Overall Automated Score of 74% (2660/3600) demonstrates that the specification supports the European Interoperability Framework in the domains where it applies.

[12] See the "results interpretation" section of the CAMSS Assessment EIF Scenario Quick User Guide:

https://joinup.ec.europa.eu/collection/common-assessment-method-standards-and-specifications-camss/solution/camss-assessment-eif-scenario/results-visualisation-and-interpretation