

# *PO<sup>2</sup> VocabularyManager*

## A Collaborative Tool to Assist Users in Building a PO<sup>2</sup> Domain Ontology Linked with Existing Resources

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SemFAEN 2018  
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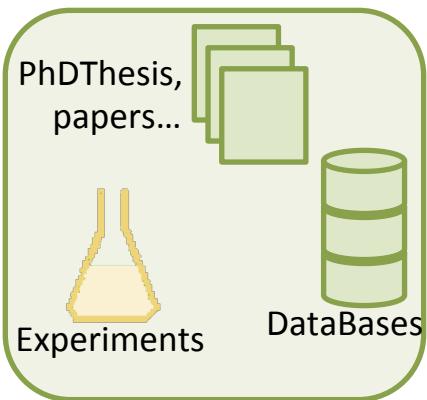


# NutriSensAI project (2015-2018)

- Aim: formulate **well-balanced** products (e.g. less fat, sugar and salt) with **acceptable sensory qualities** for the consumer while using **eco-friendly** production process.
- INRA (French National Institute for Agricultural Research) experts
  - Cheese production
  - Sensory perception
  - Life Cycle Analysis
- Available data
  - On Dairy Gels
  - Research data
  - Real and model cheeses
- A proof of concept for a decision support tool
  - **Knowledge and data representation and integration task**
  - Decision tool



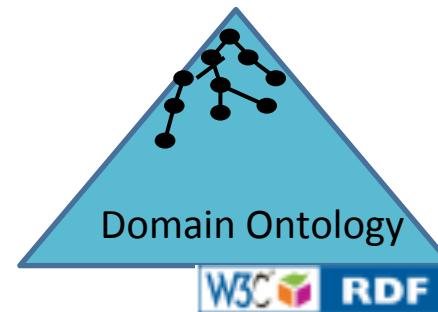
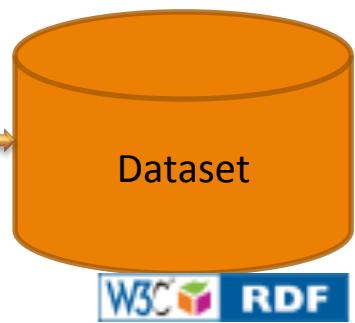
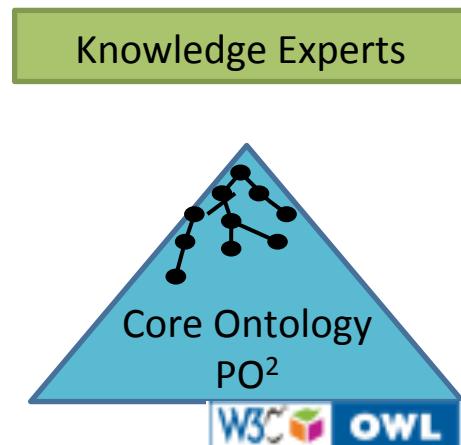
# Knowledge and data representation and integration task



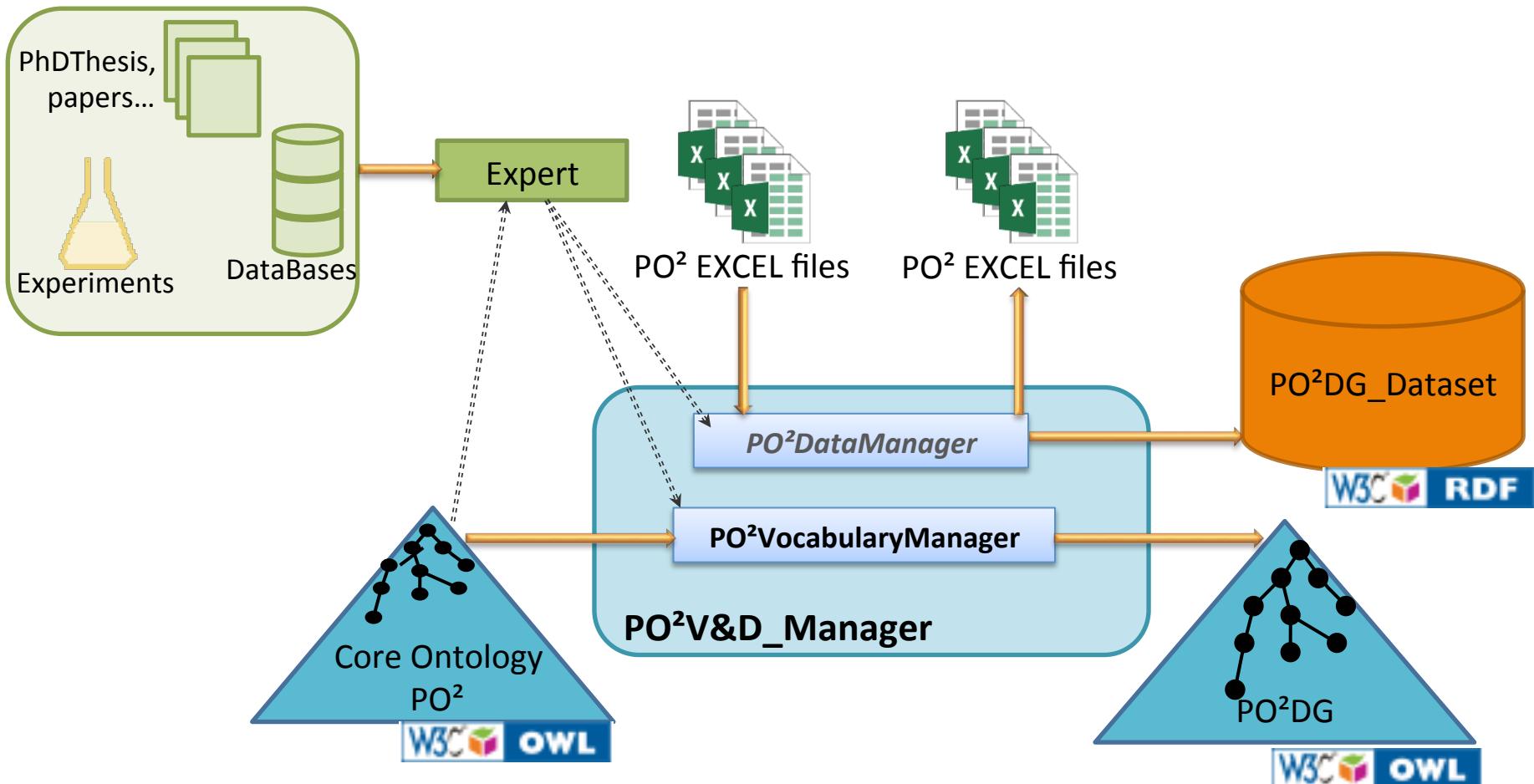
Domain Experts



Guidelines



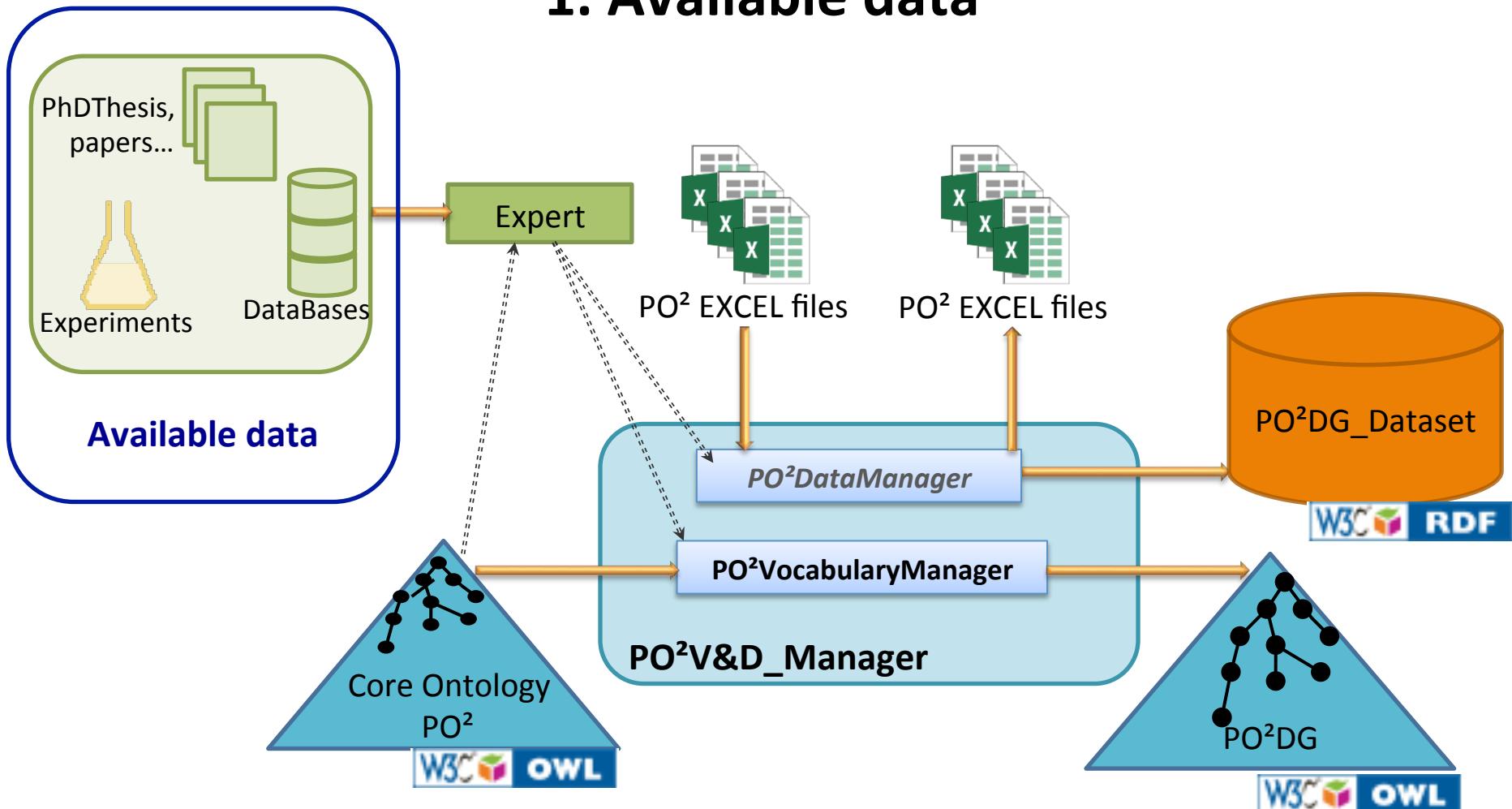
# The workflow



-----> is necessary  
→ Is used

# The workflow

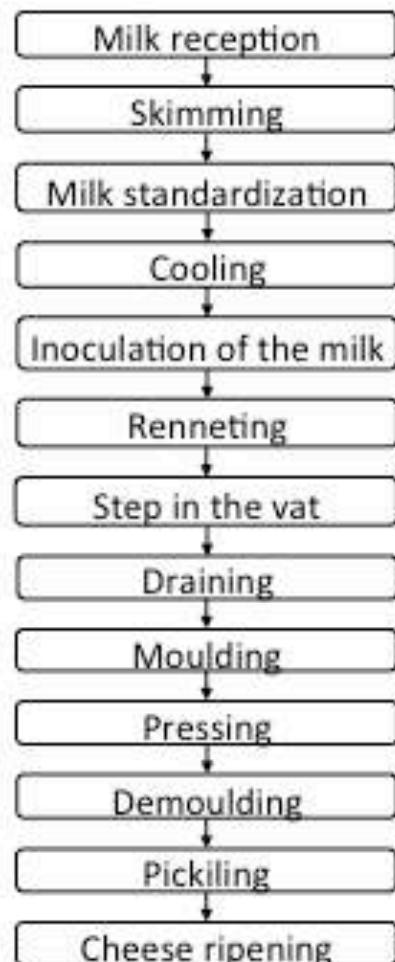
## 1. Available data



-----> is necessary  
→ Is used

# Available Data

## Cheese production steps



	Process_name	Sample	Taste_intensity	Taste_intensity_unit
1	Sensory analysis	Fd24 (T1-F2-L4)	"6.82"	/10

## Parameters for Life Cycle Assessment

Obj_label	Quality_label	Steps
electricity	energy	fermentation; centrifugation; drying
water	mass	composition; fermentation; drying
washing water	mass	fermentation
rinsing water	mass	fermentation
unclean water	mass	fermentation
supernatant effluent	mass	centrifugation
vapor	mass	fermentation
compressed air	volume	drying
washing-up liquid	mass	fermentation
saccharose	mass	composition
NaOH 0,1m	mass	fermentation
KH <sub>2</sub> PO <sub>4</sub>	mass	composition
yeast extract	mass	composition
defoamer	volume	composition
polypropylene cups	mass	centrifugation
packaging (PP)	mass	storage

Date	2012				
Project name	CARREDAS PhD BOISARD				
Sample name	cheese model				
Sample code number	L20P28				
Step	Sub-step	Measure	Scale	Files number	Data type
Before putting in the mouth	NA	Composition	Mixture	1	Raw
Before putting in the mouth	NA	Itinerary	Mixture	1	Raw
Before putting in the mouth	NA	Characteristics	Mixture	10	Raw and computed
In the mouth	Chewing	Study of the sodium release in the saliva	Mixture	1	Raw
In the mouth	Chewing	Chewing activity	Step	1	Raw and computed
In the mouth	Chewing	Study of the flavour components release in the air	Mixture	1	Computed
In the mouth	Chewing	Sensory properties	Mixture	1	Raw and computed
In the mouth	Swallowing	Swallowing number	Step	1	Raw
In the mouth	Swallowing	Study of the flavour components release in the air	Mixture	1	Raw and computed

# Process Product

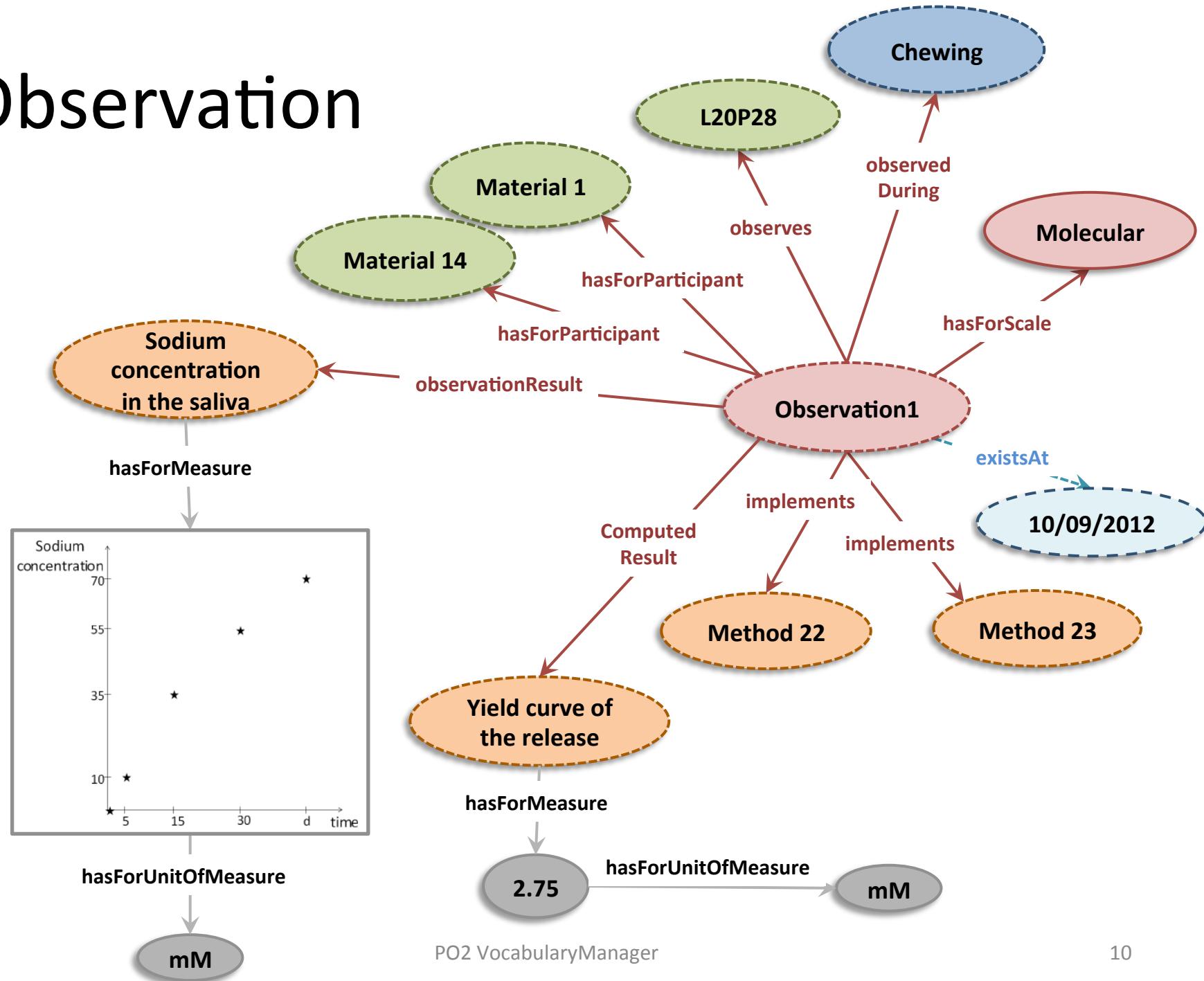
# Product, mixture

Product description		
Sample code number	L20P28	
Name of the description file	2012-CAREDAS-001-FicheDescriptif	
Raw data		
Characteristics	Value	Unit
Rennet casein	238.3	g/kg of cheese model
Acide casein	59.6	g/kg of cheese model
AMF	200.2	g/kg of cheese model
Deionized water	464.4	g/kg of cheese model
Melting salt	25	g/kg of cheese model
Added Nacl	0	g/kg of cheese model
Citric acid	2.5	g/kg of cheese model
Aromatic solution + water	10	g/kg of cheese model
lipids	20	g/kg of cheese model
proteins	28	g/kg of cheese model

# Experimental observation

General informations				
Date of the measure	10/09/2012			
Time				
Duration of the manipulation				
Step	In the mouth			
Sub-step	Chewing			
Scale	Molecular			
Repetitions	1			
Product description				
Sample code number	L20P28			
Name of the description file	2012-CAREDAS-001-FicheDescriptif			
Material used				
Identifier	Material 1			
Identifier	Material 14			
File	2012-carredas etapesenbouche-001-M&M			
Method used				
Identifier	Method 22			
Identifier	Method 23			
File	2012-carredas etapesenbouche-001-M&M			
Raw data				
Characteristics	value	Unit	Uncertainty	Description
Sodium concentration in the saliva at T0	0	mM		
Sodium concentration in the saliva at T5	10	mM		
Sodium concentration in the saliva at T15	35	mM		
Sodium concentration in the saliva at T30	55	mM		
Sodium concentration in the saliva at Td	70	mM		
Computed data				
Characteristics	value	Unité	Incetainty	Description
Yield curve of the release = sodium concentration by tooth bite	2.75	mM		

# Observation



# Competency Questions [INDA 2018]

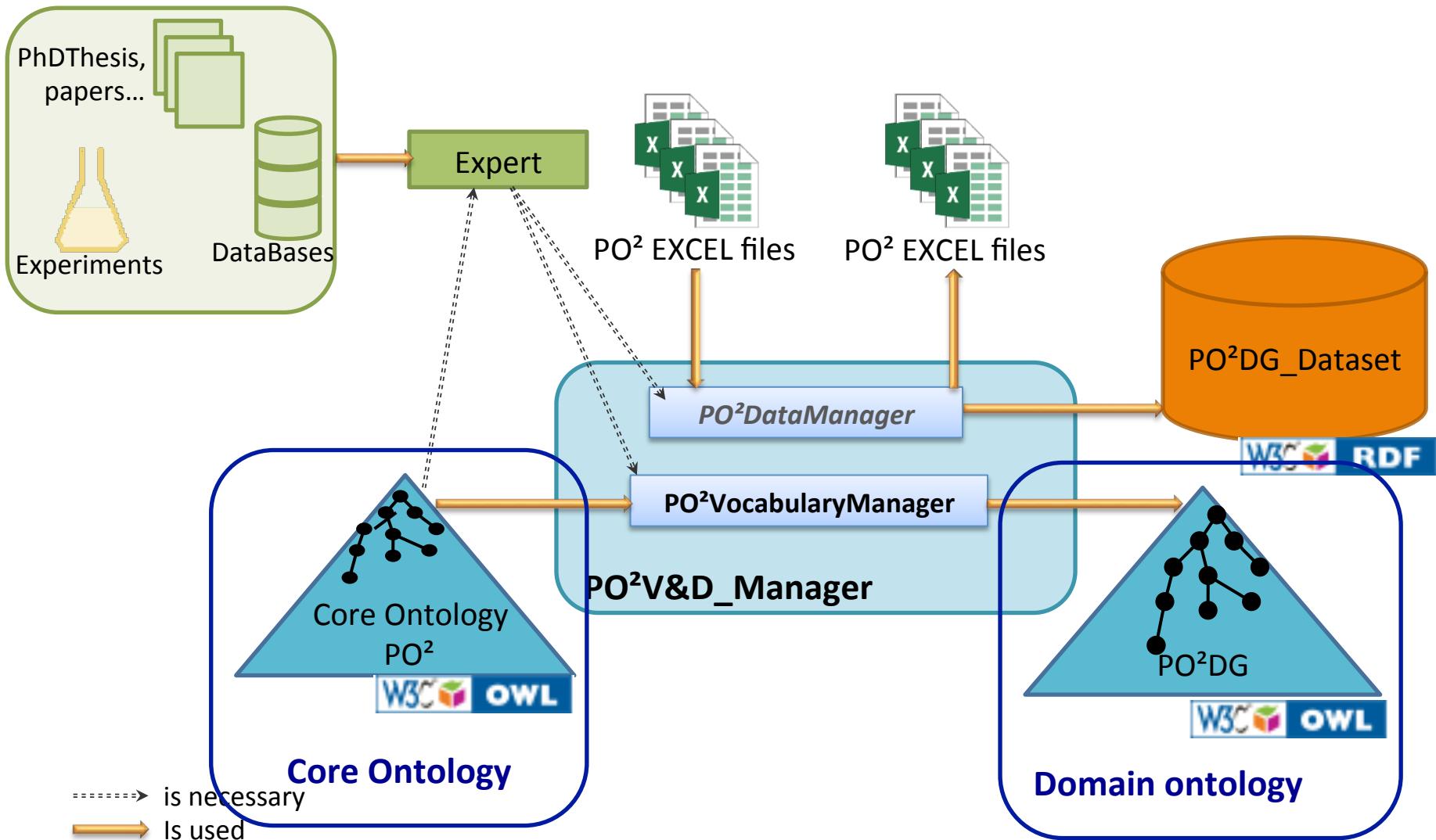
1. Which hard cheese sample has the highest value for taste intensity and the highest value for aroma intensity?
2. What is the composition of this sample at different steps in the process?
3. What are the sensory firmness and rheological properties of this sample?
4. Which parameters are needed to be measured all along the technological process in order to perform a Life Cycle Assessment of the sample?

[INDA 2018] Pénicaud, C., Ibanescu, L., Allard, T., Fonseca, F., Dervaux, S., Perret, B., Guillemin, H., Buchin, S., Dibie J., and Guichard, E.:

Relating transformation process, eco-design, composition and sensory quality in cheeses using PO<sup>2</sup> ontology.  
International Dairy Journal (accepted for publication)

# The workflow

## 2. Ontologies



# PO<sup>2</sup>DG

## Process and Observation Ontology for Dairy Gels

- Build using NeON methodology (scenario 6)
- Extends the core ontology PO<sup>2</sup> [MTSR 2016]
- Reuses
  - BFO (Basic Formal Ontology)
  - IAO (Information Artifact Ontology)
  - GACS, AgroVoc, NALT
- Developed in OWL 2
- Available on AgroPortal:
  - [http://agroportal.lirmm.fr/ontologies/PO2\\_DG](http://agroportal.lirmm.fr/ontologies/PO2_DG)



[MTSR 2016] L. Ibanescu , J. Dibie, S. Dervaux, E. Guichard and J. Raad.  
[PO<sup>2</sup> – A Process and Observation Ontology in Food Science. Application to](#) Dairy Gels.  
In *MTSR 2016 Proceedings*, pp. 155-165. (2016)

# Metrics for PO<sup>2</sup>DG

## PO<sup>2</sup> Dairy gels

[Summary](#) [Classes](#) [Properties](#) [Notes](#) [Mappings](#) [Widgets](#)

### Details

ACRONYM	PO2_DG
VISIBILITY	Public
DESCRIPTION	specialization of PO <sup>2</sup> on dairy gels
STATUS	Alpha
FORMAT	OWL
CONTACT	Stéphane Dervaux, stephane.dervaux@inra.fr
HOME PAGE	
PUBLICATIONS PAGE	
DOCUMENTATION PAGE	
CATEGORIES	Agricultural Research, Technology and Engineering, Food and Human Nutrition
GROUPS	INRA Linked Open Vocabularies

### Additional Metadata

URI	<a href="http://opendata.inra.fr/PO2_DG/">http://opendata.inra.fr/PO2_DG/</a>
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[Go to the REST API JSON entry](#)

[Get my metadata back](#)

N-Triple

Json-LD

RDF/XML

### Metrics (?)

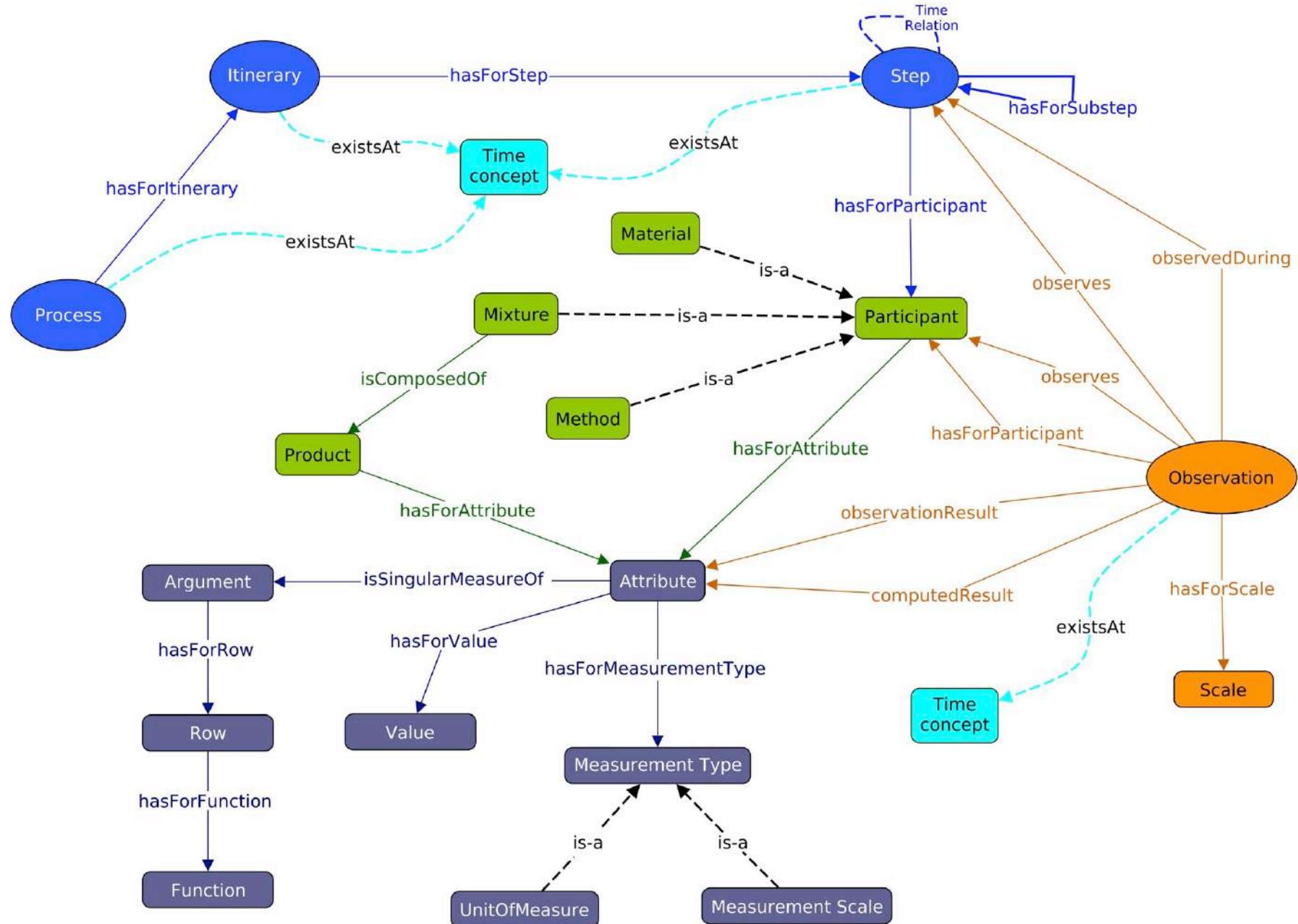
NUMBER OF CLASSES:	3475
NUMBER OF INDIVIDUALS:	6760
NUMBER OF PROPERTIES:	0
MAXIMUM DEPTH:	9
MAXIMUM NUMBER OF CHILDREN:	216
AVERAGE NUMBER OF CHILDREN:	4
CLASSES WITH A SINGLE CHILD:	280
CLASSES WITH MORE THAN 25 CHILDREN:	13
CLASSES WITH NO DEFINITION:	3470

# PO<sup>2</sup> Three parts



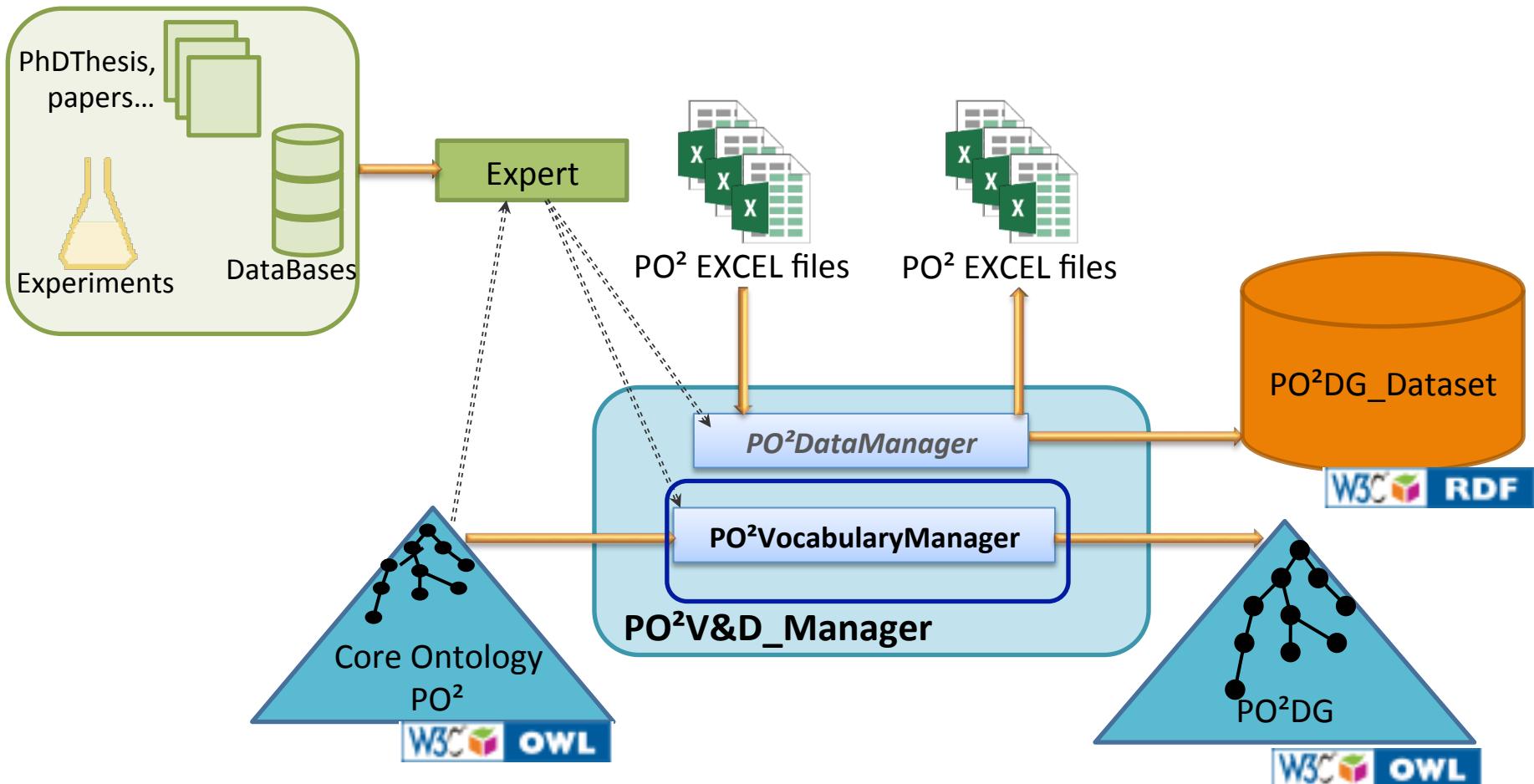
- Process
- Itinerary
- Step
- Product
- Mixture
- Material
- Observation
- Scale
- Method
- Measure

# PO<sup>2</sup>



# The workflow

## 3. PO<sup>2</sup>VocabularyManager

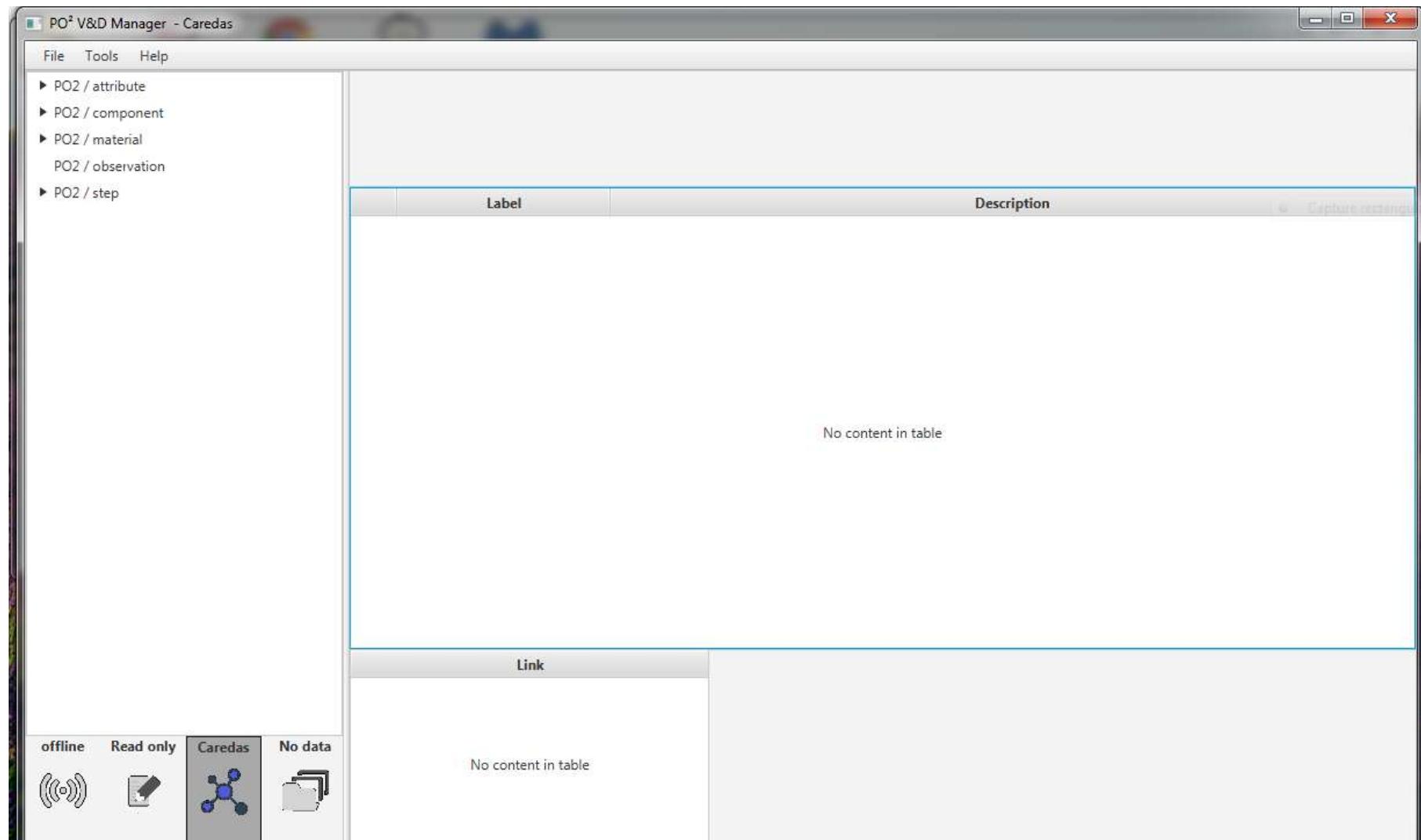


-----> is necessary  
→ Is used

# **PO<sup>2</sup>VocabularyManager**

- Assists domain experts in building PO<sup>2</sup>DG
  - Extends PO<sup>2</sup> core ontology
  - Navigation in the concepts hierarchy
  - Search for reusing existing semantic resources
  - Assist user in adding a new concept

# PO<sup>2</sup>VocabularyManager 1/9



# PO<sup>2</sup>VocabularyManager 2/9

The screenshot shows the PO<sup>2</sup>V&D Manager - Caredas application window. The left sidebar menu includes: File, Tools, Help, and categories like PO2 / attribute, PO2 / component, PO2 / material, PO2 / observation, and PO2 / step (with sub-options: before the study, cheesemaking, digestion, finished product, food processing, manufacturing process, properties, step in mouth, storage). The main area displays the entity 'food processing' with its label and description in various languages. Below this is a table of links to external resources.

**Entity Details:**

- Label:** food processing
- Description:** Lebensmittelverarbeitung, food processing, Lavorazione degli alimenti, procesamiento de alimentos, Traitement des aliments
- Link:** http://opendata.inra.fr/PO2\_Caredas\_SIM/step/food\_processing

**Bottom Status Bar:**

- offline
- Read only
- Caredas
- No data

# PO<sup>2</sup>VocabularyManager 3/9

The screenshot shows the PO<sup>2</sup>V&D Manager interface for the Caredas dataset. The left sidebar lists various manufacturing processes. The 'cheese ripening' entry is selected and highlighted in blue. The main panel displays the term 'cheese ripening' in a search bar and its detailed description in two languages: French and English. Below the description is a 'Link' section containing two URLs.

File Tools Help

manufacturing process

- addition of chrome EDTA
- addition of minerals
- addition of rennet
- adjustment of pH
- after inoculation of the milk
- brining
- cheese ripening**
- cleaning of the vat
- coagulation
- cooling
- demoulding
- end of the draining step
- enzymatic treatment
- flavouring
- gelling
- homogenization
- Ingredient preparation
- inoculation of the milk
- mechanical treatment
- milk preparation
- milk reception
- milk standardization
- mixing step
- moulding

Label

	Label	Description
	Affinage du fromage	L'affinage est la période de maturation pendant laquelle le fromage reçoit de nombreux soins à la cave ou dans un haloir. Plus la période de maturation est longue, plus le fromage sera corsé. Les soins apportés à sa croûte ainsi que les conditions de stockage du fromage influenceront son goût, sa couleur et sa texture. Il existe une grande différence de goût entre un fromage dont la croûte a été laissée sèche et un autre dont la croûte a été régulièrement humidifiée.
	maduración del queso	
	cheese ripening	Cheese ripening or alternatively cheese maturation is a process in cheesemaking. It is responsible for the distinct flavour of cheese, and through the modification of "ripening agents", determines the features that define many different varieties of cheeses, such as taste, texture, and body.

Link

<a href="http://fr.dbpedia.org/resource/Affinage_du_fromage">http://fr.dbpedia.org/resource/Affinage_du_fromage</a>
<a href="http://id.agrisemantics.org/gacs/C8808">http://id.agrisemantics.org/gacs/C8808</a>

offline Read only Caredas No data

# PO<sup>2</sup>VocabularyManager 4/9

D Manager - Caredas

Tools Help

Attribute component material observation step

re the study semaking stion ned product processing ufacturing process erties in mouth fore to put in mouth ewing allowing age

**Swallowing**

[http://opendata.inra.fr/PO2\\_Caredas\\_SIM/step/Deglutition](http://opendata.inra.fr/PO2_Caredas_SIM/step/Deglutition)

	Label	Description
	Deglutizione	La deglutizione è un atto fisiologico articolato che consente la progressione del bolo alimentare dalla cavità orale allo sputo. È una funzione essenziale molto complessa che necessita della coordinazione della muscolatura orofaringea, laringea ed esofagea. Se alterata può portare a gravi conseguenze quali disidratazione e denutrizione. Durante la deglutizione la faringe viene per solo pochi secondi in un tratto per la propulsione del cibo.
	Déglutition	La déglutition est l'action d'avaler. Le terme concerne aussi bien l'action d'avaler sa salive après la mise en occlusion des dents que l'action de déglutir une bouchée de nourriture.
	Deglución	La deglución es el paso del alimento desde la boca a la faringe y luego hasta el esófago. Los alimentos masticados por la lengua y humedecidos por la saliva, toman forma de una bola de consistencia pastosa, el bolo alimenticio, que es empujado por la lengua hacia atrás y entonces ingresa en la faringe. El pasaje del bolo alimenticio desde la boca hacia la faringe se denomina deglución.
	Swallowing	Swallowing, known scientifically as deglutition, is the process in the human or animal body that makes something pass from the mouth, to the pharynx, and into the esophagus, while shutting the epiglottis. If this fails and the object goes through the glottis, then choking or pulmonary aspiration can occur. In the human body it is controlled by the swallowing reflex.

**Link**

<http://fr.dbpedia.org/resource/Déglutition>

Read only Caredas No data

# PO<sup>2</sup>VocabularyManager 5/9

The screenshot shows the PO<sup>2</sup>VocabularyManager application interface. The left sidebar contains a tree view of vocabulary categories:

- PO2 / attribute
- PO2 / component
  - microorganisms
  - products
    - agricultural products
    - animal products
      - eggs
      - livestock products
    - meat
    - milk
      - buffalo milk
      - colostrum
      - cow milk** (selected)
      - ewe milk
      - goat milk
      - raw milk
      - whole milk
  - artificial products
  - byproducts
  - fat products
  - feeds
  - fish
  - foods
  - fresh products
  - new products
- offline
- Read only
- Caredas
- No data

The main panel displays the selected entry: "cow milk". It includes a thumbnail icon, the label "cow milk", and a link to its source: [http://opendata.inra.fr/PO2\\_Caredas\\_SIM/component/cow\\_milk](http://opendata.inra.fr/PO2_Caredas_SIM/component/cow_milk). Below this, there is a table with columns "Label" and "Description", showing the English label "cow milk" and the French label "Lait de vache". At the bottom, there is a "Link" section with the URL [http://aims.fao.org/aos/agrovoc/c\\_16080](http://aims.fao.org/aos/agrovoc/c_16080).

# PO<sup>2</sup>VocabularyManager 6/9

The screenshot shows the PO<sup>2</sup>VocabularyManager application window. The title bar reads "PO<sup>2</sup> V&D Manager - Caredas". The menu bar includes "File", "Tools", and "Help". The left sidebar contains a hierarchical tree view of product categories:

- oil products
- ▶ plant products
- ▼ processed products
  - bottled products
  - canned products
  - deep frozen products
- ▶ dried products
  - frozen products
- ▼ processed animal products
  - ▼ animal fats
  - egg products
  - ▼ milk products
    - butter
    - buttermilk
  - ▼ cheese
    - ▶ blue cheese
    - ewe cheese
    - ▶ fresh cheeses
    - goat cheese
  - ▼ hard cheese
    - Emmental cheese
    - ▼ Hard cooked cheese
      - Comté cheese
      - ▶ Semi-hard cheese
      - Model cheese

Comté cheese

[http://opendata.inra.fr/PO2\\_Caredas\\_SIM/component/comte\\_cheese](http://opendata.inra.fr/PO2_Caredas_SIM/component/comte_cheese)

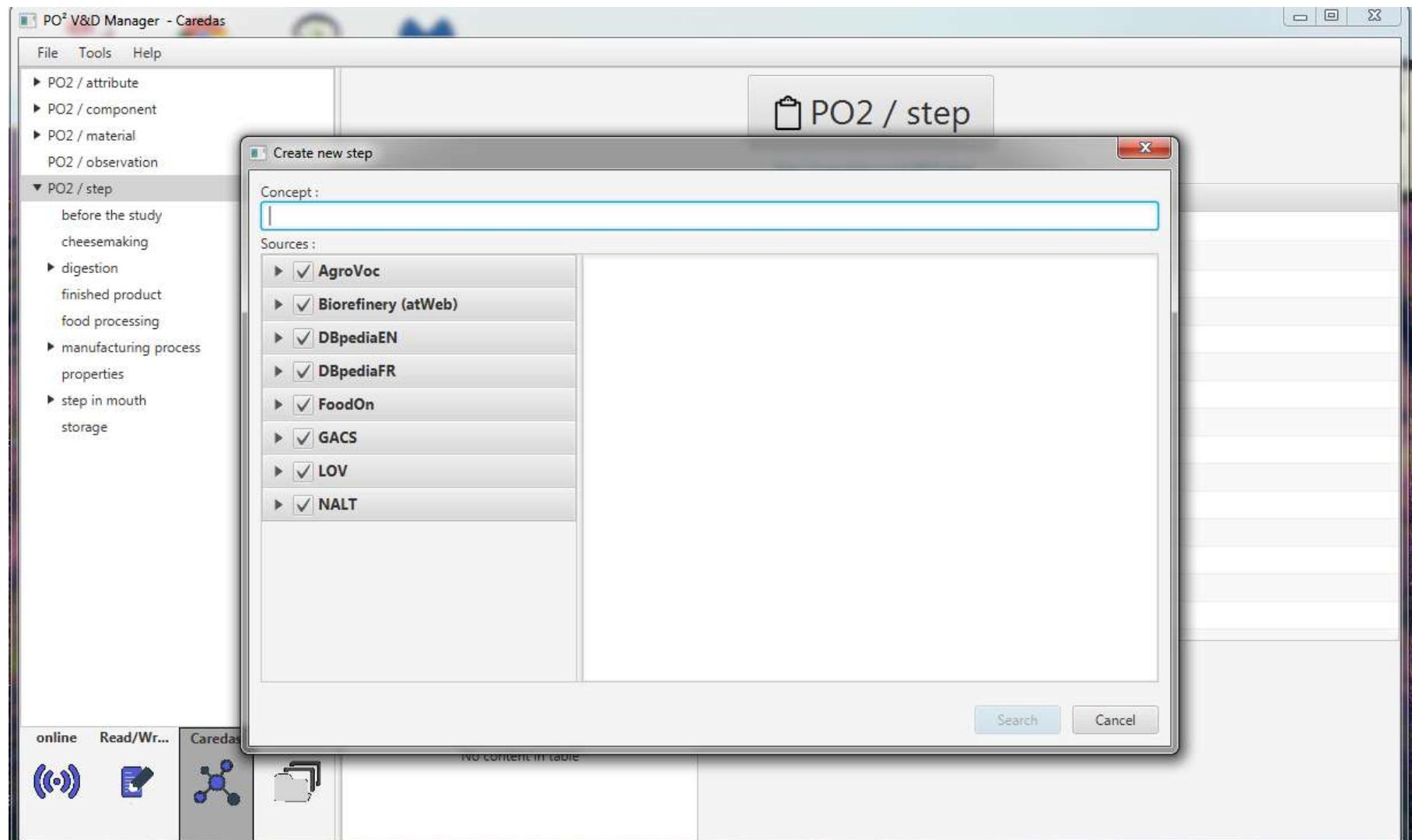
	Label	Description
	Fromage Comté	
	Comté cheese	

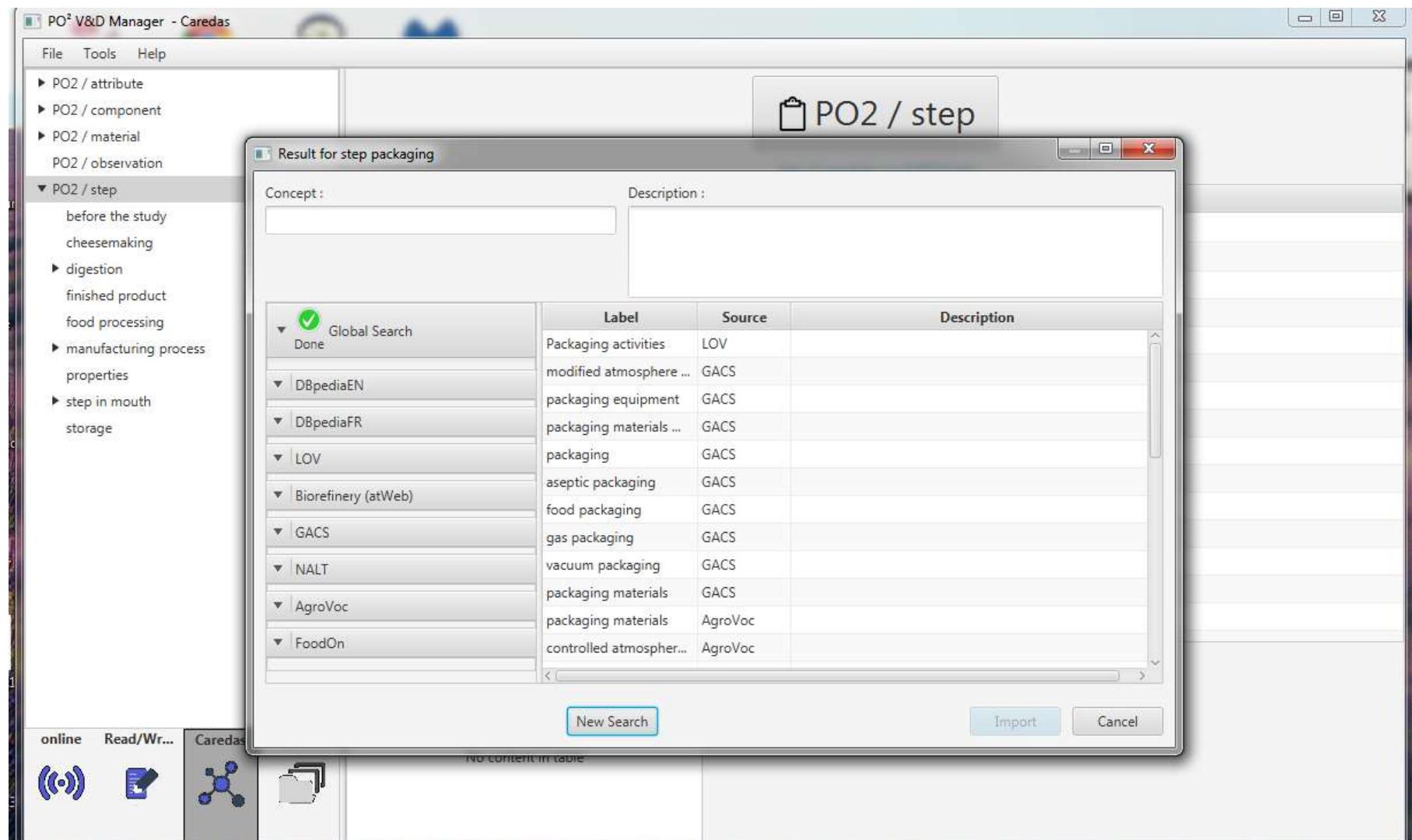
Link
No content in table



# PO<sup>2</sup>VocabularyManager 7/9



# PO<sup>2</sup>VocabularyManager 8/9



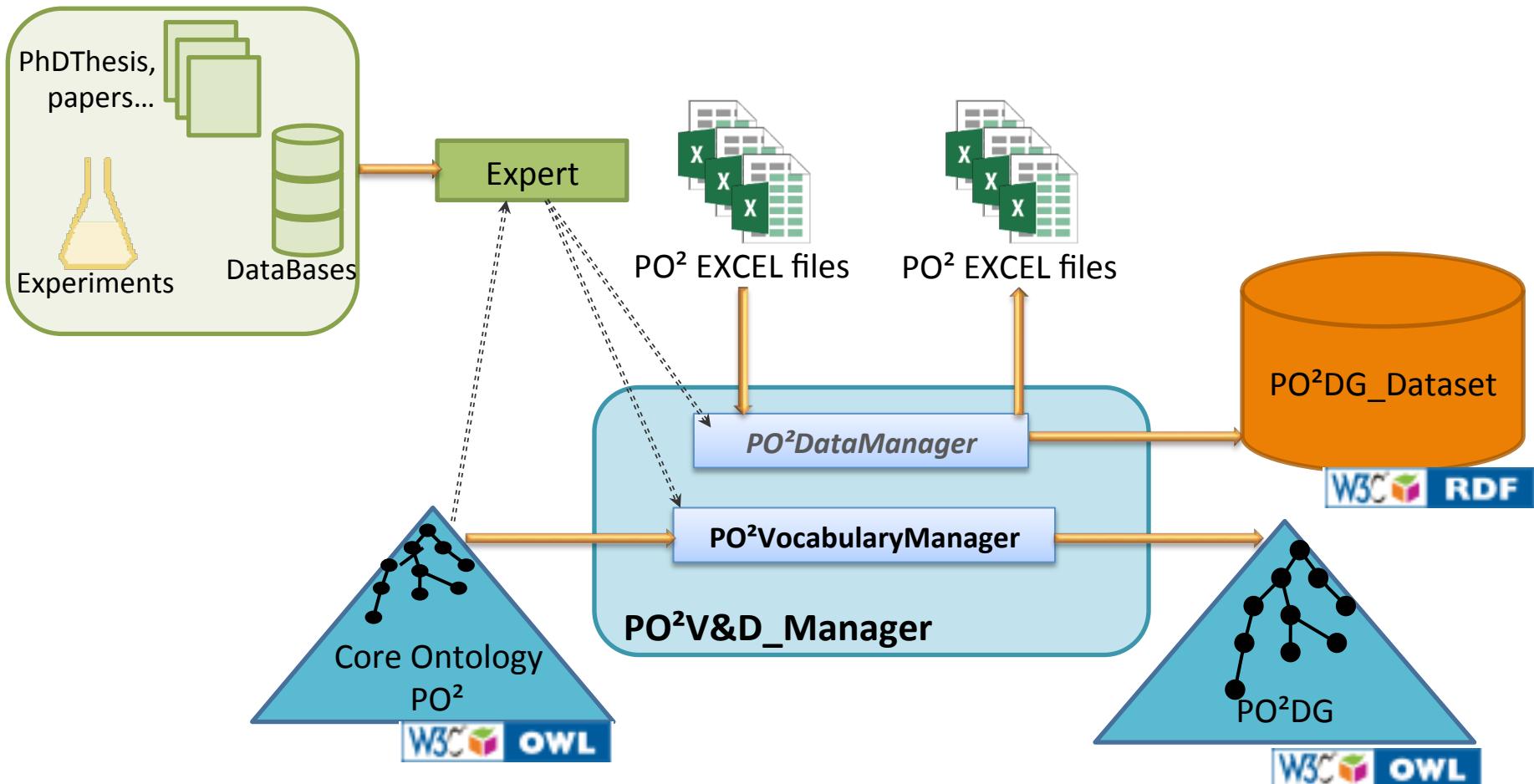
# PO<sup>2</sup>VocabularyManager 9/9

The screenshot shows the PO<sup>2</sup>V&D Manager application window titled "PO<sup>2</sup> V&D Manager - Caredas \*". The left sidebar contains a navigation tree with categories like "PO2 / attribute", "PO2 / component", "PO2 / material", "PO2 / observation", "PO2 / step", and "PO2 / step" expanded to show sub-items such as "before the study", "cheesemaking", "digestion", "finished product", "food processing", "manufacturing process", "properties", "step in mouth", "storage", and "packaging". The "packaging" item is selected and highlighted with a blue background. The main panel displays a vocabulary entry for "packaging". At the top, there is a large icon of a shopping bag labeled "packaging". Below it, the URL "http://opendata.inra.fr/PO2\_Caredas\_SIM/step/packaging" is shown. A table with two columns, "Label" and "Description", contains one row where the label is "packaging" and the description is empty. At the bottom of the main panel, there is a "Link" section with the URL "http://id.agrisemantics.org/gacs/C1915". The bottom left of the window features a toolbar with icons for "online" (refresh), "Read/Wr...", "Caredas" (with a molecular structure icon), and "No data" (with a folder icon). The status bar at the bottom shows the text "27".

# PO<sup>2</sup>VocabularyManager

- Assists domain experts in building PO<sup>2</sup>DG
  - Extends PO<sup>2</sup> core ontology
  - Navigation in the concepts hierarchy
  - Search for reusing existing semantic resources
  - Assist user in adding a new concept
- Encodes the guidelines
  - Real help for domain experts
  - Less errors
- Multi-domain (PO<sup>2</sup>)
  - Biorafinary
  - Microorganism stabilisation
  - Meat production
- A standalone application
  - Implemented in Java
  - Available under the license CC BY 4.0
  - Contact: [stephane.dervaux@inra.fr](mailto:stephane.dervaux@inra.fr)

# The workflow



-----> is necessary  
---> Is used