

# Developing a Comprehensive Ontology for Food Consumer Science: Insights from the COMFOCUS Project

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## Abstract

**Introduction:** The need for interoperable and reusable research data in food consumer science calls for a robust ontology that encapsulates the complexity of the domain. The COMFOCUS project addresses this need by developing an ontology aimed at harmonizing data models and adhering to FAIR principles, facilitating an integrated approach to food consumer research.

**Methods:** Our methodology involved a detailed process adhering to best practices in ontology development, including the integration with existing semantic resources to ensure comprehensive coverage of food consumer science. We utilized the Basic Formal Ontology as an upper framework, aligning our work with the OBO Foundry principles for compatibility and integration purposes. Key elements such as raters, attributes, targets, and micro-contexts were conceptualized within a logical framework based on both established and emerging theories in the field.

**Results:** The COMFOCUS ontology provides a structured vocabulary for food consumer science, covering aspects such as individual raters, measures (attributes), food entities (targets), and specific contexts of data collection (micro-contexts). It facilitates the semantic enrichment of data, supporting interoperability and reusability across different research domains. Additionally, the ontology serves as a tool for synthesizing diverse data sources, contributing to a unified understanding of food consumer behavior, and enabling interdisciplinary research collaboration.

**Conclusion:** The COMFOCUS ontology advances the goal of creating a shared semantic foundation for food consumer science. By offering a coherent structure for describing and comparing research data, it fosters interdisciplinary collaboration and paves the way for innovative solutions in food consumer science. The ontology shows how a semantic framework can improve data-based research in food consumer science.

## Keywords

FAIR data, food consumer science, ontology development, semantic integration, interdisciplinary collaboration

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*JOWO Workshop – IFOW 2024, July 15-19, 2024, Enschede, NL*

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## 1. Background

The main goal of the EU-funded project COMFOCUS is to harmonize the research methods in the food consumer science domain by which the evidence base for policy is extended. To facilitate food consumer scientists in managing the harmonization and integration of complex data, derived from diverse sources, and characterized by heterogeneity, we introduce a novel domain ontology called COMFOCUS. This ontology is constructed upon the COMFOCUS logical framework, designed in collaboration with experts from the domain of food consumer science. The framework serves to delineate relevant concepts, their interrelations, and interactions.

Drawing upon the principles of the C-OAR-SE framework for scale development (Rossiter, 2002), COMFOCUS adopts a structured approach. The acronym C-OAR-SE represents Construct definition, Object classification, Attribute classification, Rater identification, Scale formation, Enumeration, and reporting. Building upon this foundation, COMFOCUS extends the framework with a crucial component called "micro-context". This addition enables the consideration of individual data points within a dataset as manifestations (attributes/measures) provided by a specific entity (rater) regarding a particular subject (object) within a defined micro-context.

## 2. Methods

First, domain experts defined relevant concepts by so-called harmonized measures, covering the specific subdomains of socio-demographics, psychosocial, psycho psychological, food and product, and consumer behavior. A user-friendly tool, named Easy Questionnaire Tool (EQT), was developed to enable researchers smooth creation of questionnaires for food consumer research (EQT Manual, 2024). A valuable feature of EQT is the possibility to export questionnaires so that they can be easily imported in widely used tools, such as Qualtrics (Qualtrics, 2024). Harmonized measures that have been made within EQT were exported to serve as questionnaires for multiple primary studies.

Next, the COMFOCUS ontology was designed adhering to established standards such as OBO Foundry (OBO, 2024) and Dublin Core (DC, 2024). Employing the Minimum Information to Reference an External Ontology Term (MIREOT) principle, we selectively import or reference pertinent terms from external ontologies into our target ontology. This approach mitigates redundancy while ensuring modularity and interoperability. At the top of our ontology hierarchy lies the Basic Formal Ontology (BFO), providing foundational structure. Situated beneath are mid-level ontologies including the Relation Ontology (RO), Information Artifact Ontology (IAO), and others. This hierarchical organization streamlines conceptual clarity and facilitates effective knowledge representation.

### 3. Results

The COMFOCUS ontology has been developed by using the Protégé ontology editor (Protege, 2024). Harmonized measures from EQT and classes from external ontologies were extracted using the OntoFox tool (OntoFox, 2024) using the MIREOT principle. For the transformation of information from EQT to the COMFOCUS ontology, we have utilized a Jožef Stefan Institute (JSI) in-house plugin, however, there is also an option of applying the Celfie plug-in for Protégé (Celfie, 2024).

### 4. Conclusion

The COMFOCUS ontology has been designed and enriched with harmonized measures defined by food consumer scientists. At present, these harmonized measures are confined within the sub-domains of socio-demographics, psychosocial, psycho psychological, food and product, and consumer behavior. Moving forward, our objective is to broaden the ontology's scope by incorporating concepts pertaining to the use of emerging technologies for food consumer science. Additionally, we plan to validate the applicability of the COMFOCUS ontology by facilitating the harmonization and integration of data currently being collected by consumer scientists participating in the COMFOCUS Open Call 2. This validation process will serve to affirm the utility and effectiveness of the ontology in real-world scenarios.

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